GASTROINTESTINAL PARASITES IN GOATS (*Capra hircus*) OF DEVDAHA MUNICIPALITY-3, RUPANDEHI, NEPAL

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T.U. Registration No: 5-2-50-205-2010

T.U. Examination Roll No: 152

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A thesis submitted

In partial fulfilment of the requirements for the award of the degree of

Master of Science in Zoology with special paper Parasitology

Submitted to

Central Department of Zoology

Institute of Science and Technology

Tribhuvan University

Kirtipur, Kathmandu

Nepal

July, 2018

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 or institution.

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RECOMMENDATION

This is to recommend that the thesis entitled **"Gastrointestinal parasites in goats of Devdaha municipality-3, Rupandehi, Nepal''** has been carried out by **Shree Devi Shris** for the partial fulfillment of Master's Degree of Science in Zoology with special paper Parasitology. This is his/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

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CERTIFICATE OF ACCEPTANCE

This thesis work submitted by **Shree Devi Shris** entitled **"Gastrointestinal parasites in goats of Devdaha municipality-3, Rupandehi, Nepal"** 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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CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS

LIST OF ABBREVIATIONS

Abbreviated form	Details of abbreviations
ABPSD	Agri-Business Promotion and Statistical Division
c.f.	Correction factor
DLS	Department of Livestock Services
et al.	And his associates
KAP	Knowledge attitude and practice
MoAD	Ministry of Agriculture Development
NaCL	Sodium chloride
NLSS	Nepal Living Standard Survey
P value	Probability value
Rpm	Revolution per minute
T.U.	Tribhuvan University
UK	United Kingdom

ABSTRACT

Goat (*Capra hircus*) belongs to the Bovidae family which plays an important role in livelihood of farmer but time to time they are encountered with various gastrointestinal parasitic diseases as a major constrain for both the goat and farmers. The study was conducted in Devdaha municipality-3, Rupandehi, Nepal to assess the prevalence of various gastrointestinal parasite of goat. Furthermore, the awareness level, attitude and goat husbandry practice of goat farmers were assessed by using questionnaire survey. For the purpose of determining prevalence of gastrointestinal parasite of goat 160 fecal samples were collected. Parasitological method including direct smear, floatation and sedimentation were employed in the study. The overall prevalence of gastrointestinal parasites was 76.23% including 11genera. The most common parasites encountered were *Eimeria* sp. (43.75%), *Bunostomum* sp. (20%), *Haemonchus* sp. (17.5%), *Trichuris* sp. (15.62%), *Strongyloides* sp. (10%), *Fasciola* sp. (6.87%), *Moneizia* sp. (5.62%), *Trichostrongylus* sp. (3.12%), *Oesophagostomum* sp. (3.12%) and *Muellerious* sp. (2.5%). Nematode (53.75%) was the most prevalent parasite in the area than protozoa (43.57%), trematode (6.85%) and cestode (5%). The study revealed the significant difference in prevalence of GI parasites in association with age and sex of the goats. Female were found to be more susceptible than male. Multiple infection was observed in 41.87%. Questionnaire survey revealed that about half of the total responded had knowledge about parasitic disease of goat and also have practice of cleaning the goat sheds and giving antihelminthic drugs to their goats. Majority of them were not aware about the source of transmission of these parasites. Age, sex and the husbandry practice could be the reason for the variation in prevalence of the gastrointestinal parasites in goat.

1. INTRODUCTION

1.1 Background

Goat (*Capra*), a member of the Bovidae family and subfamily Caprinae is one of the oldest domesticated species. Goat is among the earliest animals domesticated by humans (Boyazoglu *et al*., 2005) and is believed that domestication of goat was initiated in Western Asia (Harris, 1962) and gradually reached the Indian sub-continent and later to South East Asia (Nazawa, 1991). They have worldwide distribution with higher concentration in tropical areas and in dry zone (Di Ceerbo *et al*., 2010). About 15% of the total herbivore population was covered by goats (Devendra and Burns, 1970). The world's goat population in 2004 was estimated to be over 743 million of which most of them were found in developing countries (Galan, 2005; Di Cerbo *et al*., 2010). In 2003, India had a huge population of 465 million livestock, in which goat possess the second highest position (Basic Animal Husbandry statistic, 2003).

Globally, goats are basically useful for meat, milk, wool and manure production. The meat of goat is rich source of protein which is an excellent for human consumption. In the absence of religious taboos associated with their meat, goats are consumed as source of food in all the parts of the world. Goat is often regarded as poor man's cow. The milk of goat is quite similar to that of cow milk because presence of similar fat globules (Jenness, 1980). They also produce substantial quantity of manure, which is of special importance in those areas where cattle are of lesser importance (Nawathe *et al.*, 1985). Cashmere wool, which is one of the best in the world is produced by cashmere goats. The intestine of goat is still in use to make surgical sutures and strings for musical instruments (Olinke *et al*., 2015).The skin of goat is also use to make various products such as gloves, boots and other products that is needed for soft hide.

1.1.1 Scope of goat farming in Nepal

Agriculture is the main source of livelihood in Nepal and more than 60% people are engaged in subsistence agriculture (MoAD, 2015). In Nepal livestock farming has great potentialities. It is becoming popular among farmers due to its wide market potentiality. Historically the livestock sector was subsistence oriented and dominated by small holders and even today at rural level it is considered important part of the small holder farmers and landless poor as source of income and source of generation of employment (Gadahi *et al.*, 2009; Khajuria *et al.*, 2013). Among the different livestock, goat farming has been practiced by a large section of population in rural areas of Nepal. Because small ruminants (sheep and goat) have a unique role in smallholder agriculture as they require small investment, faster growth rates, have shorter production cycle and greater environmental adaptability as compare to larger ruminants. In Nepal a typical smallholder farmer earns NRP 15,000 – 20,000 annually from selling their goats (NLSS, 2012).

Nepal had a goat population of 6.9 million in 2001 which was increased to 9.19 million in 2011 with an annual growth of just above 2% (ABPSD, 2011). The several breeds of goats reared in Nepal are Sinhal, Khari, Terai, Boer, Nubuan, Jamunapari, Saanen (Kharel and

Pradhan, 1988). In Nepal goats are mainly reared for the purpose for the meat production. With the increase of urbanization goat meat consumption is following an increasing trend in Nepal. The total domestic goat meat production in 2001- 2002 was estimated to be 38,584 MT, and increased to 52,809 MT in 2010- 2011 (ABPSD, 2011). It is estimated that 3.34 million goats are slaughtered annually for meat and for sacrifice in religious events (ABPSD, 2011). So, the national production is unable to fulfil the need of Nepal, hence the significant number of goats were imported from neighboring countries (India and Tibetan region of China) (DLS, 2011). Goat farming is going popular in Nepal but lack of the commercial farming techniques still it is being practice by using traditional and conventional method from centuries.

1.1.2 Diseases and effects

Goat plays an important economic role and make a significant contribution to both domestic and export markets through provision of food (meat and milk) and non-food (manure, skin and wool) production (Duguma *et al.,* 2011). However, goat farming plays a significant role in nation economy of the country, they were obstructed by various constraints. Disease of goat are among the important technical constraint that have hindered the progress of the sector by decreasing production (Jilok *et al*., 2016; Abdela, 2016).

Goats are generally susceptible to different microbial (viral, bacterial and fungal) and parasitological diseases. The microbial diseases of goats are brucellosis, listeriosis (Karaca *et al*., 2007), anthrax (Singh and Prasad, 2008), goat pox (Yune and Abdela, 2017), rabies (Vural *et al*., 2001), tuberculosis (Biet *et al*., 2005) etc. Goat pox is highly devastating viral systemic disease of goat which is caused by the pox virus of family Poxoviaridae (Yune and Abdela, 2017). Goat pox is economically important because it causes skin eruption that causes wool damage, internal lesion in respiratory tract and intestinal mucosa, causes decreased weight gain and death (Babiuk *et al*., 2008). Similarly, anthrax is saprobic disease of human being and animals caused by the encapsulated, spore-forming, large gram positive bacteria *Bacillusanthracis* (Hugh-Jones and De Vos, 2002). In 2004 during summer season, within 41 days 9 goats died due to anthrax in Southern Italy (Fasanella *et al*., 2010). *Listeriosismonocytogenes* is also a gram positive facultative, intracellular bacteria (Uazquez-Boland *et al*., 2001). It is ubiquitous in nature and cause septicemia, meningitis and abortion in ruminants (Dieterich *et al*., 2006). The main route of transmission of this bacteria is contaminated food (Unnerstad *et al*., 2000). In developing counties Brucellosis is considered as a great challenge for the dairy farmers and found as most economically devastating diseases because it causes early death of offspring and health problems due to the consumption of contaminated dairy products (Al-Majali, 2005).

Most of the microbial diseases causes economic losses not only by infecting the animal like by abortion and reduced production of milk but also contaminating human beings (Skovgaard *et al*., 1988; Taleski *et al*., 2002).

Goat farming is undoubtedly a profitable business and means of living for rural people but the problem of gastrointestinal parasites is always a major constraint. Generally the gastrointestinal parasites like *Eimeria, Giardia, Entamoeba*, *Haemonchus, Nematodirus, Paramphisotmum, chabertia, Taenia, Moneizia, Oxyuris, Toxocara, Trichuris, Trichostrongylus, Fasciola* etc. are the common GI parasite of goats. These parasites are wide spread in almost all tropical and sub-tropical countries and are considered responsible factor for deteriorating animal health and productivity (Ntonifor *et al.,* 2013). For example, coccidiosis causes damage to the animal's intestinal tract so that food is not absorbed well, diarrhea, poor growth, rough hair coat, a pot-bellied appearance and loss of appetite and death. Similarly, *Haemonchus contortus* and other genera/species of nematodes belongs to the groups of *Trichostrongylus* are of the major concern because of blood sucking habit of these parasites can cause anaemia and resulting in the death of animal (Barragan *et al.*, 2009).

Helminth parasites of small ruminants particularly gastrointestinal nematodes and trematodes are adversely affecting the cattle, causing hematological and biochemical disturbance, abnormal weight loss, stunted growth, lowered fertility and even death of animals in developing countries (Abdel-Ghaffur *et al.,* 2011). Disease in livestock caused by helminth parasites existing as a major productivity constraint especially in small ruminants in the tropics and subtropics (Perry *et al.,* 2002). Helminthiasis, especially parasitic gastroenteritis comprises serious health threat and a limitation to the productivity of small ruminants due to affiliated mortality, morbidity, treatment cost and their control measure (Nwosu *et al.*, 2007). In addition to these threats, infection of animals with gastrointestinal parasites lowers the immunity and makes it more susceptible to other pathogenic infection; finally this may results in heavy economic losses (Garedaghi *et al.*, 2011). Economic losses are caused by poor reproduction performance, reduced work capacity, involuntary culling and reduction in food intake, lower weight gains, lower milk production, treatment losses and mortality in heavily parasitized animals (Lebbie *et al.*, 1994). In many parts of the world, parasitism is of premier importance and still serious threat to the livestock economy worldwide (Vercruysse and Claerbout, 2001).

Every year huge amount of money is spent in worldwide to control infection of helminth parasites in livestock (Jabbar *et al.*, 2006). In India total average annual loss due to all disease in goats has been found Rs. 264.8 lakh (Singha and Prasad, 2008). In Nepal, parasitic diseases remain a major problem to livestock across all production areas. About 24% of deaths in goats were reported to be due to internal parasites and about 25% of total economic loss was reported due to gastrointestinal nematodes in goats (Lohani and Rasaili, 1995). Similarly, Joshi, 1996 reported that the total annual loss due to parasitic gastroenteritis alone was about 9.2 million Dollar. Due to lack of knowledge among the farmers about the goat parasitic diseases, causes, mode of transmission and their negligence towards the GI parasites of goat and also traditional husbandry practice of farmer makes them to suffer from huge economic loss every year.

1.2 Objectives:

1.2.1 General objective:

To determine the prevalence of gastrointestinal parasites in goats of Devdaha, municipality-3, Rupandehi, Nepal.

1.2.2 Specific objectives:

i. To determine prevalence of gastrointestinal parasites of goats
ii. To determine intensity of gastrointestinal parasites of goats
iii. To assess the knowledge, attitude and practices (KAP) on goat diseases among farmers

1.3 Rational of the study

Parasitic diseases (gastrointestinal nematodes, trematodes, cestodes and external parasites) are regarded as the most important cause of reduction in productivity of goats in Nepal. Due to the lack of adequate knowledge about these parasites and appropriate control strategies among the goat farmers large number of goats population is harboring parasitic infection. The present study was designed to determine the prevalence and intensity of GI parasites in goats. The finding of the present study revealed the present condition of GI parasites in the goat of the study area and also revealed the awareness level about the GI parasitic infection and the husbandry practice applied by the farmers. The finding of the study would be helpful to assess level of knowledge among the goat farmers regarding GI parasitic condition of the goats in their area. That would be helpful for the goat farmers to be aware about the GI parasites of goat which would be helpful to increase productivity for the goat farmers.

2. LITERATURE REVIEW

Gastrointestinal parasites are those parasites that infect the gastrointestinal tract of the host. Particularly two types of parasites, helminth and protozoa infect the goats. Among the protozoan parasites coccidian causes significant economic losses to the farmers while most of the helminth parasites retards growth of the goats.

2.1 In global context

2.1.1. Protozoan parasites in goats

Coccidiosis is the parasitic disease of the intestinal tract caused by the protozoan coccidia. Coccidia are intercellular parasites, develop and propagate within the cell lining of the gastrointestinal tract of the host. Coccidiosis caused by protozoan of the genera *Eimeria* are generally regarded as ubiquitous gastrointestinal parasites of domestic and wild animals (Vercruysse *et al*., 1982).

