GASTRO-INTESTINAL PARASITES IN GOAT (*Capra hircus)* OF PURANCHOUR VDC, POKHARA.

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

Submitted to

Central Department of Zoology

Institute of Science and Technology

Tribhuvan University

Kirtipur, Kathmandu

Nepal

December, 2015

DECLARATION

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

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RECOMMENDATION

This is to recommend that the thesis entitled **"Gastro-Intestinal Parasites in Goat (*Capra hircus*) of Puranchaur VDC of Pokhara"** has been carried out by Radha Purja for the fulfillment of master's Degree of science in zoology with special paper Parasitology. This is her original work and has been carried out under my supervision. To the best of my knowledge, this thesis work has not been submitted for any other degree in any institutions.

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LETTER OF APPROVAL

On the recommendation of supervisor **"Dr. Mahendra Maharjan"** this thesis submitted by Radha Purja entitled **"Gastro-Intestinal Parasites in Goat (*Capra hircus*) of Puranchaur VDC of Pokhara"** is approved for the examination and submitted to the Tribhuvan University in partial fulfillment of the requirements for Master's Degree of Science in Zoology with special paper Parasitology.

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This thesis work submitted by Radha Purja entitled **"Gastro-Intestinal Parasites in Goat (*Capra hircus*) of Puranchaur VDC of Pokhara"** has been approved as a partial fulfillment for the requirements of Master's Degree of Science in Zoology with special paper Parasitology.

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ABBREVIATIONS

ARPN	-	Asian Research Publishing Network
CDZ	-	Central Department of Zoology
CTVM	-	Centre for Tropical Veterinary Medicine
D/W	-	Distilled Water
DLSO	-	District Livestock Service Office
FAO	-	Food and Agricultural Organization
GI	-	Gastro Intestinal
HIV/AIDS	-	Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome
IAAS	-	Institute of Agriculture and Animal Science
ILCA	-	International Livestock Centre for Africa
LARC	-	Lumle Agriculture Research Centre
NZFHRC	-	National Zoonoses and Food Hygiene Research Centre
PAC	-	Pakhribas Agricultural Centre
TU	-	Tribhuvan University
UK	-	United Kingdom
VDC	-	Village Development Committee

ABSTRACT

Goat (*Capra hircus*), a member of the Bovidae family and subfamily Caprine is supposed to be the first farm animals domesticated. Present study was conducted to assess the prevalence of gastrointestinal parasites of goat. A total of 220 fecal samples were collected of which 110 in the month of June/July 2014 and 110 January/February 2015 from Puranchaur VDC of Pokhara and examined by sedimentation and floatation technique. A questionnaire survey was conducted among 100 farmers randomly regarding goat diseases and use of anthelmintics. The study revealed 100% prevalence of gastrointestinal parasites including 13 genera. Among the porotozoan, sporozoan (89.54%) showed higher prevalence followed by sarcodina (31.81%). Among helminth parasites, two were trematodes *Fasciola* sp. (8.18%) and *Paramphistomum* sp. (4.09%), 2 were cestodes *Taenia* sp.(4.09%) and *Moniezia* sp. (18.18%) and seven were nematode in which *Toxocara* sp. (68.18%) showed the highest prevalence followed by *Bunostomum* sp. (35%), *Oxyuris* sp. (30.45%), *Trichuris* sp. (12.27%), *Strongyloides* sp. (7.27%), *Trichostrongyloid* sp. (5.45%), *Nematodirus* sp. (4.54%). Multiple infection was observed in 202 (91.81%) samples and single infection in 18(8.18%) samples. Statistically there was no significant difference in the seasonal prevalence of gastrointestinal parasites during two seasons in goats.

1. INTRODUCTION

1.1 Background

Goat *(Capra hircus)* is one of the important domestic livestock as a source of dairy, meat and manure. Female goats are referred to as does or nannies, intact males as bucks or billies their offspring are kids. Goat meat from younger animals is called kid or cabrito, and from older animals is called chevon or "mutton" in some areas (www.wikipedia.org/goat). Gestation length is approximately 145-155 days. Twins are the usual result with single and tripled births are also common (www.bva.awf.org.uk). *Capra hircus* is a herbivorous.

Goats are primarily reared for meat and manure and regarded as the second important animal species (first being buffalo) for generating their cash income by farmers (Gatenby et al. 1990). Goats are supposed to be the first farm animals domesticated (Zenuer 1963 and Devendra 1998) and is believed that domestication of goats occurred in western Asia (Harris 1962) and gradually reached the Indian sub-continent and later to South East Asia (Nazawa 1991).

In a developing country like Nepal, natives have included meat as important part of their diet to supplement nutritional requirements. In Nepal, buffaloes, contribute about 64% of meat consumed, followed by goat meat 20%, pork 7%, chicken 6% and sheep 3% (Joshi et al. 2001). Skin of goat is used to make various products such as gloves, boots, and other products that require a soft hide. Cashmere wool which is one of the best in the world is produced by cashmere goats which grow beneath the guard hairs and is very fine and soft. The fiber is made into products such as sweaters and a dolls hair with the mohair. The word pashmina has been derived from Persian word pashm meaning soft. In South Asia, Cashmere is called pashmina and these goats are called pashmina goats (Rizal 2010).

Resource poor farmers of the hills, who cannot invest large sums of money in cattle and buffalo, prefer sheep and goat husbandry which has no social, religious or cultural taboos, or caste restrictions (Ghimire 1992). Traditionally, in Nepal meat and meat products of all domestic animals are consumed except cattle. Animal slaughter is a common practice not only for consumption but also for religious sacrifices and traditional ceremonies.

Livestock farming is an integral part of the farming system and goat contributes substantially in the livestock sector of Nepal. Goat, in Nepal has been acclimatized and adopted to a wide range of environmental conditions. It can maintain itself in a harsh environment.

There are mainly four breeds of goats in Nepal Chyangra, Sinhal, Khari and Terai (Kharel 1997). The national production is unable to fulfill the need of Nepal, hence significant number of goats are imported from neighboring countries. About 74 percent of goats are brought from India and 26 percent from different parts of Nepal in the Kathmandu market according to third National Convention 1998/1999).

In comparison to other livestock species goats are relatively resistant to many diseases. Gastro-intestinal parasitic diseases are regarded as the most important constraint to reduce the productivity of sheep and goats in Nepal. Lohani and Rasaili (1995) calculated the economic loss due to animal diseases to be about 885 million rupees (Equivalent to 17.7 million US$) (based on a survey data from six districts of the country). Joshi (1996) reported that the total annual loss due to parasitic gastroenteritis alone would be about 9.2 million US$.

Parasites are classified as endoparasites and ectoparasites on the basis where they live inside or on the body cavity. Endoparasites are those organisms living in their hosts, in the gut, body cavity, liver, lungs, gall bladder and blood and within the intestinal, tissues or cell of the host.

Among different parasitic infections, gastrointestinal diseases are most varied and of common occurrence. Different grades of infections with fluke, tapeworms and roundworms, are responsible for marked deleterious effects that tend to lower overall production both by the way of morbidity and mortality.

1.2 Intestinal Parasites of Goat

Intestinal protozoan parasites

The protozoan parasites are microscopic, unicellular organism which have complex internal structure and perform various complex metabolic activities such as digestion,

reproduction, respiration, excretion, etc. Some protozoan parasites commonly found in intestine of herbivorous include *Eimeria* sp., *Entamoeba* sp., *Giardia* sp. etc.

Intestinal helminth parasites

Trematodes

Trematodes species that have been reported in domestic ruminants are *Fasciola* sp., *Paramphistomum sp., Dicrocoelium* sp. etc. Trematodes require an intermediate host in their life cycle with vertebrates being the definitive host. Trematodes commonly known as flukes, often live in the bile ducts or small intestine and may also affect the lungs. Fascioliasis is well known parasite of herbivorous animals. It has worldwide distribution on the animal reservoir host. Man and herbivorous animals (sheep, cattle, buffalo, etc.) acquire infection by the ingestion of moist and raw aquatic plants containing metacercaria of parasite. The economic loss due to fascioliasis in Nepal was estimated to be Rs.14.2 crore (Lohani and Rasaili 1995). In addition fascioliasis is now recognized as an emerging human disease. Rice straw which is the major feed for livestock during winter months has been reported as the potential source of infection for fascioliasis (Mahato 1993). Green grasses from near permanent water sources or water lodging areas in monsoon are another potential source of *Fasciola* sp. infection. *Paramphistomum* sp. is one of the common parasites in the rumen of sheep, cattle and water buffaloes. The parasite causes ruminitis, irregular ruminition, unthriftness, lower nutrition conversion, and loss of body condition, decrease in milk production and reduction of fertility. It is distributed all around the world but the highest prevalence has been reported in tropical and sub tropical regions, particularly in Africa, Asia, Australia, Eastern Europe and Russia (Melaku and Addis 2012).

Cestodes

Tapeworms have indirect life cycles that require the passage through at least one intermediate host (insects, mites, other mammals) where the various developmental stages suffer considerable morphologic changes. Cestodes also called tapeworms that have a flat, ribbon-like body and live in the digestive system of their hosts. The body consist a head called scolex**,** followed by a neckpiece linear chain of segments called proglottids (or metamers). All the segments together form the strobila. The segments are flat and altogether the strobila looks like a tape, which is why they are called "tapeworms". They

lack alimentary canal they don't need them because each proglottid absorbs what it needs directly through its tegument. They have a rudimentary nervous system. The proglottids of tapeworms increase in size from head to tail, i.e. the head is not in the widest but in the narrowest end of the body.

Moniezia sp. in ruminants causes infections by ingesting herbage contaminated with the mites carrying the infective stage of the parasite. Heavy infections cause poor growth and diarrhoea in lambs. *Taenia* sp. The adult tapeworms live in the intestines of the definitive hosts. This infection is called taeniasis. Humans are the definitive hosts for *Taenia solium* (the pork tapeworm) and *Taenia saginata* (the beef tapeworm) worms (segements) passes out along with the faeces of human being and when ingested by animals infects them.

Nematodes

Some of the common roundworms of goats are *Haemonchus* sp., *Ostertagia* sp., *Trichostrongyloid* sp., *Bunostomum* sp., *Nematodirus* sp., *Strongyloides* sp., *Toxocara* sp., *Chabertia* sp., *Trichuris* sp.etc. These nematodes have a simple direct life cycle consisting of an egg stage, larval stages and an adult stage. They do not need an intermediate host. The life cycle of a nematode can be divided into two phases, the free-living phase in the external environment and the parasitic phase in the host. The common clinical symptoms of the infection with gastrointestinal nematodes are anorexia, diarrhea, emaciation, anaemia etc. The body is often ornamented with ridges, rings, bristles, or other distinctive structures. The head of a nematode is relatively distinct, whereas the rest of the body is bilaterally symmetrical. The mouth has either three or six lips, which often bear a series of teeth on their inner edges. Most nematode species are dioecious, with separate male and female individuals. Female round worms lay microscopic eggs that pass in the manure of cattle. Within few days the larva hatches from the egg. The larva passes via second and third stage and infects the pasture. Goats get infected when they graze on the contaminated pasture. The larva mature in the intestine, mate and begins laying eggs. The effect of these parasites is strongly dependent on the number of parasites and nutritional status of the animal they are infecting. They cause economic losses in a variety of ways: they cause losses through lowered fertility, reduced work capacity, involuntary culling, a reduction in food intake and lower weight gains, lower milk production, treatment costs, and mortality in heavily parasitized animals (Lebbie 1994).

1.3 Objectives of the Study

1.3.1 General objectives

To find out the distribution of gastro-intestinal parasites in goat of Puranchaur VDC Pokhara.

1.3.2 Specific objectives

i. To determine the seasonal prevalence of gastrointestinal parasites of goat.
ii. To Assess the knowledge, attitude and practices on goat diseases among goat farmers.

