INTRODUCTION

BACKGROUND

Goat (*Capra hircus*), a member of the Bovine family and subfamily Caprinae is one of the oldest domesticated species. For thousands of years they have been used for their milk, meat, hair, and skins over much of the world. Female goats are referred to as *does* or *nannies*, intact males as *bucks* or *billies*; their offspring are *kids*. Castrated males are *wethers*. Goat meat from younger animals is called *kid* or *cabrito*, and from older animals is sometimes called *chevon*, or in some areas "mutton" (www.wikipedia.org/goat).

Small ruminants mainly goats are essential components of the mixed farming systems in the hills of Nepal, and are found in all parts of country. They are mainly kept for meat, although wool (sheep), fibre (goats) and manure are also important products from these animals. In the present subsistence farming system of the hills, farmers have little surplus agricultural produce to sell and so depend upon the sale of livestock and their products as a source of income. However, because of their inherent ability to utilize mountain terrain, unsuitable for crop farming, a high proportion of sheep and goats are found in the hills. 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, www.fao.org/docrep/004/T0706E/HTM).

Nepal is an agrarian country where 82% of the people depend on agricultural activities. In 2004, the Ministry of Agriculture and Cooperatives (MoAC) has estimated agricultural contribution to be 39% to the national GDP, whereas livestock sector contributions have been estimated to be 16%. Around 31% of the agricultural GDP is being rendered by the livestock sector only, of which 53% is derived from the hills, 38% from the terai, and 9% from the mountains (CBS 2001–02).

Livestock population in Nepal for 2004/2005 was estimated to be 6.99 M cattle, 4.08 M buffaloes, 7.15 M goats and 0.86 M sheep (www.moacwto.gov.np.statistics/livestock/pdf). Roughly 70% of households keep some type of livestocks, including cows, buffaloes, pigs and chick

Endoparasites are those organisms living within their hosts, in the gut, body cavity, liver, lungs, gall bladder and blood or within the internal cavities, tissues or cell of the host. Such forms nearly always live a completely parasitic existence. Since they totally depend upon

their host, endoparasitism is also referred to as infection. *Fasciola* sp., *Trichostronglus* sp., *Schistosoma* sp. for examples are typical endoparasites.

Infection with gastrointestinal nematodes is regarded as one of the important factor causing productivity loss (Shrestha 1994). The most important and widely prevalent nematodes are *Ostertagia* sp., *Trichostrongylus* sp., *Cooperia* sp., *Oesophagostomum* sp. etc. These nematodes in the small intestine may cause severe damage to the intestinal mucous membrane. *Toxocara* sp. and *Dictyocaulus* sp. have the worldwide distribution and the prevalence is higher in cattle & buffaloes (Karki, 2005).

Cestodes found in gut are acquired by eating contaminated food or water found to be largely affecting the ruminants. This group comprises of the genera *Moniezia* sp., which is cosmopolitan in distribution and *Taenia* sp. which is commonly found in the rumen of the domesticated and wild carnivores They have reported from Asia and Africa (Karki, 2005).

Moniezia sp. in ruminants of the goats and cattle causes infections by ingesting herbage contaminated with the mites carrying the infective stage of the parasite. Heavy infections cause poor growth and diarrhea in lambs.

Taenia saginata usually called cow or buffalo tapeworm has two hosts viz., Definitive host man and intermediate host cow or cattle. It is also called beef tapeworm. The worms (segments) passes out along with the faeces of human being and when ingested by cattle, infects them on reaching alimentary canal of the host, the eggs hatch out and liberated, they penetrate the gut wall and enter mesenteric lymphatics and finally reaches circulation. Then they invade the muscular tissue and undergo further development.

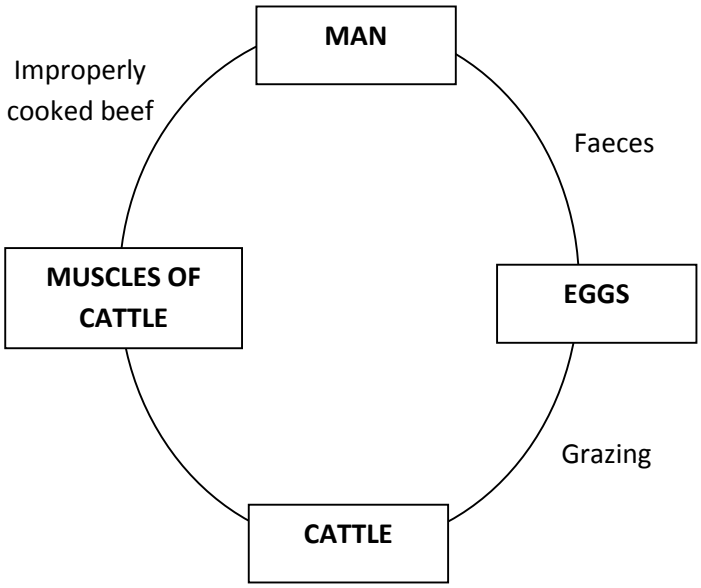

Fig. 1: Lifecycle of *Taenia* sp

Trematodes commonly known as flukes often live in the bile duct or small intestine and may also affect the lungs. Their eggs are passed with the faeces of the host. Some are ingested but some burrow into the skin after hatching for access. Trematodes especially include *Fasciola* sp, *Schistosoma* sp. & *Paramphistomum* sp. (Shah and Agrawal, 1990).