Generally goats are susceptible host of various protozoan parasites like *Eimeria* sp., *Cryptosporidium* sp., *Entamoeba* sp., *Giardia* sp., *Toxocara* sp., etc. these parasites are highly contagious and spread through a herds rapidly. Particularly *Eimeria* sp. are almost always present in the goat environment (Aumont *et al*., 1984). The coccidian parasite *Eimeria* sp. had been reported from goats of various countries like England (Norton, 1986), Czech Republic (Kaudela and Bokoa, 1988), Kenya (Munyan *et al*., 1990). In goats, coccidiosis causes enteric disease resulting diarrhea, inefficient weight gain and occasionally death (Foreyt, 1990) so, it had great economic importance because of the losses due to subclinical and clinical diseases (Radostits *et al.,* 1994). Ten (Harper and Penzhorn, 1999) and eight species of *Eimeria* (Ruiz *et al*., 2006) were recorded from the goats of South Africa and Gran Canaria Island of Spain respectively. While 13 species of *Eimeria* were identified in the goats of Northwest China (Wang *et al.,* 2010).

Coccodiosis generally occur in all age group of goats but kids were more susceptible to infection with *Eimeria* sp. (Tanseef-uf-Rehman *et al*., 2011). Goat kids around the weaning period shows higher rate of infection (Ruiz *et al*., 2012). Hundred percent prevalence of infection of *Eimeria* sp. was found in the goat kids of Western Pomeranin (Balicka-Ramisz *et al*., 2012). Similarly, kids had significantly higher prevalence of *Eimeria* than adult goats in two states of Malaysia (Tahir *et al.,* 2012).

Overcrowding and lower immunity condition around the weaning period are the main reason for harboring the large number of coccidian parasite in goat kids (Radfar *et al*., 2011; Chartier and Paraud, 2012).while, better hygiene and separate grazing of different age group may reduce the rate of infection due to the coccidian shedding (Jittapalapong *et al.,* 2012).

2.1.2 Helminth parasites in goats

Goats are vulnerable to a number of gastrointestinal helminth parasites (Sanyal, 1996). Helminthiasis is one of the important parasitic disease of ruminants (Agyei, 2003). The

infestation mostly caused by nematodes such as *Ostertagia* sp., *Capillaria* sp., *Trichuris* sp., *Strongyloides* sp., cestode such as *Moniezia* sp., *Taenia* sp.,) and trematode such as *Dicrocoellum* sp., *Fasciola* sp., *Amphiostomum* sp. (Zahid *et al*., 2005). The main reason for economic losses was due to the subclinical signs of helminthiasis because majority of the animal infected with helminth does not shows clinical signs (Opara *et al*., 2005). The economic loss have been associated with farmers through low milk production, low fertility, reduced work capacity, involuntary culling, treatment cost, mortality and reduce in the market value of infected animals (Regumes *et al*., 2006).

The problem is much more sever in topical countries (Gathuma *et al*., 2007). Heavy infection of GI helminth parasites was reported from the goat and sheep of Bokova, Cameroon (Mbuh *et al.,* 2008). Whereas, eight times higher prevalence of *Muellerious capillaris* was found in the goats than in sheep of Bangladesh (Islam and Taimur, 2008). Environmental condition of tropical countries favor in development and transmission of the parasites. As a result disease cause by helminth remains the major constraint, hindering the efficiency of rearing of small ruminant successfully in the tropics (Kumsa and Abebe, 2009).

Different genera of helminth parasites of goats were recorded from the tropical countries like India (Sutar *et al.,* 2010), Thailand (Sangvaranond *et al*., 2010), Bangladesh (Hassan *et al*., 2011), Pakistan (Farooq *et al.,* 2012), Ethiopia (Zeryehin, 2012). Thirteen different species of GI helminth parasites were identified from visceral examination of goats of Ganderbal, Kasmir, in which most common nematodes were *Haemonchus* sp., *Tirchuris* sp., *Nematodurus* sp., *Trichostrongylus* sp., *Chabertia* sp., *Strongyloides* sp. and *Oesophagostomum* sp, cestodes were *Moniezia* sp., *Avitellina* sp. and *Thysenezia* sp. and among trematodes *Fasciola* sp. *Dicrocellum* sp. and *Paraphistomum* sp. (Lone *et al*., 2012). Similarly, eleven genera of nematode and one genera of cestode were recorded from the goats of Jenin district of Palestine (Badran *et al*., 2012). In the coprological investigation, presence of *Strongyloides* sp., *Trichuris* sp., *Paraphistomum* sp., *Fasciola* sp. and *Moniezia* sp. were reported from the goats of North Ethiopia (Negasi *et al*., 2012). Similarly, high prevalence of *Strongyloides* group was found from the fecal examination in goats of Thailand (Ratanpod *et al*., 2012).

Climatic conditions are the common factor for the higher prevalence of the nematode parasites (Morgan and Van Dijk, 2012). From the epidemiological study conducted in West African Dwarf Goats of Abia state, higher prevalence of nematode was found than trematode and cestode (Amaid *et al*., 2012). Similarly, high incidence of nematode was observed from the similar investigation conducted in goats of Southern Punjab, Pakistan (Ayaz *et al*., 2013). From the goats of South West Ethiopia, nematodes were recorded predominant GI parasites (Emiru *et al*., 2013).Nematodes account the highest prevalence followed by cestode and trematode in goats of North West region of Cameroon (Ntoinifer *et al*., 2013). From fecal samples and post mortem examination performed in sheep and goats of Norway, nematode especially *Trichostrongylus* sp. was found significantly highly prevalent species (Domke *et al*., 2013). Whereas, *Haemonchus* sp. was recorded as main GI parasite of goats in Muthura, India (Singh *et al*., 2013).

Goats does not only harbor by single parasitic infection but also considered, frequently with mixed GI parasitic infection. In the investigation conducted in Korean native goats, co-infection of coccidian and nematode were reported highest among the mixed GI parasites (Gebeyehu *et al*., 2013). Significant difference in prevalence of mixed helminth infection was found in goats of Nigeria (Juliet et *al.*, 2013). Similarly, in the epidemiological survey conducted in Ghana, 9.72% prevalence was recorded with mixed infection of nematodes and *Moniezia* sp. (Blackie, 2014). Mixed infestation of nematode and trematode (6.4%), nematode and cestode (3.8%), protozoa, nematode and cestode (19.1%) were recorded from Pakistan (Raza *et al*., 2014). Significant prevalence of mixed parasitic infestation was found in both the West African Dwarf and Red Sokoto Breeds of Nigeria (Olanike *et al.*, 2015).

Incidence of GI parasites are directly associated with their risk factors. Ecological conditions like weather, texture of soil, population density, management system etc. plays an important role in distribution of GI parasites. However age, sex and breed of the host are also important factors to influence the prevalence of GI parasites (Jegede *et al*., 2015; Zvinorova *et al.*, 2016). From the goats of Udaipur, Rajasthan higher prevalence of helminth was found in female than in male and age wise prevalence showed the higher in adult goats (Faran *et al*., 2017). Significantly higher prevalence was found in female goats of Assam, India (Dutta *et al*., 2017). Form the coprocultural examination made in diarrheic goats, age wise higher incidence recorded in young kids and male goats were found highly susceptible in comparison with female (Saravanan and Palanivel, 2017). Similarly, females were significantly more susceptible than male and adults (> 6 month) were significantly more prone to parasitic infection as compare to young kids (< 6 month) (Singh *et al*., 2017).

Lower immunity and lack of environmental adaptation are the reasons for the higher incidence of GI parasites in young kid than adults (Sohail *et al*., 2017).

2.2 In the context of Nepal

Livestock farming has been integral part of Nepalese agricultural system. Cattle, buffalo, sheep and goat are the major domesticated ruminant of Nepal. Goat farming has been practiced by a large section of population in rural areas of Nepal. Goat farming in Nepal has been regarded as one of the most rewarding business as the demand for meat is increasing.

Goat farming is one of the profitable business and means of living for rural people. However, parasitic gastroenteritis is the major cause of productivity loss in livestock of Nepal (Thakuri and Mahato, 1990). Goats and sheep are very much prone to the infection of GI parasites. GI parasitic infection is one of the important cause of poor reproduction and productivity performance in goats (Joshi, 1994). The major clinical problem in goats was found to be caused by GI nematode followed by trematode and cestode (Thakuri, 1994). The Gastrointestinal parasites like *Haemonchus* sp., *Trichostrongylus* sp., *Bunostomum* sp., *Cooperia* sp., *Ostertagia* sp. are the common parasites of goats (Dhital,

2006). From the epidemiological survey, eighteen nematode species were identified in the goats of hilly region of Nepal, in which *Trichostrongylus* and *Haemonchus* were reported most prevalent species (Joshi, 2006). Similarly high prevalence of nematodes followed by trematode and cestode was reported from the goats of khasibazar, Kathmandu (Parajuli, 2007). Whereas, in the study conducted in goats of IAAS livestock farm *Haemonchus* sp., *Chabertia* sp., *Ostertagia* sp., *Strongyloides* sp., *Nematodirus* sp. were found as common GI parasites.

Seasonal studies of GI parasites of goats reveal that during summer season GI parasites were highly prevalent than winter season (Basir, 2009; Rijal, 2010). Similarly, epidemiological study conducted in goats of Banke, higher incidence of GI helminth parasite was found in wet season in comparison to dry season (Neupane, 2012). Geographical region and climatic factors had significant influence in prevalence of GI parasites in goats (Karki *et al*., 2012; Tripathi and Subedi, 2015).

Along with geographical and climatic factors but other factors like species, age, sex, grazing system and body condition also had considerable influence in the prevalence of GI parasites in goats. Epidemiological survey performed in goats of Mahottari and Dhanusa district reveals that fasciolasis had significant association with the body condition of animal and also reported higher prevalence of fasciolasis in goats grazed in free ranged system than reared under tethered husbandry practice (Yadav *et al*., 2015). From the fecal examination of goats of Western Chitwan, males were found highly infected with *Haemonchus contortus* than females (Adhakari *et al*., 2017). However, prevalence of *Giardia duodenalis* was found significantly higher in 1 – 6 month age group in comparison to >3 years in dairy ruminants of Chitwan (Mahato *et al*., 2018).

3. MATERIALS AND METHODS

3.1 Study area

Rupandehi district which is situated in Southern belt of mid-western developmental region of Nepal. Devdaha municipality-3 of Rupandehi, is low-altitude land (terai) area near the border side of India. It lies in north-east part of the Rupandehi district, situated in $27^{o}38'51.73^{0}$ N Latitude and 83^{0} 35' 36.11^{0} E Longitude at an elevation of 100 m to 1229 m from sea level.

Devdaha municipality-3, is a rural area surrounded by green forest with temperate climatic condition. Agriculture is the main occupation of the people of this area. Livestock are integral part of people engaged in agriculture and goat farming is one of the main agriculture practices along with buffalo and cow at this municipality. Almost every household rear 3 or more goats. Forest fodder, agricultural by-products, grazing on open fields and other supplementary foods are main sources of goat rearing.

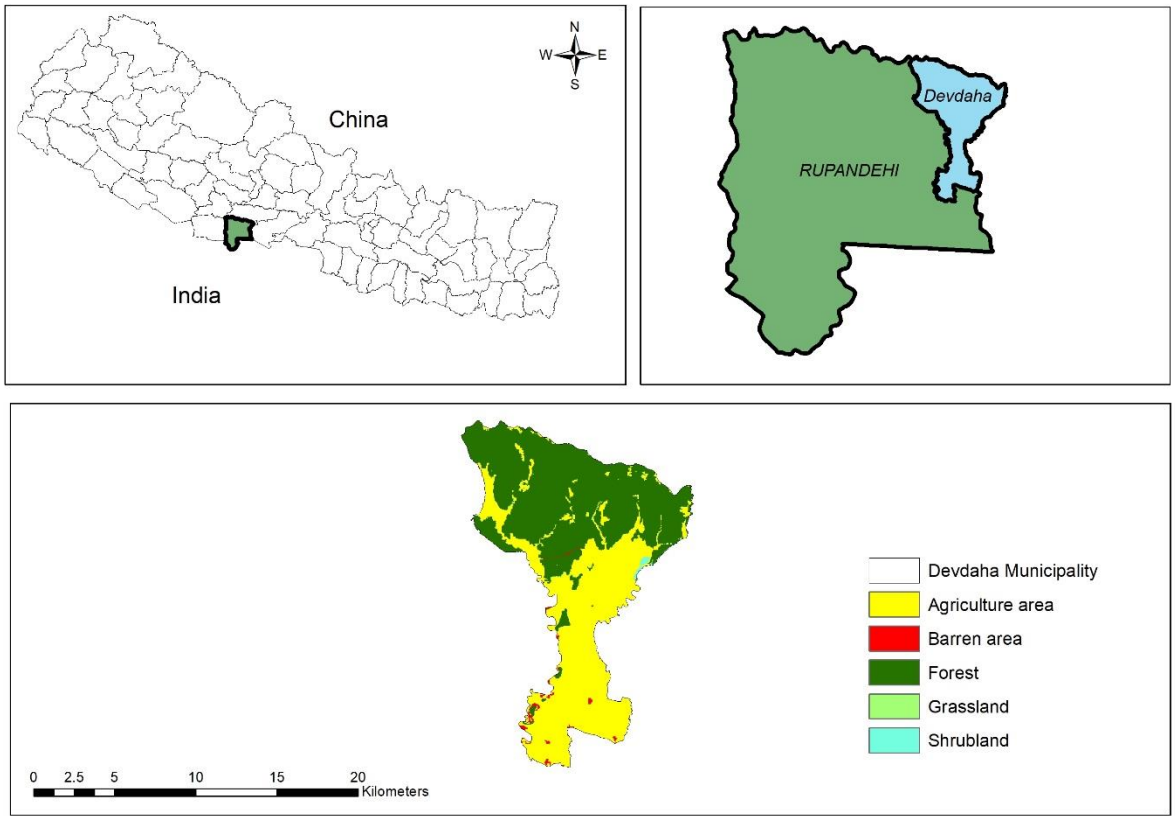


Fig 1. Map of study area.