2. LITERATURE REVIEW

Gastrointestinal parasites are those parasites that infect the gastrointestinal tract of ruminants and other animals**.** Protozoan parasites are unicellular eukaryotic organisms, the name ‘proto-zoa’ literally means ‘first animals’ they are structurally and functionally independent individual cells. The name "helminth" is derived from Greek word "helmins" or "helminthos", meaning a worm. Before 17th century, knowledge of parasitology was limited to ectoparasites like lice and flies and few internal parasites like roundworms, pinworms and tapeworms. Linnaeus gave another view about these internal parasites that they originated from accidentally swallowed free living organisms. Parasites are the organisms which depend on the host for their shelter, food and metabolic activities. The association between a parasite and a host is known as parasitism. Parasitism in actual sense can be defined as “an intimate and obligatory relationship between two heterospecific organisms during which the parasite, usually the smaller one of two partners, is metabolically dependent on the host” Domesticated animals are susceptible to many diseases like coccidiosis, fasciolopsis, schistosomiasis, nematodiasis, respiratory diseases etc.

2.1 Gastrointestinal Parasites of Ruminants

The word 'ruminant' comes from the latin ruminare which means "to chew over again". There are about 150 species of ruminants which includes cattle, goats, sheep, giraffes, deer, antelopes and some microbes. Ruminants usually have a stomach divided into four compartment called rumen, reticulum, omasum and abomasum.

Gastrointestinal parasites are the parasites that infect the gastrointestinal tract of ruminants and other animals. There are two main types of gastrointestinal parasites they are helminth and protozoan parasites that reside in the intestine (not all).

Global distribution of Protozoan parasite in ruminants:

Generally ruminants are infected by various common intestinal parasites. Coccidian parasites, particularly *Eimeria* sp. and *Cryptosporadium* sp. as well as *Entamoeba* sp. and *Giardia sp.* infect ruminants worldwide causing severe economic loss to the farmers.

Coccidiosis is a parasitic disease caused by coccidian parasites. Coccidian parasites cause intestinal and extraintestinal coccidiosis. Intestinal coccidian parasites are important causes of diarrhea in ruminants which have direct impact on economic loss among farmers. *Eimeria* sp. and *Cryptosporidium* sp. are the important causes of coccidiosis in ruminants. These parasites can be easily transmitted through fecal oral route .The parasite can be transmitted within same ruminants sp. or different sp. such as cattle to goat, goat to human, goat to other animals etc.

The coccidian parasite *Eimeria* sp. has been reported from cattles of various countries like Costa Rica, Kenya, Iran etc, (Jimenez et al. 2007, Munyua et al. 1990, Garekhane et al. 2015). Similarly farmers of several Asian Countries suffer heavy economic loss due to *Eimeria* sp. in cows and buffalos (Kaur and Kaur 2008). Another important coccidian parasites infecting ruminants includes *Cryptosporidium* sp. that has been reported either single or along with the *Eimeria* sp. in various countries like New Zealand, Norway, Nigeria etc. (Moriarty et al. 2008, Hamnes et al. 2006, Ayinmode et al. 2010) etc. Besides cocciodian parasites ruminants were found to be infected with *Entamoeba* sp. and *Giardia* sp. Amoebiasis causes both diarrhoea and dysentry in ruminants and has been distributed worldwide. Some of the countries where it has been identified are Egypt, Thailand (El- Refail 1993, Jittapalapong et al. 2011) etc. *Giardia* sp. which cause intense diarrhea in cattles are found in the small intestine of a wide range of ruminants causing giardiasis. It has been reported in variety of animals from different countries such as cattles of Spain, captive animals of Nigeria, calves of Myanmar (Castro-Hermida et al. 2006, Opara et al. 2010, Lay 2007) etc.

Global distribution of Helminth parasites in ruminants:

Helminth parasite commonly infecting ruminants includes, trematode, cestode and nematode parasites.

Trematodes:

The life cycle of trematode parasites are much complicated compared to cestode and nematode that require two intermediate hosts. Aquatic snail act as intermediate host for most of the trematodes that infects ruminants. The parasite are widely distributed throughout the world. Mostly the ruminants of Ireland, Bangladesh, Gambia, Combodia (Murphy et al. 2006, Mondal et al. 2000, Fritsche et al. 1993, Dorny et al. 2011) etc. have

shown to be infected with *Fasciola* sp. All the ruminants are susceptible for other trematode parasites *Paramphistomum* sp*., Dicrocoelium* sp. as well as *Amphistomum* sp. besides *Fasciola* sp. Infection with *Paramphistomum* sp. or *Amphistomum* sp. as single infection or in combination with liverfluke has been reported from various ruminants of Vietnam, France, Gambia, Turkey (Holland et al. 2000, Szmidt-Adjide et al. 2000, Fritsche et al. 1993, Ozdal et al. 2010) etc. While infection with *Dicrocoelium* sp. in ruminants was found comparatively less than *Fasciola* sp. and *Paramphistomum* sp. This parasite have been reported from Switzerland, Spain (Schweizer et al. 2003, Diaz et al. 2007) etc.

Cestodes:

Cestodes are commonly known as beef tapeworms found in digestive tract of vertebrates. It causes taeniasis and cysticercosis in ruminants. Ruminants are the intermediate host of *Taenia* sp. onchosphores are transmitted to cattles through contaminated fodder where larval development occurs, heavy infection cause poor growth and diarrhoea in ruminants. The parasites are found globally and most prevalently where cattle are raised like Iran, Australia (Oryan et al. 1997, Rickard et al. 1997) etc. has reported *Taenia* sp. infections. *Moniezia* sp. is another important cestode parasite of ruminants and is commonly known as sheep tapeworm or double- pored tapeworm, it requires two hosts to complete its life cycle the definitive host includes sheep, goat, cattle and some ruminants and intermediate host is the orbatid mite. This parasite is reported from various countries like Thailand, Gambia, Bangladesh (Jittapalapong et al. 2011, Fritche et al. 1993, Akanda et al. 2014) etc. whereas the prevalence of *Avitellina* sp. was less than that of *Taenia* sp. and *Moniezia* sp.

Nematodes:

There are numerous nematode parasites found in the intestine of ruminants. Prevalence of nematode parasites in ruminants results low productivity due to stunted growth, poor weight gain and poor feed utilization. Most of nematodes have direct life cycles that are without intermediate hosts or vectors, nematode infections cause losses in production due to morbidity and in some cases mortality. These genera are distributed in both temperate and tropical areas with some minor differences in species compositions in different regions, although they tend to be absent or restricted in arid zones, because the infective

stages are susceptible to heat and desiccation (Hutchinson 2009). *Haemonchus Contortus* sp. is known as barber's pole worm, it is a blood feeding parasites that causes anaemia, edema (bottle jaw), weakness etc. Acute disease is usually dependent on the intensity of infection and is associated with signs of haemorrhagic anaemia, dark-coloured faeces, oedema, weakness, reduced production of wool and muscle mass, or sometimes sudden death (Roeber et al. 2013).This parasite has been reported in ruminants of Kazakhstan (Morgan et al. 2006), Philippines (Van et al. 2000), Gambia (Kaufmann and Pfister 1990) etc. *Trichostrongyloid* sp. infects the small intestine and mainly exerts their pathogenic effects in lambs. This parasite is an important cause of diarrhea, rapid loss of weight, loss of production and death. They are commonly found among cattle, sheep, donkeys, goats, deer and rabbits etc. *Trichostrongyloid* sp. was identified from cattle of North America (Conder et al. 1998), Cambodia (Dorny et al. 2011), New Zealand (Bisset 1994) etc.

Nematodirus sp. is a parasite of ruminants, including cattle, sheep, goats and other species. This parasite is also called thin-necked worms or thread-necked worm which causes strong diarrhea (dark, green or yellow) and dehydration. It is found worldwide and have been identified from domestic and wild ruminants of Pakistan (Farooq et al. 2012), calves of Nigeria (Mahmuda et al. 2012) etc. *Oesophagostomum* sp. is a parasite of cattle, sheep, goats and other ruminants as well as deer antelope etc. The parasite is also known as nodular worms which causes diarrhea, peristaltic movements, digestion and defecation problem. It was observed in cattle of Tanzania (Keyyu et al. 2005), cattle of Costa Rica (Jimenez et al. 2007) etc. *Trichuris* sp. is commonly known as whipworm is a parasite of cattle, sheep, goats etc and causes trichuriasis which leads to irritation in the intestine, ulceration, anaemia, bloody diarrhea, dehydration, lack of appetite and weight loss. Parasite was recorded in buffalo cattles of Cambodia (Dorny et al. 2011), small ruminants of Gambia (Fritsche et al. 1993) etc. *Toxocara* sp. is also known as large white worm**,** it is a parasite of cattle**,** sheep and other ruminants and causes asscariasis. The parasite was recorded from cattle of Bangladesh (Chowdhary et al. 1993), Nigeria (Opara et al. 2010) and other several countries of the world.

Bunostomum sp. causes the disease bunostomosis in cattle, sheep, goats and other wild and domestic ruminants and were recorded from cattle of North America (Conder et al. 1998), cattle of Netherlands (Borgsteede et al. 2000) etc. *Strogyloides* sp. is also called threadworm or pinworm, it causes diarrhea, loss of appetite, strong weight losses and

even death and have been reported in small ruminants of Gambia (Fritsche et al. 1993), buffaloes of Bangladesh (Mamum et al. 2011). *Chabertia* sp. is also known as large mouthed bowel worm, which leads to anaemia were recorded from calves of Nigeria (Mahmuda et al. 2012), domestic and wild ruminants of Pakistan (Farooq et al. 2012). *Ostertagia* sp. is commonly known as brown stomach worm which causes ostertagiasis and have been reported in cattles of New Zealand (Bisset 1994) from culled cows of Ireland (Murphy et al. 2006), beef cattle of Louisiana (William et al. 1983). *Toxocara* sp. causes toxocariasis resulting diarrhea, enteritis, loss of appetite and weight loss. The parasite has been reported from throughout the world such as beef cattle of Costa Rica (Jimenez et al. 2007), cattle of Vietnam (Holland et al. 2000) etc. *Strongyle* sp. also known as blood worms or red worms causing severe to fatal blood vessel rupture. The parasite is worldwide in distribution causing disease mainly in small ruminants of Bangladesh (Mamun et al.2011) small ruminants of Nigeria (Fagbemi and Dipeolu 1982) etc.

2.2 Intestinal Protozoan Parasites of Sheep and Goat

Coccidia are the major protozoan parasite they live in the mucosa of the small intestine, and under favorable conditions can multiply very rapidly, sheep and goat are susceptible host of various intestinal coccidian parasites. Coccidian parasites of sheep and goats include *Eimeria* sp. and *Cryptosporidium* sp. large number of sheep and goat are lost due to diarrhea caused by this parasite. Coccidiosis has been reported from Asian Continent e.g. Thailand (Sangvaranond et al. 2010), Iran (Tovassoli and Khoshvagti 2010), Srilanka (Saifal et al. 2008), Myanmar (Lay 2007).The severe infection of coccidiosis has also been reported from African Continent e.g. Tanzania (Mhoma et al. 2011, Waruiru et al. 2005, Tefere et al. 2009), South American Continent Brazil e.g. (Cavalcante et al. 2012, Radavelli et al. 2014), European Continent e.g. Turkey (Kaya 2004), German (Idris et al. 2012). *Entamoeba* sp. has been reported from South American Continent e.g. Brazil (Radavelli et al. 2014), African Continent e.g. Egypt (Stauffer et al. 2006), European Continent e.g. Turkey (Kaya 2004), *Cryptosporadium* sp. from South American Continent e.g. Brazil (Radavelli et al. 2014). *Giardia* sp. has been reported from South American Continent e.g. Brazil (Radavelli et al. 2014), Asian Continent e.g. Thailand (Sanguaranond et al. 2005), Myanmar (Lay 2007), North American continent e.g. United States (Santin et al. 2012).