Fascioliasis is a well known parasite of herbivorous animal. It has worldwide distribution on the animal reservoir host. A large variety of animals such as cattle, buffaloes show infection rate that varies from 70% to 90% in some areas. The different local names of these diseases, such as Namle, Matey, Lew etc. in different regions are proof of its continued existence for many yrs. in the animal population of the country.

Infection of domestic ruminants with *Fasciola hepatica* and *F. gigantica* causes significant loss estimated at over US$ 2000 million per year to the agriculture sector worldwide with over 600 million animals affected (Hansen, 1994).

Fasciola hepatica and *Fasciola gigantica* inhabit similarly in the bile ducts of final host. The eggs produced by parasite are expelled with the bile into the intestine. These in turn are shed in the faeces as, Eggs → Free swimming miracidium → Cercariae → Metacercariae → Adults.

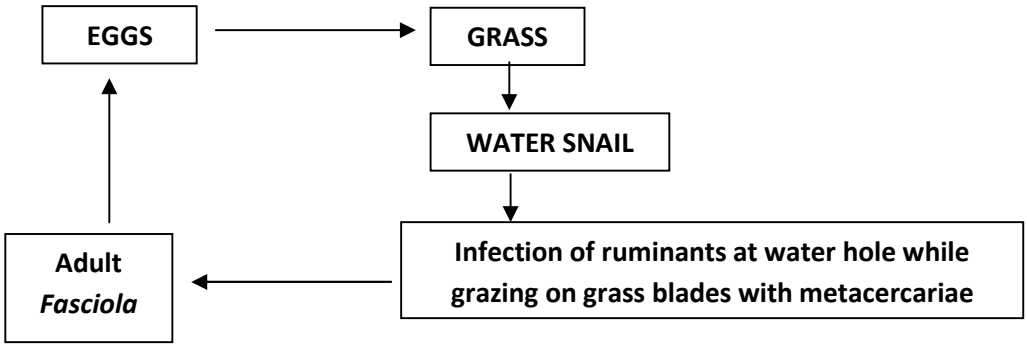

Fig. 2: Life-cycle of *Fasciola* sp.

The economic loss due to fascioliasis in Nepal was estimated to be Rs. 14.2 crore (Lohani & Rasaili, 1995). The prevalence of fascioliasis ranging between 50% to 90% has been reported in cattle. In addition fascioliasis is now recognized as an emerging human disease.

The pathogenic effects of gastrointestinal parasites may be sub-clinical or clinical. Young animals are most susceptible. The effect of these parasites is mainly dependent on the number of parasites and nutritional status of the animal they are infecting. The clinical symptoms are weight loss, reduced food intake, diarrhoea and reduced yield. Severe blood and protein loss intro abomasums and intestine due to damage caused by the parasite often results in Oedema in the sub-mandible region. Some nematode species especially *Haemonchus* sp. is most pathogenic among blood sucking worms and infection with large number of this parasite often results in severe anemia in the host.

The important species of snail involved in the transmission of fascioliasis vary in their geographical distribution in the world Man and herbivorous animals (cattle) acquire infection by the ingestion of moist and raw aquatic plants, grass harboring infective metacereacriae. The metacercariae mature to become adult worms and lay eggs which are passed in the faeces. On coming in contact with water, they mature and invade the the

freshwater molluscan host snail. The mature cercariae emerge out of the snail and get encysted on aquatic grasses, plants and develop into metacercariae which is the infective stage of the parasite.

Trichostrongyliasis is diseased stage of the gastro-intestinal tract of herbivorous animals and man is an accidental host only. This disease is caused by the member of the germs *Trichostrongylus* sp. The infection is acquired by the ingestion of contaminated vegetables or drinks with its third stage larvae. Strongyloidiasis is an intestinal infection of man caused by the penetration of the skin by the filariform larvae of *Strongyloides stercoralis*.