3.2. Study design:

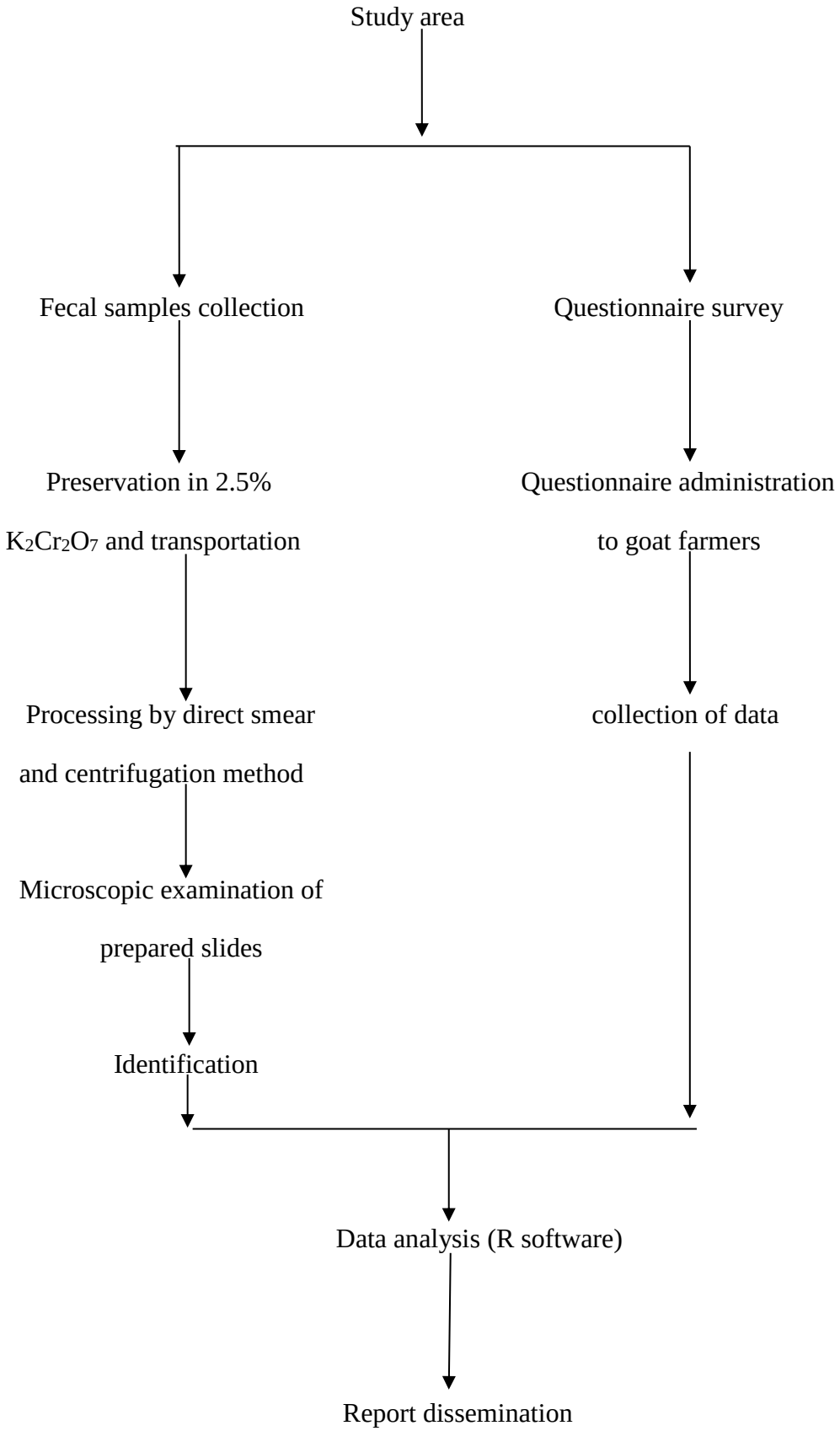


Fig 2: Flowchart of study design

3.3. Materials

Following materials have been used during the research work:

3.3.1. Materials require:

a) Sterile vials
b) Gloves
c) Electric microscope
d) Centrifuge tube
e) Beakers
f) Test tube
g) Sprit lamp
h) Tea strainer
i) Ocular micrometre
j) Glass rod
k) Cavity block
l) Camera
m) Ice box
n) Face masks
o) Centrifuge machine
p) Glass slides
q) Petri dish
r) Test tube holder
s) Dropper
t) Cover slip
u) Stage micrometre
v) Needle
w) Refrigerator
x) Filter paper

3.3.2. Chemical required:

a) Potassium dichromate
b) Normal saline
c) Distilled water
d) Lugol's iodine solution
e) Saturated NaCl solution
f) Methylene blue

3.4 Methods

3.4.1 Sample collection, preservation and transportation:

The fresh fecal sample was taken just after the defecation by the goat. The fecal sample was kept in air tight sterile vials 2.5% containing potassium Dichromate ($K_2Cr_2O_7$) solution. The vials was correctly labelled and stored in ice bag at 4^0c temperature and was transported safely to the laboratory of Central Department of Zoology Kirtipur, Kathmandu.

3.4.2. Determination of age and sex of goats:

Direct observation and questionnaire survey was carried out for the identification of sex and age of the goats.

3.4.3. Laboratory examination and identification:

Fecal samples were then processed and subjected for microscopic examination. Identification of ova/oocyst/cyst and larvae of different parasites were done according to the morphology and quantitative estimation by using concentration methods (floatation and sedimentation), preparing stained and unstained smears and Stoll's count technique to determine mix infection and intensity of parasites (Soulsby, 1982).

Unstained smear preparation:

It is useful to demonstrate motile forms and cysts of protozoans and also eggs and larvae of helminths. A small portion of fecal samples was picked up with a clean bamboo toothpick and emulsified with freshly prepared normal saline on a clean glass slide and covered with cover slip. The smear was examined under electric microscope at 10X and 40X (Soulsby, 1965).

Stained smear preparation:

It is useful to study the nuclear character and identification of cysts or dead specimens of trophozoites of protozoans. A small portion of fecal sample was picked up with a clean bamboo toothpick and emulsified with Lugol's iodine solution on a clean glass slide and covered with a cover slip. The smear was examined under electric microscope at 10X and 40X (Soulsby, 1965).

Concentration methods:

Eggs/cysts/trophozoites/larvae of parasites can be easily found in smears only in case of heavy infections but very often they are difficult to be detected in direct smears or mounts due to their low number in feces. Therefore, concentration procedures that includes floatation and sedimentation techniques were carried out (Soulsby, 1982; Zajac and Conboy, 2012).

a) Floatation technique:

This technique is based on the principle that lighter eggs/cysts of helminth and protozoans float on the medium having greater density. Approximately two gram of fecal sample was mixed with a small quantity of water and filtered with tea strainer. The filtrate solution was poured into a centrifuge tube of 15ml and centrifuged at 1000 rpm for five minutes. The tube's water was replaced with super-saturated sodium chloride (NaCl) solution and again centrifuged. After centrifuged, more saturated sodium chloride (NaCl) solution was added to develop convex meniscus at the top of the tube and one drop of Methylene blue was also added. The eggs and cysts float to the top and were collected by placing a cover slip on the surface of the meniscus at the top of the tube. A coverslip was placed for a five minutes. It was then removed from tube, placed on glass slide and examined microscopically at 10X and 40X. The photographs of eggs and cyst of parasites were taken and identified on the base of shape, shell and size (Soulsby, 1982; Zajac and Conboy, 2012). It is widely used for nematode and cestode eggs.

b) Sedimentation technique:

This technique is based on the principle that parasitic eggs having greater density than the suspending medium settles and gets concentrated at the bottom of the medium. The supernatant solution of floatation technique was removed and the sediment at the bottom was taken out with a long pipette. Iodine wet mount was prepared for each samples by mixing 1-2 drops of the sediments with Lugol's iodine solution in a glass slide and observed under for trematode eggs and not suitable for protozoan cysts.

c) Stoll's method of egg counting (Stoll and Hausheer, 1926):

Fecal samples were mixed with appropriate amount of N/10 NaOH in a thick glass tube and were vigorously shaken to make a uniform emulsion. Exactly 0.15 ml of the emulsion was taken by a measuring pipette and placed on a large slide 3"× 2"size and covering with 22/40 mm cover slip. The number of eggs per gram of faces was obtained by multiplying the count of two such preparation by 100 and considering the consistency of fecal sample correction factor (c.f.) was employed.

3.4.4. Identification:

Slides prepared using various techniques were examined under microscope under 10X and 40X respectively. Size of egg/oocyst/cysts were measured using stage and ocular micrometer. Identification and classification was done using books of Yamaguti (1961), Soulsby (1982), Zajac and Conboy (2012) and other published articles and internet sources on the basis of morphological characters (shape and size).

3.4.5. Questionnaire survey:

Structured questionnaires were delivered to 80 goat farmers during the questionnaire survey in order to assess the knowledge, attitude and practices of the farmers on the management of goats.

3.4.6. Data analysis:

Obtained data were analyzed by using 3.4.1 version of R software. Chi-square test was done to test significance level and P-value were calculated. P-value less than 0.05 was considered as significant.

4. RESULTS

4.1 General prevalence of gastrointestinal parasites

A total of 160 fecal samples of goats were collected from the Devdaha municipality – 3 to assess the distribution pattern of gastrointestinal parasite. Out of total samples, 122 (76.23%) were found to be infected with one or more species of gastrointestinal parasites (Fig. 3).

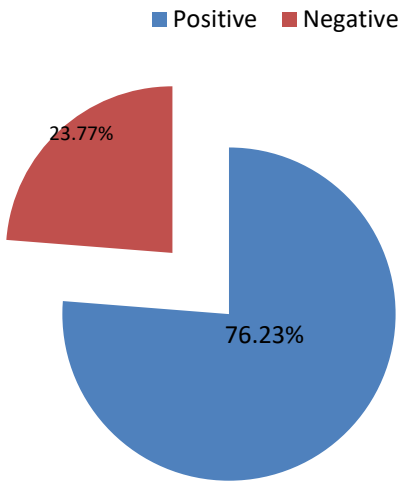


Fig. 3: General prevalence of gastrointestinal parasite in goats.

Goats were found to be infected with 11 difference species of GI parasites i.e. protozoa (1), nematode (7), trematode (1) and cestode (1). Prevalence of nematode (53.75%) was found to be highest followed by protozoa (49.57%), trematode (6.8%) and cestode (5%) respectively (Fig. 2). Statistically there was significant difference between the prevalence of different classes of GI parasites in goats (Chi-square = 73.11, df = 3, P-value = 9.17×10^{-16}).

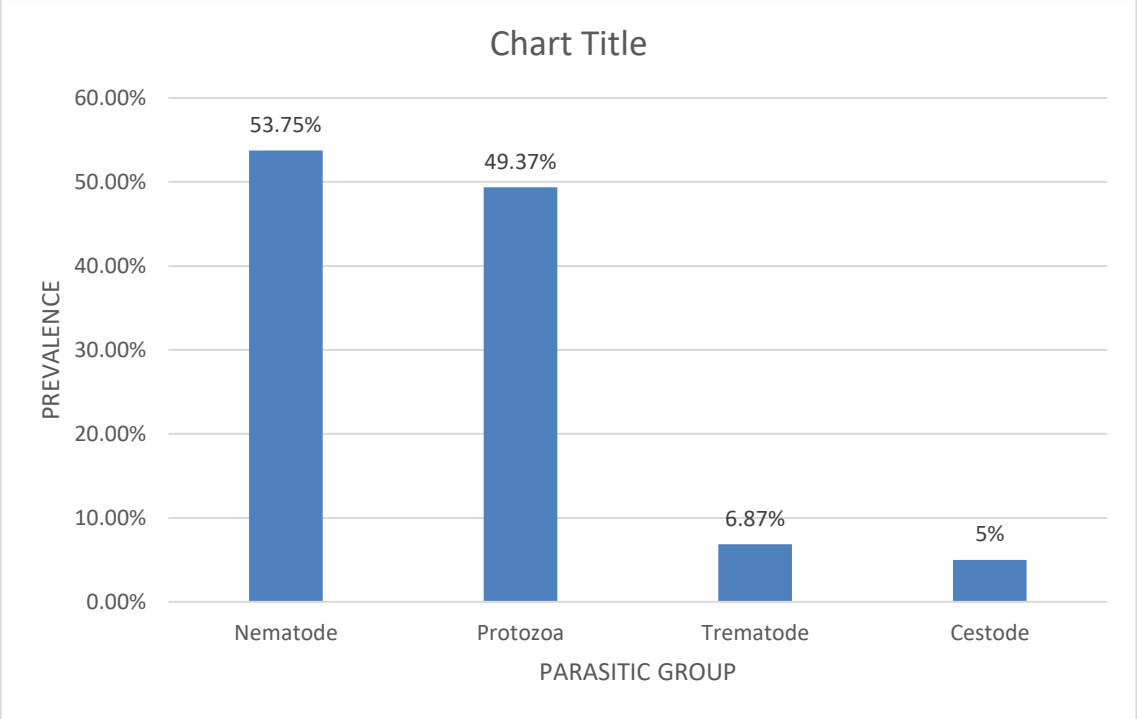


Fig.4: Distribution of parasitic group in goats.

Among all the identified species of GI parasites, *Eimeria* sp. (43.75%)[*Eimera* with micropyle (92.63%) and *Eimeria* without micropyle (72.85%)] was found to be most commonly encountered parasites followed by *Bunostomum* sp. (20%), *Haemonchus* sp.(17.5%), *Trichuris* sp. (15.62%), *Strongyloides* sp. (10%), *Fasciola* sp. (6.87%), *Moneizia* sp. (5.62%), *Trichostrongylus* sp. (3.12%), *Oesophagostomum* sp. (3.12%) and *Muellerious* sp. (2.5%) respectively (Fig. 5).