Helminth parasites in Goats and Sheep:

Trematode parasite requires aquatic intermediate host to complete their life cycle. Abundance of these parasites depends upon distribution of suitable intermediate host. In Asian continent trematode parasite has been reported as single or multiple infections. Double infection of trematode parasites such as *Fasciola* sp. and *Amphistome* sp. has been reported in sheep and goats (Muraleedharan 2005) in India. *Fasciola* sp. and *Dicrocoelium* sp. from Nepal Karki et al. (2012), *Amphistome* sp. *and Dirocoelium* sp. from India (Khajuria et al. 2013). Some studies have shown that the sheep and goats were infected by single species of trematode parasites e.g. *Paramphistomum* sp. in Thailand (Sangvaranond et al. 2005), *Fasciola* sp. from Iran (Gharekhani et al. 2015).

Small ruminants are a major source of cash for many rural population in developing countries and helps in strengthening the socio-economic conditions of farmers. Helminths cause great economic loss in livestock farming communities of the African continent. This type of parasitism is regarded as the most important cause of economic loss, as it is a flock or herd problem. The sheep and goats of African continent have been reported to be infected with either single, double, triple and multiple trematode parasites e.g. *Fasciola* sp*., Paramphistomum* sp. *and Dicrocoelium* sp. has been reported from southern Nigeria (Ikpeze and Nzemeka 2009). Trematode parasite *Paramphistomum* sp. was reported from Nigeria (Fakae 1990) and Mozambique (Specht 1982).

In a survey conducted by (Mazyad and El-Nemr 2002) from Egypt had reported Fasciola sp. and *Paramphistomum* sp. In developing countries, GI parasites are associated strongly with grazing management since pastures are usually not provided. Most pastures for animal rearing are public and are used and shared by animal owners without any regulations or guidelines. In a study carried out by Nwoke et al. (2015), Nwosu et al. (1996) and Ndao et al. (1991) reported only *Dicrocoelium* sp. in sheep and goats. *Fasciola* sp. (Ndao et al. 1991, Waruiru et al. 2005) from Senegal and Kenya. Both *Paramphistomum* sp. and *Dicrocoelium* sp. was recovered by (Silvestre et al. 2000) from France. Similarly the trematode parasitic infection has been reported from sheep and goats of European Continent e.g. (Domke et al. 2013) from Norway.

Cestodes:

Moniezia sp. of sheep and goats causes infections by ingesting herbage contaminated with the invites (carrier) carrying the infection causing poor growth, diarrhea, physical and mental retardation and even death. The problem of some helminth parasites of goats is that some of them are zoonotic and can infect human beings as intermediate host .Tapeworms belongs to cestode parasites, that have a flat, ribbon-like body some species can be as long as 50meters.Together with the trematodes they belong to the group of flatworms. *Moniezia* sp. and *Taenia* sp. of cestode parasites of sheep and goats has been reported from Asian Continent e.g. *Moniezia* sp. in sheep and goat of India (Bandyopadhyay et al. 2010), Iran (Gharekhani et al. 2015) etc. *Moniezia* sp. and *Avitellina* sp. double cestode infection in goat and sheep of India (Pathak and Pal 2008). As other helminth parasites infection, cestode parasitic infection has been reported from sheep and goats of African Continent e.g. (Tefere et al. 2009, Edosomwan and Shoyemi 2012, Nwoke et al. 2015, Fakae 1990) from Ethiopia, Benin, Nigeria, and Eastern Nigeria etc. Domestic ruminants due to improper management, unhygienic conditions and improper use of anthelminthic chemicals are suffering from helminth parasitic diseases and mostly infection occurs when they drink contaminated water and grazing near the pond. Similarly cestode parasites have been distributed in European Continent e.g. (Silvestre et al. 2000) from France, South American Continent (Lima et al. 2006) from Brazil, as well as North American Continent e.g. (Uhazy and Holmes 1971) from Canada etc.

Nematodes:

Common intestinal nematode includes *Haemonchus* sp*., Trichostrongyloid* sp., *Strongyloides* sp*., Nematodirus* sp., *Trichuris sp., Toxocara* sp., *Oesophagostomum* sp., *Capillaria* sp. *Chabertia* sp., *Ostertagia* sp. *Strongyle* sp. *Toxocara* sp., *Bunostomum* sp., etc, which infect most commonly sheep and goats worldwide.

Parasitic nematodes of small ruminants and other livestock have major economic impacts worldwide. Farooq et al. (2012) reported 18 different species of nematodes in Pakistan Where as 14 different species of nematodes were reported by Uhazy and Holmes (1971) in Canada from a single host. Common parasites reported include *Nematodirus* sp., *Trichuris* sp., *Ostertagia* sp. and *Skrjabinema* sp. The severity of disease is mainly

influenced by factors such as the parasite species and intensity of parasites present in the gastrointestinal tract, the general health and immunological state of the host, and environmental factors, such as climate and pasture type, stress, stocking rate, management and diet (Kassai 1999). Badran et al. (2012) demonstrated 11 different species of nematodes from Palestinian goat and sheep where highest prevalence was exhibited by *Diactyocaulus* sp. and lowest by *Trichuris* sp. In a study conducted by Nwoke et al. (2015) in Nigeria, 10 different species of nematodes have been recorded from single sheep and goats. Nematode infection is rampant in most developing countries where poor pastures and the quantities of nutritious food consumed do not cover the nutritional requirements of animals (Leng 1991). In addition, there is insufficient veterinary care and the environment is conducive to nematode growth and transmission (Fikru et al. 2006). Tembly et al. (1983-1985) reported 9 species of nematodes from Senegal, where as Pedreira et al. (2006) found 8 different species of nematodes in NW Spain with common parasite *Cooperia* sp., *Haemonchus* sp., *Oesophagostomum* sp.*,Trichostrongyloid* sp. and *Trichuris* sp. Sheep and goats of Ethiopia and Egypt were found to be infected with 8 different species of nematodes (Tefera et al. 2009, Khalafalla et al.2011) where highest prevalence was shown by *Trichuris* sp. (5.8%) in Ethiopia and by *Haemonchus* sp. (67.5%) in Egypt. In a survey conducted by Pandey et al. (1994) and Fritsche (1993) in Zimbabwe and Gambia seven different species of nematodes had been demonstrated, the different species of parasites observed includes *Bunostomum* sp., *Gaigeria* sp. and *Cooperia* sp. The consequences of nematode infection include reduced feed intake and weight gain, reduced immunity, lower fertility, a reduction in milk production and work capacity, treatment expenses and death in critical infections (Fikru et al. 2006). Mondal et al. (2000) identified *Haemonchus* sp., *Trichostrongyloid* sp., *Mecistocirrus* sp., *Oesophagostamum* sp., *Trichuris* sp. and *Bunostomum* sp. from Bangladesh and (Khajuria et al. 2013) found other nematode parasites from India such as *Strongyloides* sp. and *Ostertagia* sp. Rajapakse et al. (2008), Sharkhuu (2001) and Ikpeze and Nzemeka (2009) identified 5 species of nematodes from Srilanka, Mongolia and Southern Nigeria respectively. In Bangladesh *Toxocara* sp., *Strongyle* sp. and *Strongyloides* sp. has been reported by Mamun et al. (2011).

In National Context:

A common domestic ruminant found in Nepal includes cattle, buffalo, sheep, and goats. These ruminants were found infected with various protozoan as well as helminth parasites such as *Eimeria* sp., *ryptosporadium* sp., *Entamoeeba* sp., *Giardia* sp., *Fasciola* sp., *Paramphistomum* sp., *Dicrocoelium* sp., *Taenia* sp., *Moniezia* sp., *Bunostomum* sp, *Nematodirus* sp., *Oxyuris* sp., *Trichostrongyloid* sp., *Strongyloides* sp. *Trichuris* sp. *and Toxocara* sp.etc.

Coccidiosis is a parasitic disease of the intestinal tract of animals caused by coccidian protozoa. The disease spreads from one animal to another by contact with infected feces or ingestion of infected tissue. Most animals infected with coccidia are asymptomatic, but young or immunocompromised animals may suffer severe complication and death, the parasite has been reported from different ruminants such as buffalo calves (Karna 2010), Zebu cattles and water buffalo (Feng et al. 2012). *Fasciola* sp. causes fascioliasis which is considered as one of the most important parasitic diseases of domestic ruminants (Jaiswal 2006). *Paramphistomum* sp. is a tiny fluke mostly parasitising livestock ruminants, the adult worms are relatively harmless, but it is the developing juveniles that cause serious disease called paramphistomiasis especially in ruminants (Ghimire 1987, Adhikari et al. 2003) etc. Similarly *Dicrocoelium* sp. another small liver flukes which have an indirect life cycle with two intermediate hosts different from intermediate host of *Fasciola* sp. and *Paramphistomum* sp. including a snail and an ant. It has been reported from ruminants of Nepal either as single or in combination (Gurung 2007, Dhakal 2008) etc. *Moniezia sp.* is cestode parasites that infect domestic and wild ruminants as final hosts**.** The parasite has been reported from buffalo (Mukhiya 2007) in cattle and buffalo (Ghimire 1987) *Haemonchus* sp. are the most damaging gastrointestinal worms for livestock in tropical and subtropical regions. Both the larvae and the adults feed on blood and cause a considerable damage to the stomach tissues. While feeding they release anticoagulants to hinder blood clotting this species has been recorded from goats (Kushwaha 2000, Dhital 2006) etc. *Trichuris* sp. are known as whipworms because of their long, thin anterior end and a short, thick posterior end found in the caecum and colon of ruminants, *Trichostrongyloid* sp. have been reported from ruminants of Nepal (Dhakal 2008, Joshi 2000) etc. *Toxocara* sp. (Sharma 1998-99), *Strongyloides* sp. (Adhikari et al. 2003) etc.

Protozoan and helminth Parasite in Goat and sheep:

In Nepal goat and Sheep production is a major source of livelihood for local communities. There are four commonly recognized breeds of goats in Nepal i.e. Goats in high altitude/mountains are also called chyangra that have fine wool value, Sinhal are the high hill goats, Khari goats are widespread and more abundant than other indigenous breeds and are present in the mid-hills and Terai goats are present in terai region. Coccidian parasite of small ruminants is a infection caused by several species of the genus *Eimeria* sp. Bloody diarrhea is a common indication of coccidiosis. Coccidiosis is of great economic importance because of the losses due to clinical disease (diarrhea) but also because of subclinical infections (poor weight gain in particular). The parasite has been reported by several researcher from Nepal such as Nirmal (2000), Kushwaha (2000) etc.

Parasitism is of supreme importance in many agro-ecological zones and still a serious threat to the livestock economy worldwide. Sheep are known to suffer from various endoparasites of which helminth infection are of great importance (Diaz et al. 2007). Helminth parasites *Fasciola* sp. *and Paramphistomum* sp. has been reported by (Pathak 2011, Neupane 2012). *Dicrocoelium* sp. by Karki et al. (2012), as well as Parajuli (2007) *Paramphistomum* sp. is one of the common parasites of sheep and goats light infection doesn't cause serious damage to the animals but when present in massive number it can migrate through intestinal tract causing acute parasitic gastroenteritis with high morbidity and mortality rates particularly in young animals (Melaku and Addis 2012). *Paramphistomum* sp. was reported in sheep and goats (Bashir 2009, Jha et al. 1993**)** etc. Cestode parasites such *Taenia* sp. and *Moniezia* sp. has been reported from sheep and goats of Nepal (Rizal 2010, Pathak 2011, Parajuli 2007, Dhital 2006) etc. Parasites of livestock cause diseases of major socioeconomic importance worldwide.

Among the diseases that decreased the survival and productivity of sheep and goats, gastrointestinal nematode infection ranks highest. Nematode parasites such as *Haemonchus* sp., *Trichostrongyloid* sp*., Nematodirus* sp. are highly prevalent among sheep and goats of Nepal (Kushwaha 2000, Karki et al. 2011, Rizal 2010, Dhital 2006) etc. *Oxyuris* sp. is another most distributed nematode which causes oxyuriasis in wide range of small ruminants (Karki et al. 2012, Bashir 2009) etc.

Trichostrongyloid sp. are nematodes which are ubiquitous among herbivores worldwide, including cattle, sheep, goats and deer etc. The parasite was reported in goat and sheep of Nepal (Pathak 2011, Dhital 2006). Goats and sheep get infected with *Strongyloides sp.* when they graze on the contaminated pasture. In a survey conducted by (Nirmal 2000, Kushwaha 2000, Morel 1985) etc. reported *Strongyloides* sp. from sheep and goats of various parts of country. Helminths causes direct losses due to deaths and indirect losses due to reduced productivity through reduced feed intake and live weight gains and decreased quality of skin, wools, etc. Other common nematodes of sheep and goats includes *Trichuris* sp. *Bunostomum* sp., *Toxocara* sp. etc. (Bashir 2009, Pathak 2011 Neupane 2012, Karki et al. 2012, Parajuli 2007, Rizal 2010) etc.

2.3 Seasonal Distribution of Goat Parasite

In India there are four seasons spring, summer, monsoon and winter. In India season wise prevalence indicates that the overall infection was higher in monsoon season (68.36%) followed by winter (60.84%) than in summer (55.30%) (Varadharajana and Vijayalakshmi 2015). Similarly, in a survey conducted by Rizal (2010) indicated seasonal prevalence of goat intestinal parasites was highest in summer (84%), moderate in rainy (64%) and lowest in winter (54%) in Nepal. Low prevalence in winter season was due to reduced grazing hours of the animals, which helps in reducing the chances of contact between host and parasites. In Pakistan, Korea, Ethiopia, Iran these countries have four different seasons (spring, summer, autumn and winter). But, Nigeria experiences only two seasons i.e. rainy and summer. In Pakistan, Korea, Ethiopia, Iran and Nigeria the seasonal prevalence was found to be higher in rainy season than in winter (Rafiullah et al. 2011, Gebeyenu et al. 2013, Nwosu et al. 1996, Garekhane et al. 2015, Regassa et al. 2006). The rainy season, or monsoon season, is the time of year when most of a region's average annual rainfall occurs it usually lasts one or more months. In Turkey the parasite counts in the goats increased in spring, declined in summer, reached maximum levels in autumn, and then tended to decline until winter, before increasing again in mid-winter Umur et al. (2005). Among four season in Egypt, infection of gastrointestinal parasites of goat was highest during autumn (15.2%) followed by summer (11.1%) and winter (9.4%) while the lowest rate was during spring (5.6%). In United State the seasonal prevalence of infection was lowest (22−27%) in winter, gradually increased during the spring, reached peaks of 36−43% in rainy season (Amin 2002). Higher prevalence of parasitic infection during

summer and rainy season might be due to high temperature and moisture content which favors the growth and development of larvae on pasture resulting in increased contact between the host and parasites.

2.4 Risk Factors of Gastrointestinal Parasites of Goats

Health and wellbeing are affected by many factors and those that are associated with ill health, disability, diseases or death are known as risk factors. Although the risk factor of gastrointestinal parasites of goats are multiple and often interactive the vast majority of cases are due to any of the following basic reasons (Urquhart et al. 1996).

According to Sissay (2007) the risk factors of gastrointestinal parasites in goat includes an increase in the number of infective stages on pastures, an alternation in host susceptibility , the introduction of host susceptible stock into an infected environment, the introduction of infection into an environment, ineffective parasite removal from the host animal due to poor administration techniques the use of sub standard anthelminthic drugs and / or the development of anhelminthic resistances. Some other common risk factors are as given contaminated food and water, ingesting herbage contaminated with the mites carrying the infective stage of the parasites, ingestion of infected human or animal faeces, ingestion of moist aquatic plants, grasses infective metacercaria, ingestion of contaminated vegetables, ingestion of contaminated rice straw, ingestion of green grasses from near permanent water sources, grazing on contaminated pastures, overcrowding, contaminated soil feeding, transdermal transmission.

3. MATERIALS AND METHODS

3.1 Study Area

Pokhara sub-metropolitan lies in the centre of Kaski district, Gandaki Zone, Western Development Region. Pokhara is also the second largest city of Nepal with an area of 55.22 km and a population of 264,991 according to 2011 census. The city is located approximately 200 km west of the country capital Kathmandu. It is the second most populous city in Nepal and also serves as the headquarters of Kaski district. The climate is sub-tropical but due to the elevation temperature are moderate the summer temperature average between 25-35^{o}C and in winter around 5-15^{o} C. The present study was carried out in goats of Puranchaur VDC of Pokhara. Puranchaur VDC is surrounded by thick green forest of different trees and plants. According to administrative and political division, this VDC is divided into 9 wards. We find people of different cast living together sharing their culture and supporting each other. Goat farming is the main agricultural practices in Puranchaur. Goat farming is carried out on cooperative basis or individually. Almost every household rear goats. The forest fodder, hay, agricultural byproducts and concentrates includes the goat diet.

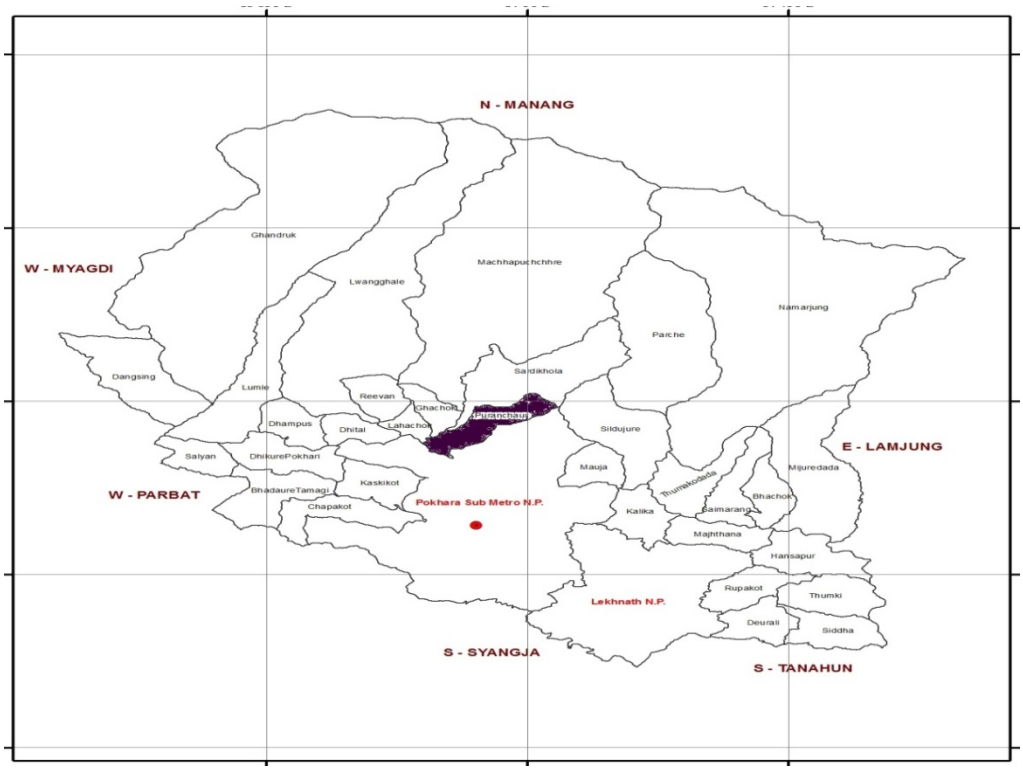

Figure 1: Map of Kaski district showing study area

3.2 Materials Used

During the research the materials used have been listed below:

3.3 Laboratory Materials

i. Gloves
ii. Slides
iii. Cotton
iv. Volumetric Flask
v. Electronic Weight Machine
vi. Pasteur Pipette
vii. Test Tube Rack
viii. Motor and Pestle
ix. Refrigerator
x. Glass Rod
xi. Cover Slips
xii. Compound Microscope
xiii. Tea Strainer
xiv. Petri Dishes
xv. Centrifuge Machine
xvi. Centrifuge Tubes
xvii. Test Tubes
xviii. Dropper

3.4 Chemicals

i. Potassium dichromate ($K_2Cr_2O_7$)
ii. Distilled water (D/W)
iii. Saturated NaCl solution
iv. Methylene blue
v. Iodine solution

3.5 Study Design

The present study was designed to assess the gastrointestinal parasitic infection in goat of Puranchaur VDC.

3.5.1 Sample Size

A total of 110 fecal samples of goat were collected from the Puranchaur VDC of Pokhara during the month of June/July 2014 and 110 fecal samples during the month of Jan/Feb 2015.

Photo 1: Collection of stool of Goat

Photo 2: Goats in thier habitat

Photo 3: Questioning with Owners

Photo 4: Goat with other animals

Photo 5: Microscopic observation of slide

3.5.2 Sample collection

Fresh fecal samples of 220 goats were collected immediately after they were defecated, and each sample was visually confirmed to be from different individuals.

3.5.3 Preservation of samples

Collected fecal samples of goats were preserved in 2.5% Potassium dichromate solution that help in maintaining the morphology of gastrointestinal parasites and prevent further development of eggs and larva.

3.6 Laboratory Examination

The samples were examined at the laboratory of Central Department of Zoology, Tribhuvan University, Kirtipur by using floatation and sedimentation technique.

3.6.1 Floatation technique

This technique is used widely for detecting eggs of nematodes and cestodes. As their eggs are lighter and small, they can float in the floatation liquid. Approximately 3 gm of faecal sample was taken in a beaker and added 15 ml of water then the sample was grinded lightly with the help of motor and pistle and filter the solution by tea strainer. The filtrate solution was poured into a centrifuge tube of 15 ml and centrifuged at 1000 rpm for 5 minutes. The tube's water was replaced with saturated sodium chloride solution and again centrifuged.

After centrifuge more saturated sodium chloride solution was added to develop convex surface at the top of the tube and one drop of methylene blue (to stain) where a cover slip is placed for a few minutes and then cover slip was removed and placed on a slide and examined at 10X and 40X. Photographs of cyst, eggs and parasites were taken and identified based on egg's color, shape, and size.

3.6.2 Sedimentation technique

This technique is used for detecting trematodes eggs. It provides good results as the eggs of the trematode are bit heaver than the other, where sediments of centrifuged contents is taken for eggs detection (Veterinary Lab. Tecniques 2003).

Saturated salt solution was removed gently from the test tube after examined the floatation portion and pour the sediment content into the watch glass and stirred the content gently to mixed it. One drop from the mixture was taken to prepared a second slide. The specimen was stained with iodine wetmounts solution.

In this way two slides were prepared from one sample (one from flotation and one from sedimentation) were examined under 10X and 40X of microscope to detect eggs of helminthes and trophozoites or cyst of gastrointestinal protozoans.

3.7 Questionnaire Survey

A questionnaire survey was conducted amongst 100 farmers of puranchaur VDC of Pokhara submetropolitan cit. The questionnaire was divided into four sections namely demography, knowledge, attitude and practice. Questionnaire survey was conducted to assess the knowledge, attitude and practices on goat diseases among goat farmers.

3.8 Intensity of Infection

Intesity of parasitic infection has been calculated based upon the number of eggs/oocyst and larvae found per field. Heavy parasitic infection was considered in those samples which has six or more ova or oocyst observed per field.

3.9 Data Analysis

Since the data was mainly focused on identification of different gastrointestinal parasites, the data were analyzed by using SPSS 21.