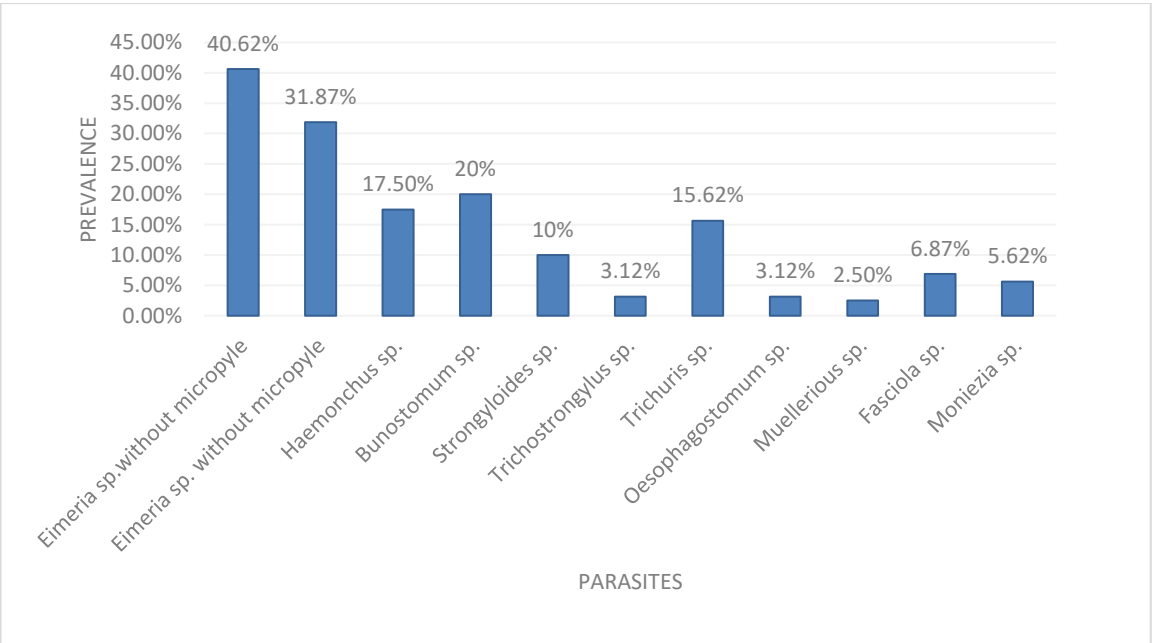


Fig.5: Species wise prevalence of parasites in goats.

Prevalence of GI parasites in females was found to be higher in adults (52.47%) followed by young (12.87%) and kids (7.92%). While in males, infection was found to be most prevalent in young (55.10%) followed by adults (25.42%) and kids (11.85%) (Table 1). The statistical analysis revealed that there was significant difference between prevalence of GI parasites with age and sex of the goats (In male, Chi-square = 31.78, df = 2, P- value = 1.25×10^{-7}, and in female, Chi-square = 48.83, df = 2, P- value = 2.49×10^{-11}).

Table 1: Age and sex wise prevalence of GI infection.

Age	**Sex**	
	Male (N = 59)	Female (N = 101)
(1 – 6 month) kid	11.85 %	7.92%
(6 – 12 month) young	55.10%	12.87%
(>12 month) adult	25.42%	52.47%

However, kids were found to be significantly highly infected with *Eimeria* sp. compared to young and adults. Similarly, *Trichuris* sp. infection was also found significantly high in kids. Whereas *Bunostomum* sp., a nematode parasite was significantly highly infected in adults (Table 2).

Table 2: Age wise parasitic prevalence of GI parasites in goats

SN	**Class**	**Genera**	**Age**			
			(1-6month) kid N=19	(6-12month) young N=53	(>12month) adult N=88	P – value
1	Protozoa	*Eimeria* sp.with micropyle	63.15%	39.62%	34.09%	0.0054
		Eimeria sp.without micropyle	47.36%	30.18%	28.40%	0.044
2	Nematode	*Haemonchus* sp.	15.78%	13.20%	22.72%	0.245
		Bunostomum sp.	5.26%	16.96%	25%	0.00191
		Strongyloides sp.	-	9.43%	12.5%	0.512
		Trichostrongylus sp.	-	-	5.18%	0.00562
		Trichuris sp.	5.26%	26.75%	14.77%	0.00058

		Oesophagostomum sp.	-	1.88%	4.54%	0.089
		Muellerious sp.	-	-	4.54%	0.010
3	Trematode	*Fascoiola* sp.	-	1.88%	11.36%	0.00022
4	Cestode	*Moniezia* sp.	-	5.66%	6.81%	0.0408

Parasitological analysis revealed that 41.87% infection was detected with mixed parasites while rest of 34.37% was found to be infected with single parasites. In mixed parasitic infection, association between protozoa and nematode showed the maximum prevalence (16.25%) followed by nematode and cestode (3.75%), nematode and trematode (3.12%), protozoa and trematode (1.25%) and protozoa, nematode and trematode (0.625%). Statistically the difference was found to be significant (chi= 34.97%, P value = 4.725×10^{-7}, df = 4).

Table 3: Prevalence of mixed infection of GI parasites in goats

Parasitic infection	**Prevalence (N=160) %**	**P value**
Protozoa + Nematode	16.87%	4.725×10^{-7}
Nematode + Cestode	3.75%	
Nematode + Trematode	3.12%	
Protozoa + Trematode	1.25%	
Protozoa + Nematode + Cestode	0.625%	

4.2 Intensity of GI parasitic infection in goats

Eimeria sp. with micropyle showed the heavy infection in 53 samples >5 egg/cyst/larva per field, *Eimeria* sp. micropyle in 26 samples, *Haemonchus* sp. in 5, *Bunostomum* sp. in 2 and *Strongyloides* sp. in one sample respectively. While maximum number of goats were observed with light infection of GI parasites (Table 4).

Table 4: Intensity of GI parasitic infection in goats

SN	Class	Name of genera	Light ≤ 2	Mild 3 - 5	Heavy >5
1	Protozoa	*Eimeria* sp.with micropyle	4	8	53
		Eimeria sp.without micropyle	11	14	26
2	Nematode	*Haemonchus* sp.	13	10	5
		Bunostomum sp.	23	7	2
		Strongyloides sp.	11	4	1
		Trichostrongylus sp.	5	-	-
		Trichuris sp.	21	4	-
		Oesophagostomum sp.	5	-	-
		Muellerius sp.	4	-	-
3	Trematode	*Fasciola* sp.	11	-	-
4	Cestode	*Moniezia* sp.	9	-	-

Note:

Light infection= ≤ 2 egg/cyst/larva per field

Mild infection = 3 – 5 egg/cyst/larva per field

Heavy infection = > 5 egg/cyst/larva per field

4.3 Assessment of knowledge, attitude and practice (KAP) of goat farmers, regarding parasitic infection in goats

A total of 80 goat farmers were randomly selected for KAP. Among them, 38.75% were male and 61.25% were female, 71.25% were either illiterate or had primary level of education while 28.74% had intermediate level of education. Structured questionnaires were prepared to assess the knowledge regarding goat disease particularly GI parasites of goat. Survey revealed that 41.25% had general knowledge about the goat parasites. Similarly 27.5% of them had knowledge about zoonotic disease and 21.25% of them knew about the different sources of transmission of parasites. While 47.5% of farmers had knowledge about the antihelminthic drugs and 68.75% of them thought the regular check-up of goat was needed to keep their goats healthy.

Table 5: Assessment of knowledge and attitude of the farmers on goat parasites.

S.N.	Questionnaires	N = 80	Percentage (%)
1	Knowledge about goat parasite	Yes No	41.25% 50.75%
2	Knowledge about zoonotic diseases	Yes No	27.5% 72.5%
3	Knowledge about source of transmission of parasites	Yes No	21.25% 78.75%
4	Knowledge about antihelminthic drug	Yes No	47.5% 52.5%
5	Regular check-up of goats	Needed Not needed No idea	68.75% 7.5% 23.75%

Among the respondents, 90% of farmers practiced of giving clean tap water to their goats. Field grazing and forest grazing was practiced by 15% and 26% of farmers respectively. While 66% of them confined in their goats in the sheds and the practice of providing supplementary foods along with grasses was done by 96.25% of the farmers. Only 10% of them used to use home remedies to treat their goats while rest of 90% of farmer used to use allopathic drugs. Forty eight percent of the farmers followed deworming practice once in a year by using antihelminthic drugs and after every 6 month by 36.25% of the farmers. Most of the farmers (86.25%) had separate shed for the goats. In case of cleaning the goat sheds, 62.5% of them use to clean their goat sheds daily.

Table 6: Assessment of the goat husbandry practices among farmers.

S.N.	Questionnaires	N = 80	Percentage (%)
1	Use of antihelminthic drug	After every 6 month Once in a year Never	36.25% 48.75% 15%
2	Sources of water	Tap water River water Pond water	90% 10% -
3	Source of food	Only grasses Grasses + other supplementary foods	3.75% 96.25%
4	Grazing site	Field grazing Forest grazing Confined in shed	15% 25% 66%
5	Used type of drugs	Aayurvedic (Home remedies) Allopathic	10% 90%
6	Cleaning of goat sheds	Daily Once in a week Once in a month Once in a year	62.5% 22.5% 8.75% 6.25%
7	Sheds of goat	Separate Mixed with other cattle	86.25% 13.75%

5. DISCUSSION

The gastrointestinal (GI) tract of the goats generally harbors different types of GI parasites. The most common and important GI parasites of goats are coccidian (protozoa), nematodes (roundworm), cestodes (tapeworm) and trematodes (flukes) (Saravanan and Palanines, 2017). These parasites are widely distributed in tropical and sub-tropical countries and plays an important role to impair the development of ruminants (Ntonif *et al*., 2013). Climatic condition of tropical and sub-tropical countries favors to survival and development of most of the parasites (Daniel *et al*., 2014).

The present study revealed that the overall prevalence of gastrointestinal parasitosis in goats was 76.23%. The current finding in line with the previous finding reported from, Bangladesh (74.55%) (Islam and Taimur, 2008), Thailand (79.47%) (Raptanapob *et al*., 2012), Southwest Nigeria (75.75%) (Olanike *et al.,* 2015), south-south Nigeria (75.5%) (Whoeli *et al.,* 2014) and Southwest Ethiopia (78.7%) (Emiru *et al*., 2013). However, the prevalence result of the present study appears to be slightly lower than the prevalence reports, 80.6% from Poland (Gorski *et al*., 2004), 81.5% from Central Oromia, Ethiopia (Kumsa *et al*., 2011), 85.22% from Chhattisghar, India (Pathak and Pal, 2008), 90.4% from West region of Cameroon (Ntonifor *et al*., 2013), 95.90% from Slovakia (Babjak *et al.,* 2017). These variation in the prevalence in different studies are due to the difference in deworming and management practice, altitude and climatic condition (Daniel *et al.,* 2014).The distribution of endoparasites depend on the ecological factors like rainfall, temperature and soil type of the area (Teklye, 1991).

The goats of the Devdaha municipality-3, were found to be infected with eleven different genera of GI parasites, in which most prevalent parasites were *Eimeria* sp. (43.75%), *Bunosotomum* sp. (20%), *Haemonchus* sp. (17.5%), *Trichuris* sp. (15.62%), *Strongyloides* sp. (10%), *Fasciola* sp. (6.87%), *Moneizia* sp. (5.62%), *Trichostorngylus* sp. (3.12%), *Oesophagoastomum* sp. (3.12%) and *Muellerious* sp. (2.5%). The various species of endoparasites recovered during present study have been reported by various researchers from different part of the world (Pedetra *et al*., 2006; Raza *et al.,* 2007; Gadhai *et al*., 2009; Tasawar *et al*., 2010; Lone *et al*., 2012; Badran *et al*., 2012; Jeged *et al*., 2015).

The prevalence of nematode (53.75%) parasites observed in this study showed the higher prevalence followed by protozoa (49.75%), trematode (6.8%) and cestode (5%). The finding of this study agree with the previous researches that also revealed the higher prevalence of nematode parasites in comparison with other endoparasites in goats of semi-arid zone of North-eastern, Nigeria (Nwosu *et al.,* 2007), South-eastern, Ethiopia (Zeryehan, 2012), South-west, Ethiopip (Emiru *et al.,* 2013), Southern Punjab, Pakistan (Ayaz *et al*., 2013), North-west region of Cameroon (Ntoinifer *et al*., 2013), Norway (Domke *et al.,* 2013). The higher prevalence could be attributed to the facts that most of the nematode parasites have direct cycle and both larval and adult stages are infective stage of the parasites (Gibbous, 2001). Nematodes have a relatively short generation interval and they have ability to take advantage of favorable environmental condition (Grant, 1981). However, trematode recorded relatively low prevalent parasite because

intermediate host is required to complete their lifecycle and transmission was depends on the availability of intermediate host (*Lymnaea* spp) which depends on season for the survival (Soubly, 2006).

Among eleven different GI nematode parasites identified in the present investigation, *Bunostomum* sp. (20%) was found to be highly prevalent. The result of the present study is in agreement with Purja and Maharjan, (2017), who found *Bunostomum* sp. (35%) as most dominating nematode parasite of goats. This parasite has been also reported from Nepal (Bashir, 2009; Rizal, 2012) and different part of the world (Abebe and Esayas, 2001; Aragaw and Gebreegziabher, 2014; Kenea *et al.,* 2015; Kekemework *et al.,* 2016). The finding of present study disagreed with the result of the previous studies carried out by Pandey et al. (1994), Kumsa, (2011); Fakae, (1990), Hassan *et al.* (2013) and Khajuria *et al*. (2013). They recorded comparatively low prevalence of *Bunostomum* sp. in goats, 3%, 0.6%, 4.3%, 1.08% and 3.83% respectively. The higher prevalence of *Bunostomum* sp. might be due to variation in geographical and climatic condition.

Haemonchus controtus is blood sucking nematode parasite commonly known as the twisted stomach worm, primarily occur in the abomasum of small ruminant notably sheep and goats (Mengistal *et al.,* 2014). It is an important and common nematode parasite of small ruminants (Asif *et al*., 2008). The overall prevalence of *Haemonchus* in the present study was found to be 17.5%. In the previous studies, various workers reported variable prevalence rate of *Haemonchus* in different geographical areas. However, the prevalence may vary from country to country and even within the country. Variable prevalence of *Haemonchus* sp. was reported by various researchers from Nepal (3.47% by Tripathi and Subedi, 2015; 14.51% by Karki *et al.,* 2012; 35% by Husain, 2017; 17.72% by Bashir, 2009; 20.97% by Neupane, 2012) and different parts of the world (16.47% by Dutta *et al.*, 2017; 24.25% by Sutar *et al.*, 2010; 26.13% by Pathak and Pal, 2008; 48.45% by Lone *et al.,* 2012; 90% by Nwosu *et al*., 1996).

In the present study besides, *Bunostomum* sp. and *Haemonchus* sp. goats were found to be infected with *Trichuris* sp., *Strongyloides* sp., *Trichostrongylus* sp., *Oesophagostomum* sp and *Muellerius* sp. in decreasing order respectively. *Trichuris* sp. is a widely spread GI nematode parasite that can be found in a broad range of host. It infects the caecum and colon of sheep, goat, cattle and other ruminants in all parts of the world (Khan, 2016). The current prevalence of *Trichuris* (15.62%) was consistent with the previous study conducted by Faran,*et al*. (2017), who reported 15.20 % prevalence of *Trichuris* in goats of Rajasthan, India.

From the fecal examination of sheep and goats in semi-arid area of Kenya, *Strongyloides* sp. was reported as highly prevalent nematode parasite with prevalence 51.6% (Woruru *et al.,* 2005) and has also been reported from some other countries such as, 51.74% from Bangladesh (Hassan *et al*., 2011), 23.5% from Korea (Gebeyehu *et al*., 2013), 20.45% from India (Lone et al., 2012), 16.76% from Thailand (Azrul *et al.,* 2017), 14.03% from Slovakia (Babjak *et al.,* 2017) etc. *Strongyloides* is one of the most pathogenic nematode species in domestic ruminants but the prevalence of this parasite was comparatively low

(10%) in this study. The observed difference in prevalence could be due to variation in geographical and climatic condition. The composition of L_3 stage of *Trichostrongylus* on pasture are predominantly influenced by temperature and moisture (Manfredi, 2006; O'connor *et al*., 2006) and have a high capacity of survival under adverse weather conditions like cold or desiccation (Urquhart *et al.,* 1987). Present study also reveals the presence of *Trichostrongylus* species but the prevalence was found to be comparatively low (3.12%). However, various researcher reported it as dominant endoparasite of goat from different parts of the world (Papadopoulos *et al*., 2007; Zanzani *et al.,* 2014; Umur and Yukari, 2005, Jegede *et al.,* 2015). This variation is due to the difference in farm management practice.

Oesophagostomum is a commonly and widely prevalent parasite of small ruminant (Olivares *et al.,* 2001). Like most of the helminth infection, it is insidious and chronic in nature. In the current study prevalence of *Oesophagostomum* (3.12%) was lower than (11%) by Adem and Antevch, (2011), in Haramoga university dairy farm, (13%) by Wururu, (2005), in semi-arid area of Kenya, (16.7%) by Amaid *et al*, (2012), in West African Dwarf Goats of Abia State. This difference could be due to difference in deworming habit of farmers. Similarly, very low prevalence of *Muellerious* species was recorded in the current study than those records shown by different authors (Richard *et al*., 1990; Gorski *et al*., 2004; Islam and Taimur, 2008). This is because *Muellerious* had an indirect lifecycle and needed intermediate host like several snails (*Helix*, *Helicell*, *Theba*, *Abida*) and slugs (*Limax*, *Agriolima*) which required favorable climatic condition for survival (Soulsby, 1982).

Goats were found to be infected with protozoan parasites such as Giardia, Entamoeba, *Eimeria* (Azrul *et al.,* 2017; Purja and Maharjan, 2017). While in the present study, only *Eimeria* species was observed as a protozoan parasite, which is supported by the result of researches carried out in different part of the world, from England (Norton, 1986), North Eastern China (Wang *et al.,* 2010), Ethiopia (Terefe *et al*., 2012), Brazil (Cavalcante *et al*., 2012), Southeastern Iran (Kheirandish *et al.,* 2014), Egypt (Mohamaden *et al.,* 2018). Coccidiosis caused by *Eimeria* species in goats is regarded as one of the most ubiquitous and economically important parasite of the goats (Foreyt, 1990). Ten species of *Eimeria* from Spain (Ruiz *et al*., 2006), nine from Iran (Heidari *et al*., 2014) were recorded. In the current study, since oocyst were not cultured, species could not be identified. Hence, on the morphological structure *Eimeria* sp. has been broadly differentiated as *Eimeria* with micropyle and *Eimeria* without micropyle. Prevalence of *Eimeria* species was found (43.08%) in this study is comparable with results reported by (41.08%) by Azrul *et al*. (2017), (47.76%) by Islam and Taimur, (2008), while the other studied were incomparable (100% by Balicka-Ramisz *et al.,* 2012; 98.6% by Sliva *et al.,* 2014) could be due to poor hygienic condition in the management system.

The definitive host range for *Fasciola* sp. is widely diverse which includes household ruminant (goat, sheep, cattle, and buffalo). The snail belongs to family Lymnaeidae play an important role in transmission of this parasite (Caron *et al.,* 2014). In the investigation carried out in Jammu, 3.08% goats were found to be infected with *Fasciola* sp. (Yadav *et*

al., 2006). Similarly, 7.1% was reported from Nigeria (Jeged *et al*., 2015), 7.9% reported from Cholista desert of Pakistanc (Raza *et al*., 2014) that shows confirmatory with result of present study (6.87%) which was much more lower than those reported from Mahottari and Dhanusa, district (47%) (*Yadav et al.,* 2015) and Kapilwastu (15.97%), Nepal (Tripathi and Subedi, 2015), from Pakistan (27.90%) (Ahmed *et al*., 2005) and from Bangladesh (44.2%) (Sangma *et al*., 2012). Goats are more likely to graze on dry pasture therefore less chance for goats to ingest metacercaria larva. Because infection with *Fasciola* sp. are usually associated with grazing in wetland and drinking water contaminated by the metacercaria larva, which might be the reason for the low prevalence of *Fasciola* sp. in the present study.

Overall prevalence of *Moniezia* sp. was comparatively low (2.5%) in the present study then the nematode, protozoa and trematode respectively. Among cestodes, *Moniezia* sp. was observed in goats by various researchers (Singh *et al*., 2015; Sutar *et al*., 2010; Silvestre *et al*., 2000; Bansal *et al.,* 2015). As all tapeworms, *Moniezia* sp. has an indirect lifecycle with ruminants (goat, sheep, cattle etc.) as final host and Oribatid mites also known as "moss mites" and "beetle mites" as intermediate hosts. The chance of ingestion of infected intermediate host by the goats might be the reason for low prevalence of these parasite in the present study.

Age, sex and breed of the host plays an important role to influence the prevalence of GI parasites (Jegede *et al*., 2015; Zvinorova *et al.,* 2016). Statistically significant difference in the prevalence of GI parasites between the sexes was observed by Emiru *et al*., (2013). The present study showed the statistically higher prevalence of GI parasites in female goat than male which was supported by many researchers (Dutta *et al*., 2017; Saravanan and Palanivel, 2017; Saravanan and Palanivel, 2017,Gorski *et al.,* 2004; Bansal *et al.,* 2015; Jegede *et al.,* 2015, Dangnachew *et al.,* 2011). However, in the contrast higher GI parasitic infection was observed in male goats in comparison to female goats by Raza *et al.,* 2014. The higher infection of GI parasites in female than male because female animal were used to expose to stress than male animal in different time such as during pregnancy and lactation period that decreases immune status (Thrusfield, 2005; Urquthart *et al.,* 1996).

In case of age wise prevalence of protozoan parasites, kids were found to be more susceptible to infection with *Eimeria* sp. (Tanseef-uf-Rehman *et al*., 2011; Norton, 1986; Ruiz *et al.,* 2006; Cavalcante *et al*., 2012; Sharma *et al*, 2009); Balicka-Ramisz *et al*., 2012). High coccidian infection was found to be associated with the poor hygienic condition in the management system (Tahir *et al.,* 2011). Overcrowding and lower immunity condition around the weaning period are the main reason for harboring the large number of coccidian parasite in goat kids (Radfar *et al*., 2011; Chartier and Paraud, 2012). Whereas in case of helminth parasites, present study revealed the higher prevalence of GI parasite in adult goats in comparison with young and kids. Result of the current investigation was supported by Husain, (2017); Faran *et al*., (2017); Singh *et al.,* (2017) and Rahman *et al.,* (2014). In the contrast various researchers revealed the higher incidence of GI parasites in kids and young than in adult goats, which does not supports the result of

present study (Raza *et al.,* 2014; Bansal *et al*., 2015; Zeryehun, 2012; Lashari and Tasawar, 2011; Emiru *et al.,* 2013).

Grazing ruminants are usually infected with more than one species of GI parasites. In the present study 41.87% samples were found to be infected with mixed parasitic infection. However, the prevalence of mixed infection was vary according to literatures such as 19.25 % reported by Faran *et al*., (2017); 11.32% by Zeryehun, (2012); 6.49% by Juliet *et al*., (2013). This variation is due to the variation in husbandry practice and geographical variation.

Questionnaire survey was conducted among the goat farmers reveals that only 41.25% had knowledge about the GI parasite of the goat. While only 21.25% had knowledge about the source of transmission of these parasites. Majority of the farmers feed their goat in confinement shed with the grasses and other supplementary foods. Field grazing and forest grazing was less practiced by the farmers, which could be the reason for low prevalence of trematode and cestode parasites in goats of the area. Because, trematode and cestode require intermediate host which depends up on the season for survival (Soubly, 2006). Goat intestinal status of host can positively influence the pathogenesis of the disease depend up on various factors and management system as well as environmental condition (Houdijks *et al*., 2000). Only 40% farmers treats their goats with antihelminthic drugs. Some did not treats their pregnant goats because of fear of the abortion.

Eimeria sp. and *Bunostomum* sp. were the most abundant parasite throughout the study period. Probably because of the climatic condition, management system, practice of keeping their goats in confined sheds could be the reason for the transmission of these GI parasites among the herd.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The present study was conducted to assess the prevalence of gastrointestinal parasite of goat in Devdaha municipality- 3, Rupadehi, Nepal. The overall prevalence of GI parasites was 76.23%. Altogether one genera of protozoa, seven genera of nematode, one genera of trematode and one genera of cestode were found in this study. Nematode (53.75%) was found to be most prevalent parasite followed by protozoa (49.57%), trematode (6.8%) and cestode (5%) respectively. Among the identified nematode parasites the most commonly encountered GI parasite was *Bunostomum* sp. (20%) and least common was *Muellerious* sp. (2.50%).

In the present study significant difference was observed in prevalence of GI parasite with respect to age and sex of the host. Female were found to be significantly highly infected than male goats. In case of age wise prevalence protozoan parasites were significantly high in kids compared to young and adult and helminth parasites were found to be higher in adult than young and kids respectively.

The questionnaire survey revealed that nearly half of the respondent were found to be aware about the GI parasite of goat and majority of the farmers treat their goat with antihelminthic drugs once in a year. While most of the farmers kept their goats in confined sheds that could be the reason for the low prevalence of trematode and cestode parasites in goat of the area. Traditional husbandry practice and lower knowledge of the farmers about the source of transmission of GI parasite could be the reason for the higher prevalence of protozoan and nematode parasite in goats of the area.

6.2 Recommendations

On the basis of conclusion the following recommendations are made to reduce the risk of GI parasite of goats.

- Knowledge about use and benefits of deworming should be provided to goat farmers.
- Regular screening of goats for the parasitic infection need to be carried out time to time.
- Further molecular identification is necessary to identify the parasites up to the species level.

7. REFERENCES

Abdel – Ghaffur, F., Semmier, M., Khaled, A., Al-Rasheid, S., Strussen, B., Tuscher, et al., 2011. The effect of different plant extract on intestinal cestodes and trematodes. Parasitology Research, **108**: 979-984.

Abdela, N. 2016. Important cattle ticks and tick born haemoparasitic disease in Ethiopia: A Review. Acta Parasitologica Globalis, **7**: 12-20.

Abebe, W. and Esayas, G. 2001. Survey of ovine and caprine gastrointestinal helminthosis in eastern part of Ethiopia during the dry season of the year. Revue de Medecine Veterinaire, **152**(5): 379-384.

ABPSD (Agri-Business Promotion and Statistical Division), MoAD, 2011. A study on goat value chain in Nepal. Heifer International Nepal.

Adhikari, K., Rana, H.B., Kaphle, K., Khanal, T. and Raut, R. 2017. Prevalence of *Haemonchus contortus* in goats of Western Chitwan of Nepal. International Journal of Applied Science and Biotechnology, **5**(3): 321-325.

Adem, H. and Anteneh, W. 2011. Occurrence of nematodiasis in Holstein Friesian dairy breed. Journal of Veterinary Medicine and Animal Health, **3**: 6-10.

Agyei, A.D. 2003. Epidemiological Studies on gastrointestinal parasitic infections of lambs in the coastal savanna regions of Ghana. Tropical Animal Health Production, **35**(3): 207-217.

Ahmed, S., Nawaz, M., Gul, R., Zakir, M. and Razzaq, A. 2005. Diversity and prevalence of trematodes in livers of sheep and goat in Quetta, Pakistan. Pakistan Journal of Zoology, **37**(3): 205.

Al-Majal, A.M. 2005. Seroepidemilogy of caprine Brucellosis in Jordan. Small Ruminant Research, **58**(1): 13-18.

Amadi, A.N., Azoaja, D.A. and Essien, E.J. 2012. Epidemiology of helminth parasites of West African Dwarf Goat (*Capra hircus*) in Umuariaga in Ikwuano L.G.A., Abia state. Journal of Applied Science Environment Management, **16**(4): 359-362.