4. RESULTS

To assess the seasonal pattern of gastrointestinal parasitic infection in goats of Puranchaur VDC of Pokhara, 220 fecal samples were collected and microscopically examined using floatation and sedimentation technique. The result revealed that all the goats examined were found positive for either protozoan or helminth parasites or both.

The goats were infected with 13 different genera of parasites including sporozoan, sarcodina, trematode, cestode and nematode.

4.1 Seasonal Prevalence of Gastrointestinal Parasites

Gastrointestinal parasites are parasites that can infect the gastrointestinal tract of animals, they can live throughout the body but most prefer the gastrointestinal wall. The two main types of intestinal parasites are protozoan and helminth parasites.

4.1.1 Seasonal prevalence of protozoan parasites

Sporozoan parasites

A total of 220 fecal samples of goats were collected during summer and winter season. In both seasons, coccidian parasite infection was found maximum compared to *Entamoeba* sp. among the intestinal protozoan parasites identified, *Eimeria* sp. without micropile (65%) showed highest prevalence followed by *Eimeria* sp. with micropile (46.81%).

Among 110 samples examined each during winter and summer revealed maximum 78(70.90%) infection with *Eimeria* sp. without micropile compared to winter 65(59.09%) but difference is not statistically significant (X^2=3.37, p=.066, d.f=1). In case of *Eimeria* sp. with micropile, maximum 55(50%) infection was revealed during summer than in winter with 48(43.63%). The difference in the prevalence was found to be insignificant (X^2=.89, p=.344, d.f=1) (Figure 2).

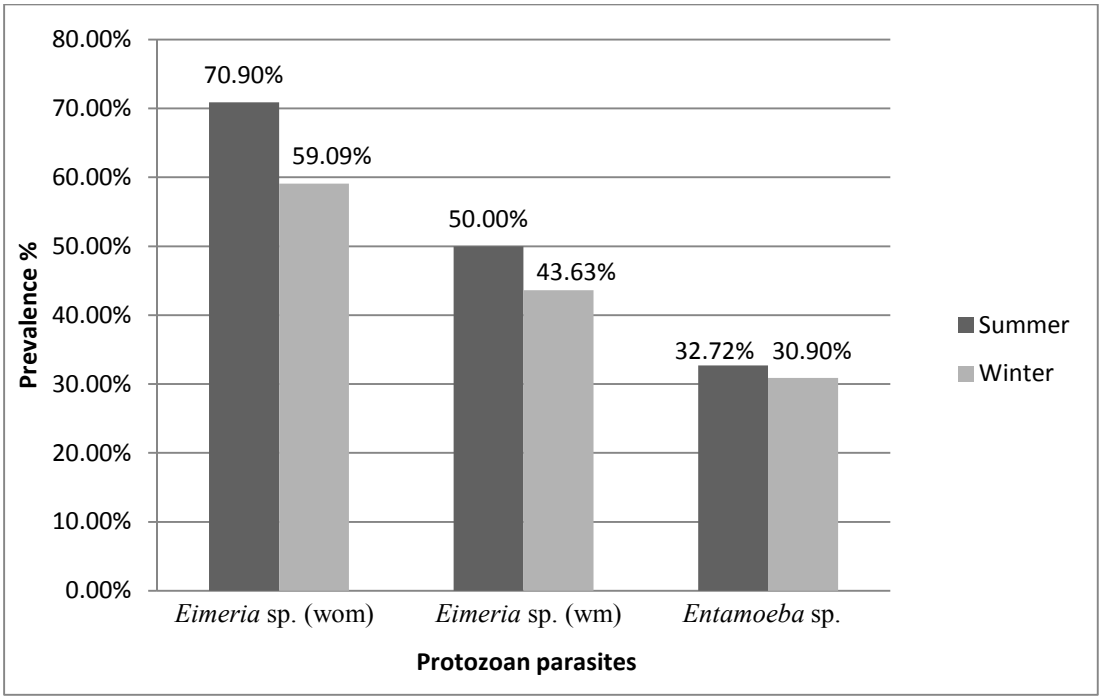

Figure 2: Seasonal prevalence of protozoan parasites.

(Note: wom- without micropile and wm- with micropile)

Sarcodina parasites

Only one genera of Sarcodina i.e. *Entamoeba* sp. was observed during the study and the prevalence was found to be 70 (31.81%) out of 220 samples. The difference in the seasonal prevalence was found to be statically insignificant (X^2=.08, p=.772, d.f=1).

4.1.2 Seasonal prevalence of helminth parasites

Goats of Puranchaur VDC were found to be infected with all three classes of helminth parasites trematode, cestode and nematodes. Maximum (91.82%) samples were found positive for nematode parasites followed by trematode (12.27%) and cestode (22.27%). Among them *Toxocara* sp. (68.18%) showed the highest prevalence and lowest by *Taenia* sp. and *Paramphistomum* sp. i.e. (4.09%). The seasonal prevalence of helminth parasite was higher in summer (95.45%) than winter (88.18%). (Figure 3).

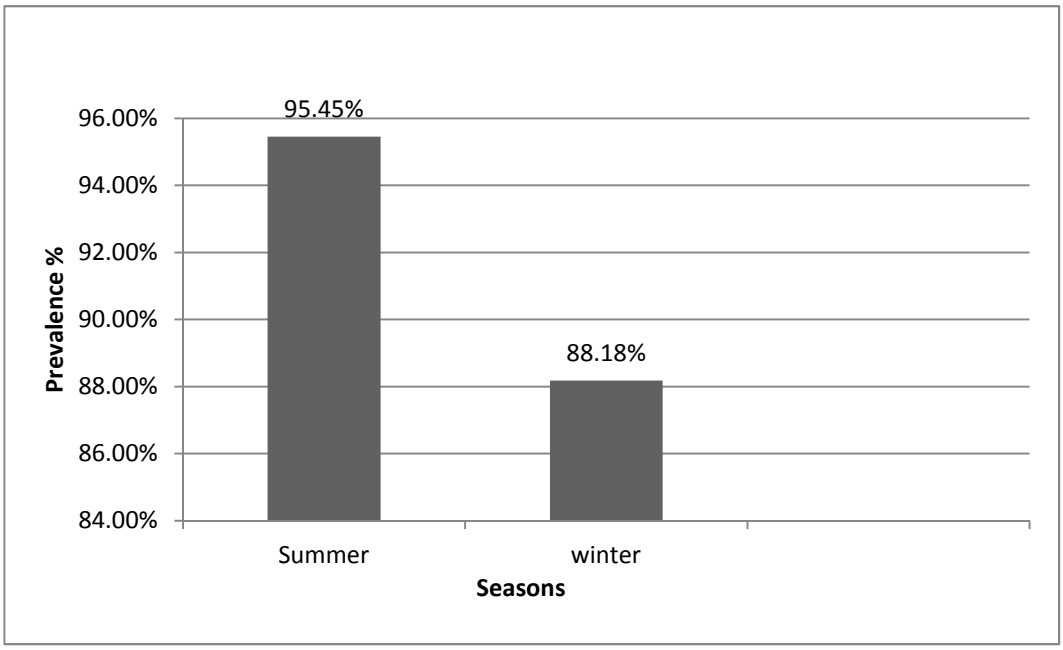

Figure 3: Seasonal prevalence of helminth parasites of goats

Trematode parasites

Two different genera of trematode parasites were observed infecting goats among 12.27% positive samples. *Fasciola* sp. (8.18%) showed higher prevalence than *Paramphistomum* sp. (4.09%). Difference in the seasonal prevalence of trematode was found statistically insignificant, whereas the difference was statistically significant for *Fasciola* sp. (X^2=4.6, p=.031, d.f=1), in between two seasons. (Figure 5).

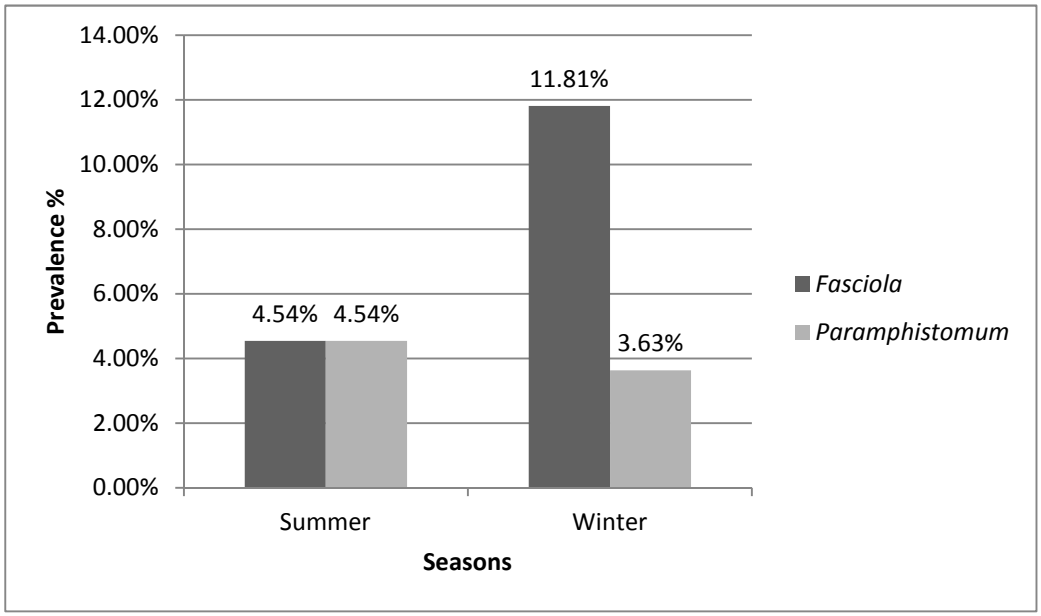

Figure 4: Seasonal prevalence of trematode genera in goats

Cestode parasites

Out of 220 samples examined, the goats were found to be infected with two species of cestodes parasites (*Moniezia* sp. and *Taenia* sp.). The study showed a higher prevalence of *Moniezia* sp. (18.18%) as compared to *Taenia* sp. (4.09%).Statistically there was no significant difference in the seasonal prevalence of cestode parasites (X^2=.93,p≤.334,d.f=1), *Moniezia* sp. (X^2=.47, p≤.493, d.f=1) and *Taenia* sp. (X^2=.41,p ≤.517,d.f=1) respectively.(Figure 6)

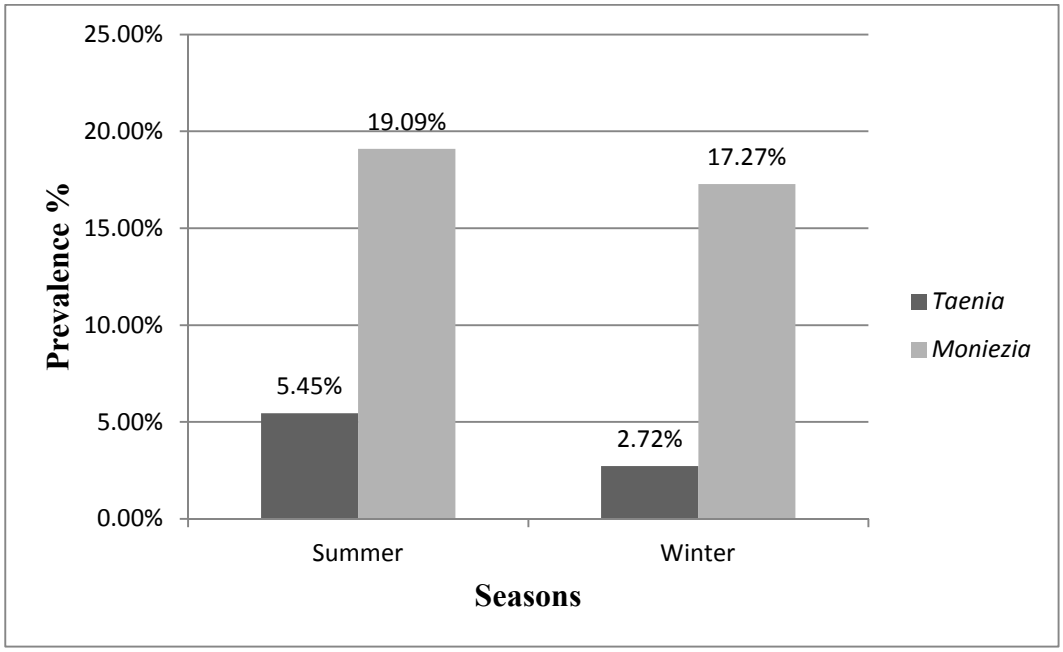

Figure 5: Seasonal prevalence of cestode genera in goats

Nematode parasites

A total of seven different nematode parasites were observed in (91.82%) positive samples. Among them *Toxocara* sp. (68.18%) was the most prevalent nematode in goats followed by *Bunostomum* sp. (35%), *Oxyuris sp.* (30.45%), *Trichuris* sp. (12.27%), *Strongyloides* sp. (7.27%), *Trichostrongyloid* sp. (5.45%), *Nematodirus* sp. (4.54%). Difference in seasonal prevalence of nematode parasite was statistically significant (X^2=6.37, p=.012, d.f=1). Parasitic association between summer and winter revealed insignificant for *Bunostomum* sp. *Nematodirus* sp. *Oxyuris* sp. *Trichostrongyloid* sp. and *Strongyloides* sp. While there was significant association for *Trichuris* sp. and *Toxocara* sp.

Table 1: Seasonal prevalence of Nematode genera

9S/N	Name of genera	Summer N=110	Winter N=110	p value
1	*Bunostomum* sp.	34(30.09%)	43(39.09%)	p≤.867
2	*Nematodirus* sp.	6(5.45%)	4(3.63%)	p≤.517
3	*Oxyuris* sp.	35(31.81%)	32(29.09%)	p≤.884
4	*Trichostrongylus* sp.	4(3.63%)	8(7.27%)	p≤.235
5	*Strongyloides* sp.	8(7.27%)	8(7.27%)	p≤.604
6	*Trichuris* sp.	7(6.36%)	20(18.18%)	p≥.012
7	*Toxocara* sp.	91(82.72%)	59(53.63%)	p≥.000

4.1.3 Concurency and intensity of intestinal parasites

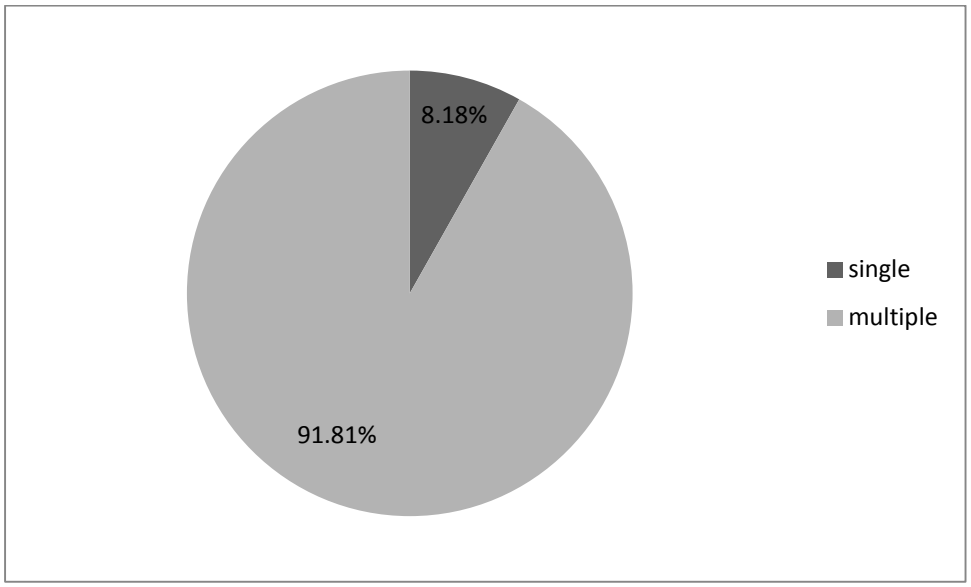

Figure 7: Single and multiple infection

During the study different type of parasitic infections were encountered in goats. Multiple infection 202 (91.81%) was found to be higher than single infection 18 (8.18%). (Figure 7

Table 2: Intensity of infection

S/N	**Class**	**Name of the genera**	+	++	+++
1.	**Sporozoan**	*Eimeria* sp. (wom)	52	46	45
		Eimeria sp. (wm)	71	21	11
2.	**Sarcodina**	*Entamoeba* sp.	35	27	8
1.	**Trematode**	*Fasciola* sp.	11	7	_
2.		*Paramphistomum* sp.	7	2	_
3.	**Cestode**	*Taenia* sp.	9	_	_
4.		*Moniezia* sp.	20	11	9
5.	**Nematode**	*Bunostomum* sp.	57	14	6
6.		*Nematodirus* sp.	8	2	_
7.		*Oxyuris* sp.	43	16	8
8.		*Trichostrongyloid* sp.	9	3	_
9.		*Strongyloides* sp.	11	5	_
10.		*Trichuris* sp.	18	9	_
11.		*Toxocara* sp.	96	40	14

+ = less than 2 ova per field i.e. light infection

++ = 3-5 ova per field i.e. moderate infection

+++ = 6 or more ova per field i.e. heavy infection

Heavy parasitic infection was considered in those samples which has six or more ova or oocyst observed per field. Among the total positive samples heavy infection was observed in 45 samples of *Eimeria* sp. (wom) and 11 with micropile. While 14 samples of *Toxocara* sp., 9 *Moniezia* sp., eight each of *Entamoeba* sp. and *Oxyuris* sp. Forty six samples of *Eimeria* (wom), 21 with micropile, forty samples of *Toxocara* sp. showed moderate infection which considered 3-5 ova/oocyst was observed per field. While maximum numbers of goats were infected with light infection i.e. ≤ 2 ova or oocyst observed per field.

4.2 Assessment of Knowledge, Attitude and Practices on Goat Diseases among Goat Farmers

A total of 100 farmers were participated in the questionnaires survey, 76 were males and 24 were the females. 78% of the farmers had primary or lower secondary level of education whereas 22% of the farmers had secondary or above secondary level of education. Structured questionnaire were prepared pretested, before administration. Questionnaire were related to assess the knowledge regarding goat disease particularly parasitic disease, attitude related to causes of diarrhea, swelling, ascariasis, fasciolopsis, taeniasis, practice related to treatment, frequency of anthelminthic, medication through and types of goat diseases.

From the 100 goat farmers through the questionnaire survey it was found that 96.05% (73/76) of male and 95.8% (23/24) of female had general knowledge about the helminth parasites of the goat. But on the knowledge of protozoan parasites almost 66(86.84%) male and 20/ (83.33%) female farmers were unknown about the diseases. Only few i.e. 7(9.21%) male and 4(16.66%) female had knowledge of protozoan parasites. Though the farmers had higher percentage of general knowledge of helminth parasites there was statistically insignificant association between the prevalence of helminth parasites and the difference in gender of farmers. (Table 3)

Table 3: Assessment of knowledge on goat diseases among farmers

S/N	Knowledge	Male (76)	Female(24)	P value
1.	General knowledge about helminthic parasites	73(96.05%)	23(95.8%)	
2.	Specific knowledge about helminthic parasites			
A.	**Ascariasis**			p=.521
1.	Passing worms in faeces	7(9.5%)	4(17.3%)	
2.	Abdominal swelling	4(5.4%)	2(8.69%)	
3.	Diarhoea	6(8.2%)	3(13.04%)	
4.	Above all	56(76.7)	14(60.86%)	
B.	**Fasciolopsis**			p=.372
1.	Joundice	5(6.84%)	3(13.04%)	
2.	Anaemia	19(26%)	8(34.78%)	
3.	Loss of appetite	3(4.1%)	2(8.69%)	
4.	Above all	46(63%)	10(43.47%)	
C.	**Taeniasis**			p=.354
1.	Presence of proglottids in faeces	12(16.4%)	6(26.08%)	
2.	Diarhoea and constipation	8(10.9%)	3(13.04%)	
3.	Weight loss	2(2.73%)	2(8.69%)	
4.	Above all	51(69.8%)	12(52.17%)	
D.	**Infectious nature of parasitic diseases**			p=.184
1.	Goat to goat	58(79.4%)	12(52.17%)	
2.	Goat to other animals	6(8.21%)	4(17.39%)	
3.	Goat to human	5(6.84%)	3(13.04%)	
4.	Only in goat	4(5.47%)	5(21.73%)	
E.	**Other diseases**			p=.871
1.	Neck swelling	12(16.43%)	3(13.04%)	
2.	Stomach swelling	10(13.69%)	2(8.69%)	
4.	Foot and mouth diseases	10(13.69%)	4(17.39%)	
5.	Above all	41(56.16%)	14(60.86%)	
F.	**General knowledge about protozoan parasites**	7(9.21%)	4(16.66%)	
1.	Watery stool	2(28.57%)	1(25%)	
2.	Bloody diarrhea	5(71.42%)	3(75%)	

In relation to causes of goat diseases such as diarrhea, ascariasis, fasciolopsis, taeniasis and swelling variation in knowledge has been found among goat farmers of Puranchaur VDC, Pokhara. Among these farmers 45% of them had knowledge of causing the

diarrhea by microorganisms, wet and rice floor. Similarly 36% of them had knowledge of causing swelling by wet, poisonous plant, eating corn and parasitic infection. Twenty five percent of them had knowledge of causing the fascioliasis by parasitic infection, soil feeding, contaminated food and water similarly some of the farmer said parasitic infection, contaminated soil, contaminated food and water are the causes of disease in goats. But some percent of the farmers has given their view of causing the diarrhea, swelling, ascariasis, fascioliasis, and taeniasis through specific reason as listed in the table. (Table 4)

Table 4: Assessment of knowledge of farmers on causes of diseases in goat.

S/N	Attitude	Causes of diseases N=100	**Percentage %**
1.	**Causes of**		
a.	**Diarrhea**	microorganism	10%
		wet	35%
		rice floor	10%
		above all	45%
b.	**Swelling**	wet	36%
		poisonous plant	12%
		eating corn	6%
		parasitic infection	10%
		all above	36%
c.	**Ascariasis**	parasitic infection	26%
		salt feeding	6%
		contaminated food and water	43%
		all above	25%
d.	**Fascioliasis**	parasitic infection	25%
		soil feeding	22%
		contaminated food and water	34%
		above all	21%
e.	**Taeniasis**	parasitic diseases	10%
		contaminated soil	23%
		contaminated food and water	21%
		above all	46%

Out of 100 respondents 96 (96%) of the farmers regularly treated their goats and rest of them did not. Among these 96% of farmers who treated their goats had used the antihelmenthic drugs. Of them 90(93.75%) dewormed their goats by using the antihelminthic twice a year and 6(6.25%) of them treated their goats when they observed

worms in the faeces or when risk. Those farmers who treated their goats were as advised by the veterinarian. From these farmers 83.33% (80/96) were consulted to the vet pharmacy when they needed. Similarly 16.66% (16/96) of them were medicated through the private practitioner but none of them did the traditional way of healing. Those farmers who didn't adopt any preventive measures may be due to the fear of abortion of their goats.

Out of 100 farmers selected for the questionnaire they gave their opinion that diarrhea, cough, saliva secretion, stomach and neck swelling are some of the common diseases observed in goats. Among them diarrhea accounts for maximum problem compared to swelling.