Aragaw, K. and Gebreegziabher, G. 2014. Small intestinal helminth parasites in slaughtered sheep and goats in Hawassa, Southern Ethiopia. African Journal of Basic and Applied Sciences, **6**: 25-29.

Asif, M., Azeem, S., Asif, S. and Nazir, S. 2008. Prevalence of gastrointestinal parasites of sheep and goats in and around Rawalpindi and Islamabad. Pakistan Journal of Veterinary Animal Science, **1**: 14-17.

Aumont, G., Yvore, P. and Esnault, A. 1984. Experimental coccidiosis in goats. 1. Experimental model. Effects of parasitism on the feeding behaviour and the growth of animals; intestinal lesions. Annales De Recherches Veterinaires, **15**: 467-473.

Ayana, T. and Ifa, W. 2015. Major gastrointestinal helminth parasites of grazing small ruminants in and around Ambo town of central Oromia, Ethiopia. Journal of Veterinary Medicine and Animal Health, **7**(2): 64-70.

Ayaz, M.M., Raza, M.A., Murtaza, S. and Akhtar, S. 2013. Epidemiological survey of helminths of goats in southern Punjab, Pakistan. Tropical Biomedicine **30**(1): 62–71.

Azrul, L.M., Poungpong, K., Jittapalapong, S. and Prasanpanich, S. 2017. Descriptive prevalence of gastrointestinal parasites in goats from small farms in Bangkok and Vicinity and the associated risk factors. Annual Research and Review in Biology, **16**(16): 1-7.

Babiuk, S., Bowden, T.R., Boyle, D.B., Wallace, D.B. and Kitching, R.P. 2008. Capripoxoviruses: an emerging worldwide threat to sheep, goat and cattle. Transboundry and emerging Diseases, **55**(7): 263-272.

Babjak, M., Konigova, A., Urda-Dolinska, M. and Varady, M. 2017. Gastrointestinal helminth infection of dairy goats in Slovakia. Helminthologia, **54**(3): 211-217.

Badran, I., Abuamsha, R., Aref, R., Alqisi, W. and Alumor, J. 2012. Prevalence and diversity of gastrointestinal parasites in small ruminants under two different rearing systems in Jenin district of Palestine. An-Najah University Journal for Research, **26**: 1-18.

Balicka-Ramisz, A., Ramisz, A., Vovk, S. and Snitynsky, V. 2012. Prevalence of coccidia infection in goats in Western Pomerania (Poland) and West Ukraine region. Annals of Parasitology, **58**(3): 167-171.

Bansal, D.K., Agrawal, V. and Haque, M. 2015. A slaughter house study on prevalence of gastrointestinal helminths among small ruminants at Mhow, Indore. Journal of Parasitic Diseases, **39**(4): 773-776.

Barragan, R.M., Ruiz, V.A., Rodriguez, J.R. and Marquez, L.J. 2009. Grazing sheep poisoned by milkweed *Asaepias curasuvica* or gastrointestinal haematosis? Case report finding. Veterinary Mexico, **40**(3): 275-281.

Bashir, B.K. 2009. Seasonal prevalence of intestinal helminth parasites of goat (*Capra hircus*) of Khashi Bazaar, Kalanki, Kathmandu. M. Sc. Thesis, Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Biet, F., Boschiroli, M.L., Thorel, M.F. and Guilloteau, L.A. 2005. Zoonotic aspects of *Mycobacterium bovis* and *Mycobacterium avium-intracellulare* complex (MAC). Veterinary Research, **36**(3): 411-436.

Blackie, S. 2014. A review of the epidemiology of gastrointestinal nematode infections in sheep and goats in Ghana. Journal of Agricultural Science, **6**(4): 109-118.

Boyazoglu, J., Hatziminaoglou, I. and Morand-Fehr, P. 2005. The role of the goat in society: past, present and perspectives for the future. Small Ruminant Research, **60**(1-2):13-23.

Caron, Y., Martens, K., Lempereur, L., Saegerman, C. and Losson, B. 2014. New insight in lymnaeid snails (Mollusca, Gastropoda) as intermediate hosts of *Fasciola hepatica* (Trematoda, Digenea) in Belgium and Luxembourg. Parasites and Vectors. **7**(1): 1-8.

Cavalcante, A.C.R., Teixeira, M., Monteiro, J. P. and Lopes, C.W.G. 2012. *Eimeria* species in dairy goats in Brazil. Veterinary parasitology, **183**(3-4): 356-358.

Chartier, C. and Paraud, C. 2012. Coccidiosis due to *Eimeria* in sheep and goats, a review. Small Ruminant Research, **103**(1): 84-92.

Dagnachew, S., Amamute, A. and Temegen, W. 2011. Epidemiology of gastrointestinal helminthiasis of small ruminants in selected sites of North Gondar zone, Northwest Ethiopia. Veterinary Journal, **15**(2): 57-68.

Danile, A., Deneke, Y. and Ibrahim, N. 2014. Gastrointestinal parasites in sheep in Gemechis and Boke District, West Harerghe Zone, Ethiopia. Acta Parasitological Globalis, **5**(2): 120-124.

Devendra, C. and Burns, M. 1970. Goat production in the tropics. Commonwealth Bureau of Animal Breeding and Genetics, 19-184 pp.

DSL (Department of Livestock Services), 2011. A study on goat value chain in Nepal. Heifer International Nepal.

Dhital, V.P. 2006. Prevalence of gastrointestinal parasites in goats at the IAAS livestock farm and Manglapur VDC-2, Chitwan. The Blue Cross, **8**: 122.

Di Cerbo, A.R., Manfredi, M.T., Zanzani, S. and Stradiotto, K. 2010. Gastrointestinal infection in goat farm in Lambardy (Northern Italy): Analysis on community and spatial distribution of parasites. Small Ruminants Research, **88**: 102-112.

Dieterich, G., Karst, U., Fischer, E., Wehland, J. and Jansch, L. 2006. LEGER: knowledge database and visualization tool for comparative genomic of pathogenic and non pathogenic *Listeria* species. Nucleic Acid Research, **34**: 402-406.

Domke, A.V.M., Chartier, C., Gjerde, B., Leine, N., Vatn, S. and Stuen, S. 2013. Prevalence of gastrointestinal helminths, lungworms and liver fluke in sheep and goats in Norway. Veterinary Parasitology, **194**(1): 40-48.

Duguma, G., Mirkena, T., Haile, A., Okeyo, A. M., Tibbo, M., Rischkowsky, B., et al. 2011. Identification of smallholder farmers and pastoralists' preferences for sheep breeding traits: choice model approach. The Animal Consortium, **5**(12): 1984-1992.

Dutta, B., Konch, P., Rahman, T., Upadhyaya, T.N., Pathak, D.C, Tamuli, S.M., et al. 2017. Occurrence and pathology of *Haemonchus contortus* infection in Goats, Journal of Entomology and Zoology Studies, **5**(3): 1284-1287.

Emiru, B., Amede, Y., Tigre, W., Feyera, T. and Deressa, B. 2013. Epidemiology of gastrointestinal parasites of small ruminants in Gechi District, Southwest Ethiopia. Advances in Biological Research, **7**(5): 169-174.

Fake, B.B. 1990. The epidemiology of helminthiasis in small ruminants under the traditional husbandry system in Eastern Nigeria. Veterinary Research Communication, **14**(5): 381-391.

Faran, N.K., Khatoon, S., Sharma, D. K., Ganguly, S. and Kumar, V. 2017. Studies on prevalence of helminth infection in goats in Udaipur district (Rajasthan). Journal of Entomology and Zoology Studies, **5**(6): 2002-2006.

Farooq, Z., Mushtaq, S., Iqbal, Z. and Akhtar, S. 2012. Parasitic helminths of domesticated and wild ruminants in Cholistan desert of Pakistan. International Journal of Agriculture and Biology, **14**(1): 63-68.

Fasanella, A., Garofolo, G., Galante, D., Quaranta, V., Palazzo, L., Lista, F., et al. 2010. Severe anthrax outbreaks in Italy in 2004: considerations on factors involved in the spread of infection. New Microbiologica, **33**: 83-86.

Forety, W.J. 1990. Coccidiosis and cryptosporidiosis in sheep and goats. Veterinary Clinics of North America: Food Animal Practice, **6**(3): 655-670.

Gadahi, J.A., Arshed, M.J., Ali, Q., Javad, S.B. and Shah, S.I. 2009. Prevalence of gastrointestinal parasites of sheep and goats in and around Rawalpindi and Islamabad, Pakistan. Veterinary World, **2**(2): 51-53.

Galan, S. 2005. Biodiversity in goats. Small Ruminant Research, **60**: 75-81.

Garedaghi, Y., Rezii-Saber, A.P., Naghizadehi, A. and Nazeri, M. 2011. Survey on prevalence of sheep and goats lungworms in Tabiz abattoir, Iran. SADV. Environment Biology, **5**: 773-775.

Gathuma, J.M., Gachuiri, C.K. and Omore, A. 2007. Risk factors of gastrointestinal nematode parasite infections in small ruminants kept in smallholder mixed farms in Kenya. BMC Veterinary Research, **3**(1): 6.

Gebeyehu, E.B., Seo, M.G., Jung, B.Y., Byun, J.W., Oem, J.K., Kim, H.Y., et al. 2013. Prevalence of gastrointestinal parasites in Korean native goats (*Capra hircus aegagrus*). Journal of Animal and Plant Science, **23**(4): 986-989.

Gibbous, W.J. 2001. Bovine medicine and surgery. A test and reference work America Veterinary Publication Inc., 4 pp.

Gorski, P., Niznikowski, R., Strzelec, E., Popielarczyk, D., Gajewska, A. and Wedrychowicz, H. 2004. Prevalence of protozoan and helminth internal parasite infections in goat and sheep flocks in Poland. Archive Fur Tierzucht, **47**(6): 43-49.

Grant, J.L. 1981. The epizootiology og nematode parasites of sheep in a high rainfall area of Zimbabwe. Journal of South African Veterinary Association, **52**: 33-37.

Harris, R.D. 1962. The distribution and ancestry of the domestic goats. Proceeding of Linean Society of London **173(**2): 79-91.

Harper, C.K. and Penzhorn, B.L. 1999. Occurrence and diversity of coccidia in indigenous, Saanen and crossbred goat in South Africa. Veterinary Parasitology, **82**(1): 1-9.

Hassan, M.M., Hoque, M.A., Islam, S.K.A., Khan, S.A., Roy, K. and Banu, Q. 2011. A prevalence of parasites in black bengal goats in Chittagong, Bangladesh. International Journal of Livestock Production, **2**(4): 40-44.

Heidari, H., Sadeghi-Dehkordi, Z., Moayedi, R., and Gharekhani, J. 2014. Occurrence and diversity of *Eimeria* species in cattle in Hamedan province, Iran. Veterinarni Medicina, **59**(6): 271-275.

Houdijk, J.G.M., Kyriazakis, I., Jackson, F., Huntley, J.F. and Coop, R.L. 2000. Can an increased intake of metabolizable protein affect the peripaturient relaxation in immunity against *Teladorsagia circumcincta* in sheep? Veterinary Parasitology, **91**: 43–62.

Hugh-Jones, M.E and De Vos, V. 2002. Anthrax and wildlife. Revue Scientifique et Technique-Office International des Epizooties, **21**(1): 359-384.

Husain, A. 2017. Prevalence of gastrointestinal parasites of goat (*Capra hircus*) in Tilottama municipality-17, Rupandehi, Nepal. M.Sc. thesis. Central Department of Zoology, Tribhuvan University,Kathmandu, Nepal.

Islam, K.B.M.S. and Taimur, M.J.F.A. 2008. Helminthic and protozoan internal parasitic infections in free ranging small ruminants of Bangladesh. Slovenia Veterinary Research, **45**(2): 67-72.

Jabbar, L.K. 2007. Study on Fascioliasis in ruminants at Dhanusha district. The Blue Cross, **8**: 122.

Jegede, O.C., Adejoh, A.A., Obeta, S.S and Olayemi, O.D. 2015. Gastrointestinal parasites of sheep and goats in Gwagwalada area council, federal capital territory, Abuja, Nigeria; with a special reference to sex, breed and age. Alexandria Journal for Veterinary Science, **46**(1): 170-176.

Jenness, R. 1980. Composition and characteristics of goat milk: Review. Journal of Dairy Science, **63**(10): 1605-1630.

Jilo, K., Abdela, N. and Adem, A. 2016. Insufficient veterinary service as a major constrants in pastoral area of Ethiopia: A Review. Journal of Biology, Agriculture and Healthcare, **6**: 94-101.

Jittapalapog, S., Saengow, S., Pinyopanuwat, N., Chimnai, W., Khacharem, W. and Stich, R. 2012. Gastrointestinal helminthic and protozoal infections of goats in Satun, Thailand. The Journal of Medicine and Parasitology, **35**: 48-54.

Joshi, B.R. 1994. Effects of parasitic gastro-enteritis in goats under sedentary management in a low hill village of Nepal. Veterinary Review, **9**: 18-20.

Joshi, B. R. 1996. The epidemiology, effects and possible control strategies for parasitic gastroenteritis of small ruminants in the hills of Nepal. In LARC Seminar Paper (Nepal). Lumle AgriculturalResearch Centre.

Juliet, O.N., Oliver, O.N., Oliver, O.O. and Cosmas, U.O. 2013. Comparative study of intestinal helminths and protozoa of cattle and goats in Abakaliki metropolis of Ebonyi State, Nigeria. Advances in Applied Science Research, **4**(2): 223-227.

Karaca, M., Babur, C., Celeb, B., Akkan, H.A., Tutuncu, M., Keles, H., et al. 2007. Investigation on the seroprevalence of *Toxoplasmosis*, *Listeriosis* and *Brucellosis* in goats living in the region of Van, Turkey. YYU Vet. Fak. Derg, **18**(1): 45-49.

Karki, K., Bashir, B. and Subedi, J. 2012. A case study on seasonal prevalence of helminth parasites in goats (*Capra Hircus*) in Kalanki (Khasibazar), Kathmandu, Nepal. Bulletin of Environment, Pharmacology and Life Science, **1**(2): 11-13.

Kelemework, S., Tilahun, A., Benalfew, E. and Getachew, A. 2016. A study on prevalence of gastrointestinal helminthiasis of sheep and goats in and around Dire Dawa, Eastern Ethiopia. Journal of Parasitology and Vector Biology, **8**(10): 107-113.

Kenea, T., Bekele, J. and Sheferaw, D. 2015. Gastro-intestinal nematodes of sheep and goats in three districts of Kaffa and Bench Maji Zones, Southwest Ethiopia. Ethiopian Veterinary Journal, **19**(2): 67-76.

Khajuria, J.K., Katoch, R., Yadav, A., Godara, R., Gupta, S. K. and Singh, A. 2013. Seasonal prevalence of gastrointestinal helminths in sheep and goats of middle agro-climatic zone of Jammu province. Journal of Parasitic Diseases, **37**(1): 21-25.

Kharel, M. and Pradhan, S. L. 1988. Goat meat production in Nepal. In Goat meat production in Asia: proceedings of a workshop held in Tando Jam, Pakistan.

Kheirandish, R., Nourollahi-Fard, S. R. and Yadegari, Z. 2014. Prevalence and pathology of coccidiosis in goats in southeastern Iran. Journal of Parasitic Diseases, **38**(1): 27-31.

Koudela, B. and Bokova, A. 1998. Coccidiosis in goats in the Czech Republic. Veterinary Parasitology, **76**(4): 261-267.

Kumsa, B. and Abebe, G. 2009. Multiple anthelmintic resistance on a goat farm in Hawassa (Southern Ethiopia). Tropical Animal Health. Production, **41**: 655-662.

Kumsa, B., Tadesse, T., Sori, T., Dugum, R. and Hussen, B. 2011. Helminths of sheep and goats in central Oromia (Ethiopia) during the dry season. Journal of Animal and Veterinary Advance, **10**(14): 1845-1849.

Lashari, M.H. and Tasawar, Z. 2011. Prevalence of some gastrointestinal parasites in sheep in southern Punjab, Pakistan. Pakistan Veterinary Journal, **31**(4): 295-298.

Lohani, M.N. and Rasaili, D.P. 1995. Economic analysis of animal diseases in Nepal. Bulletin of Veterinary Science and Animal Husbandry, Nepal, **15**: 67-72.

Lebbie, S.H., Rey, B., and Irungu, E.k. 1994. Small ruminant research and development in Africa. Proceedigs of the 2nd Biennial Conference of the African Small Ruminant Research Net Work. ILLA, 1-5 pp.

Lone, B.A., Chishti, M.Z., Ahmad, F. and Tak, H. 2012. A survey of gastrointestinal helminth parasites of slaughtered sheep and goat in Ganderbal, Kashmir. Global Veterinaria, **8**(4): 338-341.

Mahato, M.K., Singh, D.K., Rana, H.B., and Acharya, K.P. 2018. Prevalence and risk factors associated with *Giardia duodenalis* infection in dairy cattle of Chitwan, Nepal. Journal of Parasitic Diseases, **42**(1): 122-126.

Manfredi, M.T. 2006. Biology of gastrointestinal nematodes of ruminants. Parassitologia, **48**(3): 397-401.

Mbuh, J.V., Ndamukong, K.J.N., Ntonifor, N. and Nforlem, G.F. 2008. Parasites of sheep and goats and their prevalence in Bokova, a rural area of Buea Sub-Division, Cameroon. Veterinary Parasitology, **156**: 350-352.

Mengist, Z., Abebe, N., Gugsa, G. and Kumar, N. 2014. Assessment of small ruminant haemonchosis and its associated risk factors in and around Finoteselam, Ethiopia. IOSR-JAVS, **7**(12): 36-41.

MoAD (Ministry of Agriculture Development), Nepal Portfolio Performance Rewiew, 2015.

Mohamaden, W. I., Sallam, N. H., & Abouelhassan, E. M. (2018). Prevalence of *Eimeria* species among sheep and goats in Suez Governorate, Egypt. International Journal of Veterinary Science and Medicine, **6**(1): 65-72.

Morgan, E.R. and Van Dijk, J. 2012. Climate and the epidemiology of gastrointestinal nematode infections of sheep in Europe. Veterinary parasitology, **189**(1): 8-14.

Munyua, W.K. and Ngotho, J.W. 1990. Prevalence of *Eimeria* species in cattle in Kenya. Veterinary Parasitology, **35**(1-2): 163-168.

Nawathe, D.R., Sohael, A.S. and Umo, I. 1985. Health management of a dairy herd on the Jas Plateau, Nireria. Bulletin of Animal Health Production in Africa, **33**: 199-205.

Nazawa, K. 1991. Domestication and history of goats. Genetic resources of pig, sheep and goat. Elsvier Science Publisher, **1**: 391-404.

Negasi, W., Bogale, B. and Chanie, M. 2012. Helminth parasites in small ruminants: prevalence, species composition and associated risk factors in and around Mekelle town, Northern Ethiopia. European Journal of Biological Sciences, **4**(3): 91-95.

NLSS (Nepal Living Standard Survey), 2012. A study on goat value chain in Nepal. Heifer International Nepal.

Neupane, 2012. Epidemiology of gastrointestinal helminth parasites in goats of Banke, Nepal. Msc. Thesis. Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Norton, C. C. 1986. Coccidia of the domestic goat *Caprahircus*, with notes on *Eimeriaovinoidalis* and *E. bakuensis* (syn. *E. ovina*) from the sheep *Ovisaries*. Parasitology, **92**(2): 279-289.

Ntonifor, H.N., Shei, S.J., Ndaleh, N.W. and Mbunkur, G.N. 2013. Epidemiological studies of gastrointestinal parasitic infection in ruminants in Jakiri, Bui Division, North West Region of Cameroon. Journal of Veterinary Medicine and Animal Health, **5**(12): 344-352.

Nwosu, C.O., Madu, P.P. and Richards, W.S. 2007. Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi- arid zone of north- eastern Nigeria. Veterinary Parasitology, **144**(1-2): 188-124.

Nwosu, C.O., Ogunrinade, A.F. and Fagbemi, B.O. 1996. Prevalence and seasonal changes in the gastro-intestinal helminths of Nigerian goats. Journal of Helminthology, **70**(4): 329-333.

O'Connor, L.J., Walkden-Brown, S.W., Kahn, L.P, 2006. Ecology of the free-living stages of major *Trichostrongyloid* parasites of sheep. Veterinary Parasitology, **142**(1-2): 1-15.

Olanike, A. O., Olayide, A. J., Oludunsin, F. O., Racheal, A. O. and Japhe, D. W. 2015. Prevalence of gastrointestinal parasites of goats in Ibadan, Southwest, Nigeria. World Journal of Agricultural Research, **3**(2): 49-51.

Olivares, J.L., Rodriguez, D.L.G., Herrera, H., Cortes, S. and Gonzalez, O. 2001. Experimental *Oesophagostomum columbianum* infection in ovines. A Review. Journal of Salud Animal, **23**: 118-122.

Opara, M.N., Nwaobasi, J. K. and Okoli, I.C. 2005. Occurrence of parasitic helminthes among ruminants reared under traditional husbandry system in Owerri, South East Nigeria. Bulletin of Animal Health Production Africa, **53**: 226-233.

Owhoeli, O., Elele, K. and Gboeloh, L.B. 2014. Prevalence of gastrointestinal helminths in exotic and indigenous goats slaughtered in selected abattoirs in Port Harcourt, south-south, Nigeria. Chinese Journal of Biology, **2014**: 1-8.

Pal, R.A. and Qayyum, M. 1993. Prevalence of gastrointestinal nematodes of sheep and goats in upper Punjab, Pakistan. Pakistan Veterinary Journal, **13**(3): 138-141.

Pandey, V.S., Ndao, M. and Kumar, V. 1994. Seasonal prevalence of gastrointestinal nematodes in communal land goats from the highveld of Zimbabwe. Veterinary Parasitology, **51**(3-4): 241-248.

Papadopoulos, E., Arsenos, G., Himonas, C. and Coles, G.C. 2007. Gastrointestinal nematode infection pattern of Greek dairy goats reared under extensive husbandry conditions and treated with anthelminthics at different times during the year. Small Ruminant Research, **69**(1-3): 68-73.

Parajuli, L. 2007. A study on intestinal helminth parasites of goat (*Capra hircus*) brought to Khasibazar Kalanki (Kathamandu) for slaughter purpose. M.Sc. Thesis. Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Pathak, A.K. and Pal, S. 2008. Seasonal prevalence of gastrointestinal parasites in goats from Durg district of Chhattisgarh. Veterinary World, **1**(5): 136-137.

Perry, B.D., Randolph, T.F., McDermott, J.J., Sones, K.R. and Thornton, P.K. 2002. Investing in animal health research to alleviate poverty. International Livestock Research Institute (ILRI), Nairobi, Kenya, 148 pp.

Pedreira, J., Silva, A.P., Andrade, R.S., Suarez, J.L., Arias, M., Lomba, C. et al. 2006. Prevalence of gastrointestinal parasites in sheep and parasite control practices in North-West Spain. Prevent Veterinary Mededicine, **75**: 56-62.

Purja, R. and Maharjan, M. 2017. Gastrointestinal parasites in Goat (*Caprahircus*) of Puranchaur VDC, Pokhara. International Journal of Research Studies in Zoology, **3**(4): 39-45.

Radfar, M.H., Sakhaee, E., Shamsaddini Bafti, M. and Haj Mohammadi, H. 2011. Study on gastrointestinal parasitic infections of Raeini goats. Iranian Journal of Veterinary Research, **12**(1): 76-80.

Radostits, O.M., Blood, D.C. and Gray, C.C. 1994. Veterinary medicine (6th edn). Bailliere Tindall, London, 356-358pp.

Rahman, M., Sharifuzzaman, J., Sarker, E., Shahiduzzaman, M. and Mostofa, M. 2014. Prevalence of parasitic diseases of goat at Pirganj upazilla of Bangladesh. International Journal of Natural and Social Sciences, **1**: 8-12.

Ratanapob, N., Arunvipas, P., Kasemsuwan, S., Phimpraphai, W. and Panneum, S. 2012. Prevalence and risk factors for intestinal parasite infection in goats raised in Nakhon Pathom Province, Thailand. Tropical animal health and production, **44**(4): 741-745.

Raza, M.A., Iqbal, Z., Jabbar, A. and Yaseen, M. 2007. Point prevalence of gastrointestinal helminthiasis in ruminants in southern Punjab, Pakistan. Journal of Helminthology, **81**(3): 323-328.

Raza, M.A., Younas, M. and Schlecht, E. 2014. Prevalence of gastrointestinal helminths in pastoral sheep and goat flocks in the Cholistan desert of Pakistan. The Journal of Animal and Plant Science, **24**(1): 127-134.

Regassa, F., Sori, T., Dhuguma, R. and Kiros, Y. 2006. Epidemiology of gastrointestinal parasites of ruminants in western Oromia, Ethiopia. International Journal of Applied Research in Veterinary Medicine, **4**(1): 51-57.

Richard, S., Cabaret, J. and Cabourg, C. 1990. Genetic and environmental factors associated with nematode infection of dairy goats in Northwestern France. Veterinary Parasitology, **36**(3-4): 237-243.

Rizal, B. 2010. Determination of seasonal prevalence of helminth parasites in goats from village area of Arghakachi, Khiljee, Nepal. M.sc. Thesis. Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Ruiz, A., Gonzalez, J.F., Rodriguez, E., Marin, S., Hernandez, Y.I., Almeida, R., et al. 2006. Influence of climatic and management factors on Eimeria infections in goats from semi-arid zones. Journal of Veterinary Medicine, **53**(8): 399-402.

Ruiz, A., Guedes, A.C., Muñoz, M.C., Molina, J.M., Hermosilla, C., Martín, S. et al. 2012. Control strategies using diclazuril against coccidiosis in goat kids. Parasitology Research, **110**(6): 2131-2136.

Sangvaranond, A., Lampa, N., Wongdachkajorn, D. and Sritong, D. 2010. Prevalence of helminth parasites and intestinal parasitic protozoa among meat goats raised in private farms in Saraburi Province Thailand. Journal of Kasetsart Veterinarians **20**: 85-95.

Sangma, A., Begum, N., Roy, B.C. and Gani, M.O. 2012. Prevalence of helminth parasites in sheep (*Ovisaries*) in Tangail district, Bangladesh. Journal of the Bangladesh Agricultural University **10**(2): 235-244.

Sanyal, P.K. 1996. Gastro-intestinal parasites and small ruminant production in India. Australian Center for Inernatfonal Agricultural Researches, **74**: 109-112.

Saravanan, S. and Palanivel, K.M. (2017). Detection of Gastrointestinal Helminthic and Protozoan Infections in Diarrhoeic Goats. International Journal of Current Microbiology and Applied Sciences, **6**(4): 801-805.

Sharma, D.K., Agrawal, N., Mandal, A., Nigam, P. and Bhushan, S. 2009. Coccidia and gastrointestinal nematode infections in semi-intensively managed Jakhrana goats of semi-arid region of India. Tropical and Subtropical Agroecosystems, **11**(1): 135-139.

Silva, L.M.R.D., Vila-Viçosa, M.J.M., Nunes, T., Taubert, A., Hermosilla, C. and Cortes, H.C.E. 2014. *Eimeria* infections in goats in Southern Portugal. Revista Brasileira de Parasitologia Veterinária, **23**(2): 280-286.

Silvestre, A., Chartier, C., Sauve, C. and Cabaret, J. 2000. Relationship between helminth species diversity, intensity of infection and breeding management in dairy goats. Veterinary Parasitology, **94**(1-2): 91-105.