Table 5: Assessment of practice of farmers on the management of illness in goat

S/N		**N=100**	**Percentage %**
1.	Do you treat your goats?	a. Yes b. No	96(96%) 4(4%)
2.	Frequency of anthelminthic.	a. Once in a year b. Twice in a year c. Thrice in a year d. When risk	0 90(93.75)% 0 6(6.25%)
3.	Treatment of pregnant goats.	a. Yes b. No	76(79.1%) 20(20.83%)
4.	Do you give supplementary food to your goats.	a. Yes b. No	95(95 %) 5(5%)
5.	Medication through.	a. Vet pharmacy b. Private practitioner c. Traditional healer	80(83.33%) 16(16.66%) 0
6.	Where do get your drugs from?	a. Open market b. Vet pharmacy c. Private clinic	23(23.95%) 73(76.04%) 0
7.	Types of goat illness.	a. Diarrhea and cough. b. Diarrhea, cough and neck swelling. c. Cough and saliva secretion. d. Stomach and neck swelling.	30(30%) 50(50%) 14(14%) 6(6%)

Photos of parasites of goat

Cyst and Oocyst of protozoan parasites:

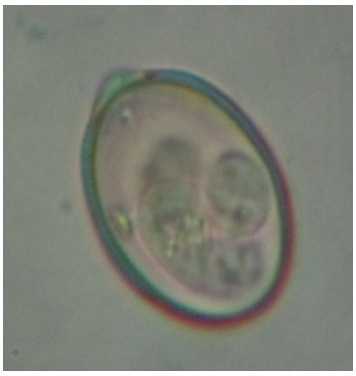

Photo 6: *Eimeria* with micropile

Photo 7: *Eimeria* without micropile

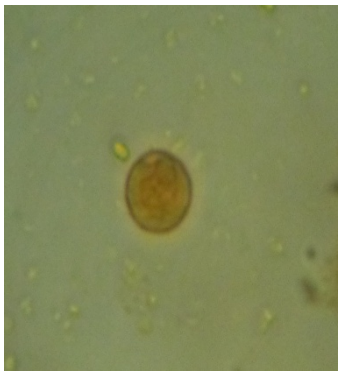

Photo 8: *Entamoeba sp.*

Eggs of trematode parasites:

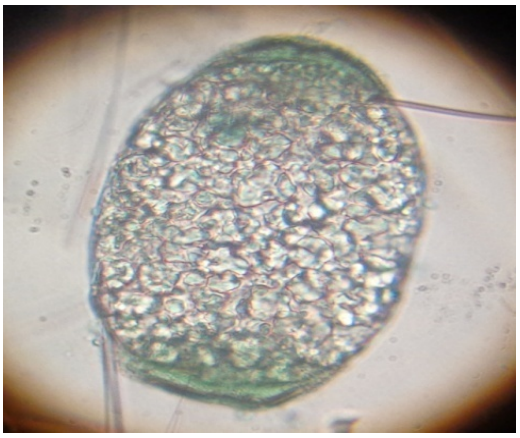

Photo 9: *Paramphistomum* sp.

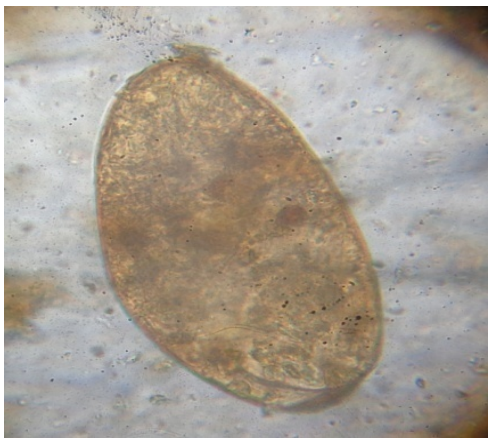

Photo10: *Fasciola* sp.

Eggs of cestode parasites

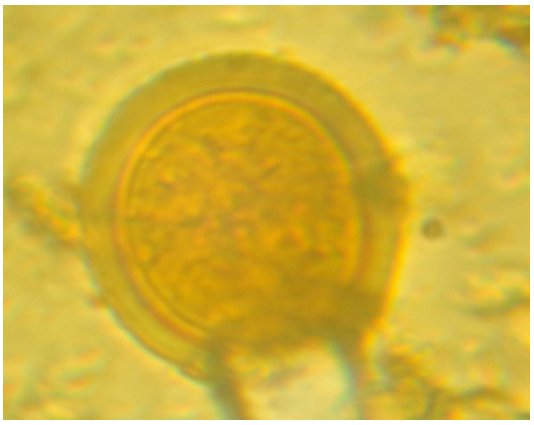

Photo 11: *Taenia* sp.

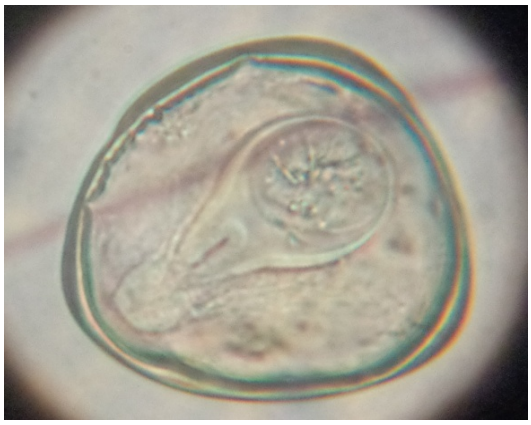

Photo 12: *Moniezia* sp.

Eggs of nematode parasites:

Photo 13: *Bunostomum* sp.

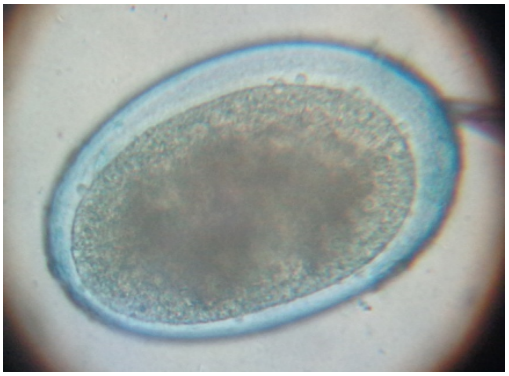

Photo 14: *Nematodirus* sp.

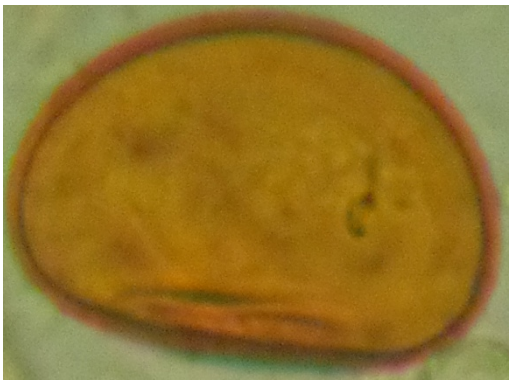

Photo 15: *Oxyuris* sp.

Photo 16. *Trichostrongyloid* sp.

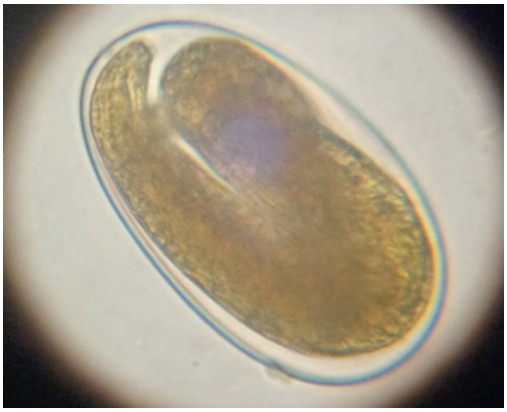

Photo 17: *Strongyloides* sp.

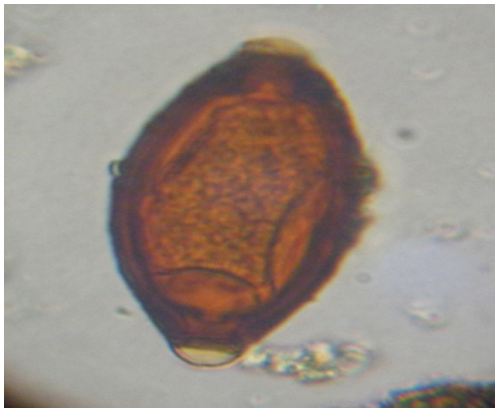

Photo 18: *Trichuris* sp.

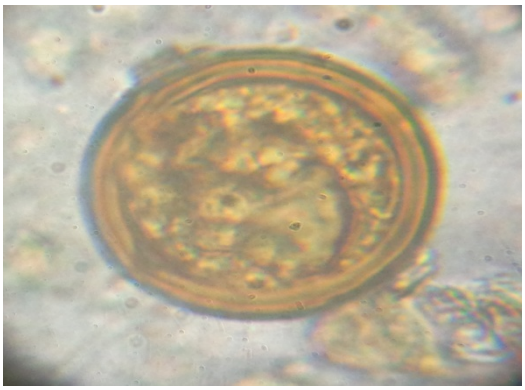

Photo 19: *Toxocara* sp.

Photo 20: *Strongyloides* larva

5. DISCUSSION

The present study was carried out to determine the seasonal prevalence of gastrointestinal parasites of goats. It can be said that the prevalence of gastrointestinal parasites is considerably influenced by the climatic conditions and geographical factors. Generally the warm and humid conditions, continuous high rainfall throughout the year which prevail in much of South-East Asia, provide good conditions for many gastro intestinal parasites to flourish that means there is no season during which the parasites are not a problem. (Tiyo et al. 2008).

In the present study 100% of the goats of Puranchaur VDC were found to be infected with one or more species of gastro-intestinal parasites which is similar to 100% GI parasites observed by Umar and Yakuri (2005). 94.09% samples were found to be infected with protozoan parasites where as 91.82% of the goats were found to be infected with helminth parasites in the present study.

Sporozoan parasites

The presence of oocysts of *Eimeria* sp. was observed in domestic ruminants of different countries (Radavelli et al. 2014), (Jimenez et al. 2007), (Idris et al. 2011), (Nirmal 2000) etc. Kaya (2004) reported ten *Eimeria* species from Antakay Province, nine species (Heidari et al. 2014) from Iran six species (Rehman et al. 2011) from Pakistan as well as five species of *Eimeria* sp. were reported by Radfar et al. (2011) from Iran. In present study, since oocyst were not cultured, species couldn't be identified hence *Eimeria* sp. has been broadly differentiated into two types (*Eimeria* with micropile and without micropile) on the basis of morphological structure. Goats of Pokhara were found to be infected with 197 (89.54%) of coccidian parasites which is higher in comparision to 27.1%, 50%, 57.5% and 22.4% revealed by Gupta and Chabra (1990) and Kaur and Kaur (2008), Rehman et al. (2011) and Gebeyehu et al. (2013) but lower than 94.7% and 93.7% Jimenez et al. (2007) in goat and sheep of Costa Rica respectively. The high prevalence rates of *Eimeria* sp. in the present study may be due to the contamination of drinking water and food by manure of infected goats and unhygienic yards etc.

Sarcodina parasites

Infection with sarcodina parasites revealed 70 (31.81%) positivity for *Entamoeba* sp. which is comparatively similar to 33.04% observed by (Jittapalapong et al. 2011) from Thailand, but higher than 1.84% and 3.2% recovered by (Radavelli et al.2014) from Brazil and Tanzania (Mhoma et al. 2011). From different countries indicating that goats are much more susceptible with protozoan parasites. Both cocidiosis and amoebiosis causes serious complication in growth, development and reproduction of the goats causing severe economic loss of the farmers. The present prevalence rate was found to be lower than 83% observed by Kanyari et al. (2010).