Singh, A.K., Das, G., Roy, B., Nath, S., Naresh, R. and Kumar, S. 2015. Prevalence of gastro-intestinal parasitic infections in goat of Madhya Pradesh, India. Journal of Parasitic Diseases, **39**(4): 716-719.

Singh, B. and Prasad, S. 2008. Modelling of economic losses due to some important diseases in goat in India. Agricultural Economic Research Review, **21**(2): 297-302.

Singh, E., Kaur, P., Singla, L.D. and Bal, M.S. 2017. Prevalence of gastrointestinal parasitism in small ruminants in western zone of Punjab, India. Veterinary World, **10**(1): 61.

Singh, V., Varshney, P., Dash, S.K. and Lal, H.P. 2013. Prevalence of gastrointestinal parasites in sheep and goats in and around Mathura, India. Veterinary World, **6**(5): 260.

Sohail, M., Nauman-ul-Islam, M., Shah, S.S.A., Shah, I.A., Raziq, A. and Ilyas, M. 2017. Incidence of gastrointestinal parasites in Beetal goats at district Peshawar, Pakistan. Advance in Animal and Veterinary Science, **5**(5): 205-207.

Soubly, E.J.L. 2006. Gastro intestinal nematodes of small ruminant's life ciue, antihelmintics and diagnosis. Journal of Veterinary Clinics and Animal Practice, **22**: 529-531.

Soulsby, E.J.L. 1965. Textbook of veterinary clinical parasitology. Helminths, **1**.

Soulsby, E.J.L. 1982. Helminths, arthropods and protozoa of domesticated animals 7th ed. Bailliere Tindall, London, 809 pp.

Stoll, N.R. and Hausheer, W.C. 1926. Accuracy in the dilution egg counting method. American Journal of Hygiene. March Supplement, **6**: 80-133.

Sutar, A.U., Kengar, S.B., Patil, S.S. and Khan, M.R. 2010. Prevalence of gastrointestinal parasites in goats of Ahmednagar district of Maharasthra. Veterinary World, **3**(10): 456-475.

Tahir, M.S., Ibrahim, T.A.T. and Babjee, S.M.A. 2011. Study on coccidia infection and species in Cyprus Shami goat population. 6th proceedings of the seminar on veterinary science, 46-50pp.

Taleski, V., Zerva, L., Kantardjiev, T., Cvetnic, Z., Erski-Biljic, M., Nikolovski, B., et al. 2002. An overview of the epidemiology and epizootology of Brucellosis in selected countries of central and southeast Europe. Veterinary Parasitology, **90**: 147-155.

Tasawar, Z., Ahmad, S., Lashari, M.H. and Hayat, C.S. 2010. Prevalence of *Haemonchus contortus* in sheep at research centre for conservation of Sahiwal cattle (RCCSC) Jehangirabad, District Khanewal, Punjab, Pakistan. Pakistan Journal of Zoology, **42**(6): 735-739.

Tauseef-ur-Rehman, M.N.K., Khan, I.A. and Ahmad, M. 2011. Epidemiology and economic benefits of treating goat coccidiosis. Pakistan Veterinary Journal, **31**(3): 227-230.

Teklye, B. 1991. Epidemiology of endoparasites of small ruminants in sub-saharan Africa. Proceedings of Fourth National Livestock Improvement Conference. Addis Ababa, Ethiopia, 13-15pp.

Terefe, D., Demissie, D., Beyene, D. and Haile, S. 2012. A prevalence study of internal parasites infecting Boer goats at Adami Tulu Agricultural Research Centre, Ethiopia. Journal of Veterinary Medicine and Animal Health, **4**(4): 12-16.

Thakuri, K.C. and Mahato, S.N. 1990. Prevalence of gastrointestinal helminthic infections in ruminants in Dhankuta district, proceeding of the 2nd national workshop on livestock and fisheries in Nepal, 120-125 pp.

Thrusfield, M., 2005. Veterinary Epidemiology 3rd edition. UK, Black well Publishing, 183pp.

Tripathi, R. P. and Subedi, J. R. 2015. Seasonal prevalence of gastrointestinal helminth parasites of goat (*Capra* sp.) of Shivaraj Municipality-13 Kapilvastu, Nepal. Nepalese Journal of Zoology, **3**(1): 63.

Urquhart, GM; Armour, J; Duncan, JL; Dunn, AM and Jennings, FW (1987). Veterinary parasitology. 3rd edition, Burnt Mill, Harlow, UK, Longman Scientific and Technical, 217-224 pp.

Urquhart, G.M., Armour, J., Duncan, J.L., Dunn, A.M. and Gennings, F.W. 1996. Verterinary Parasitology 2nd edition. Blackwell Science Ltd. UK, 170-176.

Umur, S. and Yukari, B.A. 2005. Seasonal activity of gastro-intestinal nematodes in goats in Burdur region, Turkey. Turkish Journal of Veterinary and Animal Sciences, **29**(2): 441-448.

Unnerstas, H., Romell, A., Ericsson, H., Danielsson-Tham, M.L. and Tham, W. 2002.Listeria monocytogenes in faeces from clinically healthy dairy cows in Sweden. Acta Veterinaria Scandinavica, **41**(2): 167-71.

Vazquez-Boland, J.A., Kuhn, M., Berche, P., Chakraborty, T., Dominguez-Bernal, G., Goebel, W. et al. 2001. Listeria pathogenesis and molecular virulence determinants. Clinical microbiology reviews, **14**(3): 584-640.

Vercruysse, J. 1982. The coccidian of sheep and goats in Sengal. Veterinary Parasitology, **10**(4): 297-306.

Vercruysse, J. and Claerbout, E. 2001. Treatment versus Non Treatment of Health Infections in Cattle: Defining the Thresholds. Veterinary Parasitology, **98**: 195-214.

Vural, S.A., Alcigir, G. and Berkin, S. 2001. Immunohistochemical and histopathological studies of fixed rabies virus in goats. Onderstepoort Journal of Veterinary Research, **68**: 83-89.

Wang, C R., Xiao, J.Y., Chen, A.H., Chen, J., Wang, Y., Gao, J.F., et al. 2010. Prevalence of coccidial infection in sheep and goats in northeastern China. Veterinary parasitology, **174**(3-4): 213-217.

Waruru, R.M., Mutune, M.N. and Otieno, R.O. 2005. Gastrointestinal parasite infections of sheep and goats in a semi-arid area of Machakos District, Kenya. Bulletin of Animal Health and Production in Africa, **53**(1): 25-34.

Yadav, A., Khajuria, J. K. and Raina, A.K. 2006. Seasonal prevalence of gastrointestinal parasites in sheep and goats of Jammu. Journal of Veterinary Parasitol, **20**(1): 65-68.

Yadav, S.K., Ahaduzzaman, M., Sarker, S., Sateed, M.A. and Hque, M.A. 2015. Epidemiological survey of Fasciolasis in cattle, buffalo and goat in Mahottari and Dhanusha, Nepal. Journal of Advance in Parasitology, **2**(3): 51-56.

Yamafuti, S. 1961. System helminthum. The nematodes of vertebrates. Interscience Publishers Incorporation, New York, **3**: 1261 pp.

Yune, N. and Abdela, N. 2017. Epidemiology and economic importance of sheep and goat pox: a review on past and current aspects. Journal of Veterinary Science and Technology, **8**(2): 1-5.

Zahid, I.A., Latif, M. and Baloch, K.B. 2005. Incidence of endoparasites in exotic cattle calves. Pakistan Veterinary Journal, **25**(1): 47-48.

Zanzani, S.A., Gazzonis, A.L., Cerbo, A., Varady, M. and Manfredi, M.T. 2014. Gastrointestinal nematodes of dairy goats, anthelmintic resistance and practices of parasite control in Northern Italy. BMC Veterinary Research, **10**(1): 114.

Zeryehun, T. 2012. Helminthosis of sheep and goats in and around Haramaya, Southeastern Ethiopia. Journal of Veterinary Medicine and Animal Health, **4**(3): 48-55.

Zvinorova, P. I., Halimani, T. E., Muchadeyi, F. C., Matika, O., Riggio, V. and Dzama, K. 2016. Prevalence and risk factors of gastrointestinal parasitic infections in goats in low-input low-output farming systems in Zimbabwe. Small Ruminant Research, **143**: 75-83.

APPENDICES

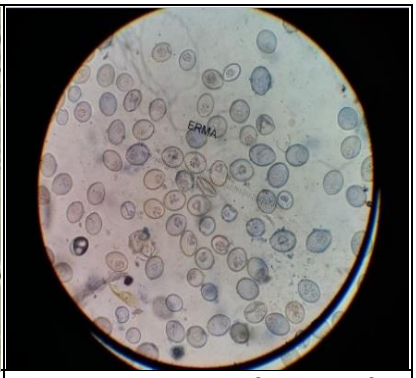
Table 7: Size of egg/oocysts of different GI parasites of goat.

Name of parasite	**Size in present study (l x b)**	**From literatures range of egg (l x b)**	**Remark**	**Reference**
Eimeria with micropyle	(25µm x 22.68µm)	(28-19) µm	Pink/green in color, contain morulla located centrally, micropyle occur in one side	Soulsby, 1982. 7th edition, helminths, arthropods and protozoa of domestic animal.
Eimeria without micropyle	(24 µm x 18.9 µm)	(16-24) µm	Pink/green in color, contain morulla located centrally, absence of micropyle	
Haemonchus sp.	(80.64 µm x47.88µm)	(75-85) µm x 44 µm	Oval, yellowish in color, embryo 16-32 cell.	
Bunostomum sp.	(98.28 µm x57.96 µm)	(79-97) µm x (47-50) µm	Thin shell, ends are bluntly rounded, embryonic cell are darkly granulated	
Strongyloides sp.	(60.48 µm x 37.8 µm)	(40-60) µm x (20-40) µm	Blunt end, thin shell, embryonated	
Tirchostrongylus sp.	(73.08 µm x45.36 µm)	(79-100) µm x (39-47) µm	Oval bilaterally symmetrical, embryo mass multisigmented, thin transparent outer layer	
Trichuris sp.	(70.56 µm x30.24 µm)	(70-80) µm x (30-42) µm	Brown in color, barrel-shaped,with transparent plug at either pole	

Oesophagostomum sp.	(83.16 µm x40.32 µm)	(73-89) µm x (34-45) µm	Thin shelled with 8 to 16 cell stage	
Muellerious sp.	Presence of distinct curved spicules which is alate and ends in sharp points	(12-14) µm male and (19-23) µm female	The spicules are curved and each consists of a proximal half which is alate and two distal serrated arms ending in sharp points	
Fasciola sp.	(131.04 µm x 75 µm)	(130-150) µm x (63-90) µm	Oval shape, yellowish in color, operculum usually distinct	
Moniezia sp.	65.52 µm	(56-67) µm	Somewhat triangular in shape, contain a well-developed pyri-form apparatus	

PHOTOGRAPHS

OOCYST OF PROTOZOAN PARASITE

		
Photo 1: *Eimera* sp.with micropyle Size: 25µm x 22.68µm	Photo 2: *Eimera* sp.without micropyle Size: 24µm x 18.9 µm	Photo 3: Heavy infection of *Eimera* sp.

EGG OF CESTODE AND TREMATOD

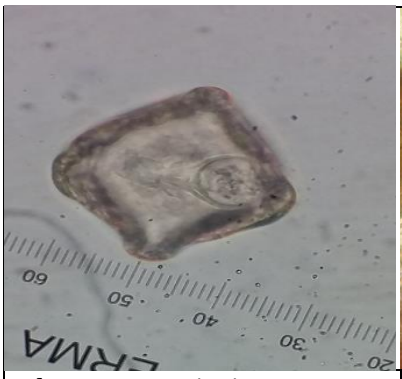
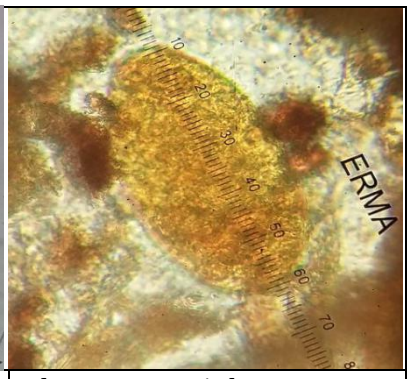
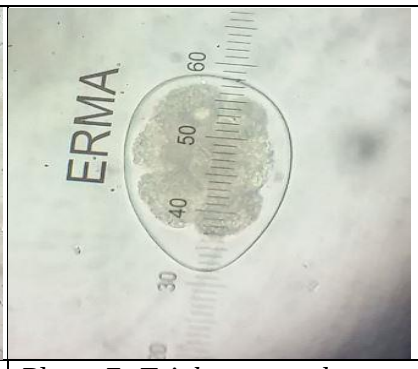
	

Photo 4: *Moniezia* sp. Size: 65.52µm	Photo 5: *Fasciola* sp. Size: 131.04 µm x 75µm

EGG AND LARVA OF NEMATODE

		
Photo 6: *Trichuris* sp. Size: 70.56µmx 30.24µm	Photo 7: *Trichostrongylus* sp Size: 73.08µm x 45.36µm	Photo 8: *Haemonchus* sp Size: 80.64µm x 47.88µm

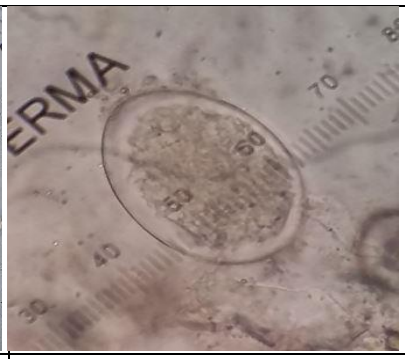
		
Photo10: *Oesophagostomum* sp. Size: 83.16µm x 40.32µm	Photo 12: *Strongyloides* sp. Size: 60.48µm x 37.8µm	Photo 11: *Muellerious* sp. (larva)

		
Photo13. Goats in their habitat	Photo14. Goats in their shed.	Photo15. Collection of fecal sample of goat.