Trematode parasites

The trematodes observed in the goats of study area were *Fasciola* sp. and *Paramphistomum* sp. Fasciolopsis and paramphistomosis are two important parasitic diseases in farmed livestock all over the world where they causes huge losses to production (Wamae et al. 1998 and Mage et al. 2002). Overall prevalence of trematode parasites in goats showed 12.27%. *Fasciola* sp. is widely distributed trematode parasites and has been reported from variuous countries such as Cambodia (Dorny et al. 2011), Thailand (Jittapalapong et al. 2011), Pakistan (Lashari and Tasawar 2011), Bangladesh (Sangma et al. 2012), India (Chaubisa and Jaroli 2013) and Nepal (Karki et al. 2012) etc. High prevalence of *Fasciola* sp. has been observed in livestock from Surkhet, Nepal by Ghimire (1987) with the prevalence of 83%. Similarly fascioliasis has been reported from Kenya with 31.5% prevalence in 2005 and increased prevalence 64.2% in 2010. In this investigation, the prevalence of *Paramphistomum* sp. (4.09%) was much lower than those reported from Kenya by Opara et al. (2005), India by Lone et al. (2012), Nepal by Devi (2012) which were 86.7%, 46% and 11.76% respectively and by Sangma et al. (2012) from Bangladesh (44.2%) etc. This variation in the prevalence of *Paramphistomum* sp. in goats may be due to agro-ecological conditions, animal husbandry practices, breeds of animal, prevalence of intermediate snail hosts etc.

Cestode Parasites

Overall prevalence rate of cestodes in the current study was found to be 49(22.27%). Among Cestodes, *Moniezia* sp. was observed in ruminants by Silvestre et al. (2000) in France, Waruiru et al. (2005) from Kenya, Pathak (2011) from Nepal and Gebeyehu et al.

(2013) from Korea. Tefera et al. (2009) from Tanzania found the prevalence of *Moniezia* sp. to be 24.8%. In the present study the prevalence of *Moniezia* sp. was observed 18.18%, this parasite has been reported in goats (Mir et al. 2013) from India, (Sharkhuu 2001) from Mongolia etc. The prevalence of *Taenia* sp. in goats of Pokhara was found to be (4.09%) and this parasite has been reported in domestic animals by different researchers like Bashir (2009) in goats, Fakae (1990) in small ruminants, Edosomwan and Shoyemi (2012) in cattles and goats etc. The lower prevalence of cestode parasites in this study area is may be due to the fact that the cestode parasites require an intermediate host to complete their life cycle such *Moniezia* sp. whose infective larval form lives in orbatid mites and also goats are fed with upper parts of shrubs and trees where there is less chance of encountering infective larvae.

Nematode Parasites

The overall prevalence of nematodes parasites in the goats at Puranchaur VDC showed an infection rate of 91.82%. This may be attributed to the temperature and climatic condition of the area, which are suitable for the development of endoparasites. The *Bunostomum* sp. was one of the most dominant species (35%) in this study. This parasite has also been reported previously from Nepal (Bashir 2009 and Rizal 2012) and different parts of the world. The high prevalence of the parasites in this study could be due to keeping of goats together this could increase the degree of contamination leading to high prevalence rate. (Asif et al. 2008) examined fecal samples of sheep and goats in Pakistan and reported the prevalence of *Nematodirus* sp. (29.03%) and has also been reported from some other countries such as 100% from Serbia (Bojkovski et al. 2013), 27.17% from Morocco (Lamrioui et al. 2013), 11.12% from Nepal (Neupane 2012) etc. *Nematodirus* sp. is one of the most pathogenic nematode species in domestic ruminants but the prevalence of this parasites was very low (4.54%) in this study. The observed differences in prevalence could be mainly due to variations in geographical and climatic conditions. *Oxyuris* sp. is also a common parasite of domestic animals. The route of infection is through feed contaminated with faeces containing the infectious stage of the parasite. Parajuli (2007) and Karki (2012) reported this parasite from goats in Nepal. The high prevalence of *Oxyuris* sp. in this findings is because the eggs are either directly ingested or along with the food on the contaminated ground. The eggs and infective larvae of *Trichostrongyloid* sp. have been reported to have a high capacity of survival under adverse weather

conditions like cold or desiccation (Urquhart et al. 1987). In our study, they were also found to be a common species in the goat. However, the prevalence of *Trichostrongyloid* sp. in goat is found to vary according to the literature. For example, 48.8% from Ethiopia (Tefera et al. 2009), 21.19% from Pakistan (Asif et al. 2008), 17.56% from Nepal (Parajuli 2007), 42% from Turkey (Umar and Yakuri 2005), (4.85%) from India (Shirale 2008) etc. The variations among the findings might be due to the difference in the selection of animal, techniques of sample collection, period and place of study, environmental factors and breed of the animals etc.

Nematode are always more prevalent than trematodes and cestodes in ruminant. The reasons are that nematodes do not require intermediate hosts and both larval and adult stages are all infective stages of the parasite. *Strongyloides* sp. was observed in domestic ruminants by different researchers (Khajuria et al. 2013, Tefera et al. 2009, Chaudhary et al. 1993, Yeasmin et al. 2014, Badran et al. 2012, Devi 2012) etc. *Strongyloides* sp. can remain infective in the environment for up to 4 months this might be the reason for there high prevalence in this study.

Trichuris sp. has been observed frequently in domestic animals worldwide such as khajuria et al. (2013) from India, Devi (2012) from Nepal, Fritche et al. (1993) from Gambia etc. Beside this 46.67% by Yeasmin et al. (2014) from Bangladesh, 74% by Umar and Yakuri (2005) from Turkey, 40% by Gadahi et al. (2009) from Pakistan etc. reported high prevalence of the parasite. The high prevalence may be due to feeding of grasses directly from the ground. The most prevalent nematode recovered in this study was *Toxocara* sp. has been reported from domestic ruminants of Nepal (Sharma 1998-99), Bangladesh (Chowdhary et al. 1993), Palestine (Badran et al. 2012) etc. The variable distribution of these worms may be attributed to difference in climatic conditions prevailed in the area at the time of faecal samples collection on farm managemental practices such as grazing, salt feeding, and sources of drinking water can also influence the relative infection of different nematodes.

Several nematodes like *Capilaria* sp., *Cooperia* sp., *Chabertia* sp., *Ostertagia* sp., *Dictyocaulus* sp., *Haemonchus* sp., and *Strongyle* sp. etc have been reported by different researcher in global and national context. In the present study these parasites were not observed in the fecal samples of goat.

Assessment of knowledge, attitude and practices on goat diseases among goat farmers.

Goat is ideally suited for the poorest of the poor because of short gestation period, low risk capital investment and low cost of maintenance. Goat rearing being a traditional practice among the rural poor, is wisely considered as a "poor man's cow"(Gopala et al. 2010). This study result shows that there was no significant difference in the distribution of gastrointestinal parasites in goats during both summer and winter. This is probably because the climatic condition in the study area is favorable for gastrointestinal parasites in both seasons. All the farmers included in the questionnaire were the owners and fed their animals with nutritional supplements. All the goats in the study area were kept in the yard both in the day and night therefore there was low prevalence of trematode genera (*Paramphistomum* sp. and *Fasciola* sp.) in this study because they require intermediate hosts to complete their life cycle and so transmission is dependent on the availability of intermediate host. Various species of snail act as intermediate host of trematode parasites in different countries. In Nepal *Lymnaea* sp. is found most widely and these snails are found in permanent and temporary watercourse, irrigation channels, dam edges and depressions. They are attached normally to vegetation in these habitats and are dependent on season for survival (Soubly 2006).

Good nutritional status of a host can positively influence the pathogenesis of gastrointestinal parasitic infections. Pathogenesis of a disease depends upon various factors including breed, age, nutritional status and management systems as well as environmental condition (Houdijks et al. 2000). Some of the farmers in the study observed worms and segments of proglottids in faeces of their goats. Most of the farmers deworm their goats twice a year while some did not treated their pregnant goats because of the fear of abortion. *Toxocara* sp. was the most abundant nematode genus throughout the study period. This is probably due to the fact that the eggs are extremely resistant to dryness, freezing and disinfectants, and can remain infective in the environment for years, which means that it is likely that the larvae are ingested in higher numbers than those of other genera

In general, this study showed that gastrointestinal infection in the Puranchaur VDC is still under control. This could be due to good farming practices and the good nutritional status of the goats sampled. However, attention should be focused on dominant genera such as *Eimeria* sp.*, Bunostomum* sp. and *Toxocara* sp. that have the potential to become problematic, especially in calves. It is therefore important that appropriate control and management of these gastrointestinal parasites should be practiced. To increase the productivity of goats, gastrointestinal parasites control should be based on epidemiological observations and should not rely on anthelmintics only. Alternative means of control like use of medicinal plants should be practice (Hammond et al. 1997), infected animals should be isolated from others. Emphasis should be placed on education of goat breeders on the importance of environmental sanitation, personal hygiene, proper disposal of manure, a communication network amongst farmers, the government and experts is essential. The results in the present study showed that coccidia, nematodes and cestodes and trematode as single or mixed infections are prevalent in goats. The results also suggest a need for well-coordinated, permanent sanitary monitoring of goat farms to reduce the prevalence and intensity of parasitic load.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Goats are essential components of the mixed farming systems in the hills of Nepal, and are found in all parts of country. Goat farming has been practiced by a large section of population in rural areas of Nepal. It is a profitable business with a low investment because of its multi functional utility like meat and milk that are very nutritious. Goats are the most important livestock in Nepal, most of the goat farms are to produce goat meat there is no dairy goat farms in Nepal. Goat farming is going popular in Nepal but lack of the commercial farming techniques still it is being practiced by using traditional and conventional methods from centuries. It could be the major cause of heavy economic losses among farmers.

In order to assess the seasonal prevalence of gastrointestinal parasites in goats, fresh stool samples were collected from Puranchaur, VDC of Pokhara and examined using concentration method (sedimentation and floatation). During the study period total 220 samples were collected and examined of which 110 were collected in summer and 110 in winter respectively. The overall prevalence of gastrointestinal parasites was found to be 100%. From the present study it has been concluded that the gastrointestinal parasites in goats are highly prevalent in Puranchaur. Thirteen different genera of parasites were observed in the present study which are as follows protozoans; *Eimeria* sp. (89.54%) and *Entamoeba* sp. (31.81%) among trematodes; *Fasciola* sp. (8.18%) and *Paramphistomum* sp. (4.09%) among cestodes; *Taenia* sp. (4.09%) and *Moniezia* sp. (18.18%) amongs nematodes; *Bunostomum sp.* (35%), *Nematodirus* sp. (4.54%), *Oxyuris* sp. (30.45%), *Trichostrongyloid* sp. (5.45%), *Strongyloides* sp. (7.27%), *Trichuris* sp. (12.27%) and *Toxocara* sp. (68.18%) amongs nematodes. Among 13 genera *Eimeria* showed the highest prevalence followed by *Toxocara* sp., *Bunostomum* sp., *Entamoeba* sp., *Oxyuris* sp. etc. Single infection was found in (8.18%) and multiple infections were observed in (91.81%) samples. All the thirteen genera were observed in both the season i.e. winter and summer. Parasitewise association between summer and winter was found to be insignificant for *Eimeria* sp. (wom) and (wm), *Entamoeba* sp., *Paramphistomum* sp., *Taenia* sp., *Moniezia* sp., *Bunostomum* sp., *Nematodirus* sp., *Oxyuris* sp.,

Trichostrongyloid sp. and *Strongyloides* sp. and significant for *Fasciola* sp., *Trichuris* sp., and *Toxocara* sp.

6.2 Recommendations

- Since all the goats of Puranchaur VDC of Pokhara were infected with various intestinal parasites, DLSO should initiate the routine treatment of parasitic diseases in symptomatic and non- symptomatic goats.
- Coccidiosis is a major problem in these goats hence mass treatment program against coccidiosis must be initiated regularly in this VDC.
- Knowledge on goat diseases seems poor among farmers hence regular training programme of goat farming focussed on disease aspect should be provided to goat farmers.

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