Rice straw which is the major feed for livestock during winter months has been reported as the potential source of infection for fascioliasis (Joshi, 1987 & Mahato, 1993). Green grasses from near permanent water sources or water lodging areas in Monsoon are another potential source of *Fasciola* infection. Therefore in the Nepalese hills, the major risk period of *Fasciola* infection is during post monsoon and winter months. *Gnathostoma spinigerum* can generally be found in wet tropical environments. Larvae can be found in many classes of animals that inhabit that ecosystem as well *Dicrocoelium* spp. was first reported by Mukhia in 2007 buffaloes where prevalence rate was found upto 29.61%

Schistosoma spp. are the only trematodes living in the blood stream of warm blooded hosts. The blood stream is rich in glucose and amino acids. So along with the plasma and blood cells, it represents an environment which is suitable for egg producing trematodes. *Schistosoma* spp. causes diseases called schistosomiasis or Bilharziasis and is the main helminth diseases. The infections are often manifest by acute intestinal signs, the mucosa of the intestine is severally damaged and the animal develops profuse bloody diarrhea, dehydration and loss of appetite. Not only goats, sheep or cattle, over 200 million people are infected in at least 75 countries with 500 million or more people exposed to infection. (Arcari, 2000). Most of the species like *Schistosoma spindalia*, *S. japonicum* & *S. bovis* has been reported among buffaloes from Surkhet district (Ghimire, 1987). In Satungal, Kathmandu prevalence rate of *Schistosoma* sp. was found about 9% (Mukhia, 2007). But, it

was not reported in goats of Nepal before, but during this study period it has been reported from Khasibazar of Kalanki, Kathmandu.

Among roundworms of goats, the commonest are *Trichostrongylus* sp., Hookworms, *Ascaris* sp., *Strongyloides* sp. Female roundworms 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. They infect the pasture. Goats get infected when they graze on the contaminated pasture. The larva mature in the intestine, mate and begins laying eggs. Adult roundworms can cause anemia, diarrhoea, poor growth and even death. Hookworms like *Necator* and *Ancylostoma* shows severe symptoms like anemia, laziness and lack of physical and mental ability. Their infection also leads to physical and mental retardation. The heavy infection of the worms numbering from 250-400 may lead to loss of about 268ml blood per day from the host body.

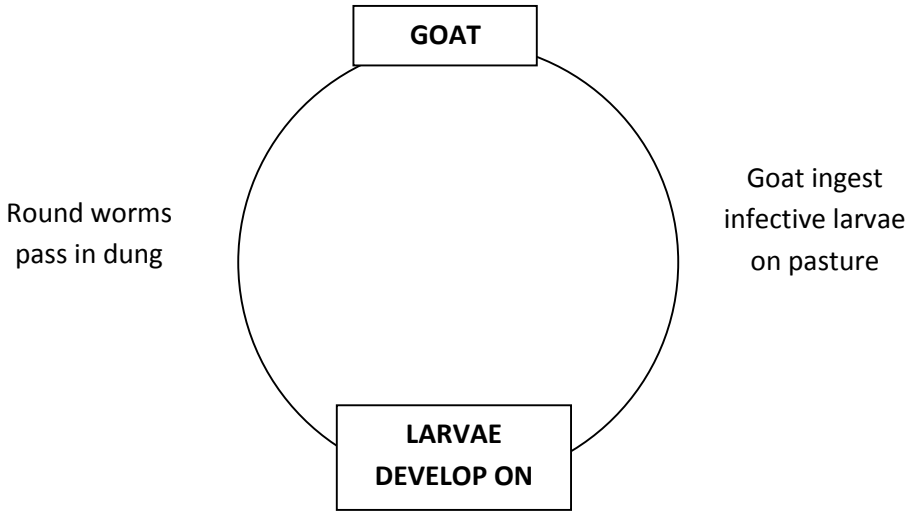

Fig. 3: Life cycle of gastrointestinal roundworms in general

Table 1: Parasites and their host with location of infection

S.N	Parasite	Definitive host	Location
a.	*Trichostrongylus* sp.	cattle, sheep, goat, man, pig & horse	small intestine, abomasum & omasum
b.	*Schistosoma* sp.	cattle, buffalo & goat	Mesenteric veins
c.	*Dipylidium* sp.	Man, cattle, dog & cat	small intestine
d.	*Toxocara vitulorum*	Buffalo, cattle, calves	small intestine
e.	*Fasciola* sp.	Sheep, goat, cattle, dog, cat & man	liver, lungs, bile duct & kidney

Source: Chandler, ASA.C.

Table 2: Trade in Goat

Species	1980			1990			2000			2002		
	Export	Import	Net trade	Export	Import	Net trade	Export	Import	Net trade	Export	Import	Net trade
Quantities (count)												
Sheep and goat	0	93,600	-93,600	112,769	7,630	105,139	21,476	14,350,	7,126	28,150	1,306	26,844
Values (1,000 US $)												
Sheep and goat	0	2,000	-2,000	1,243	184	1,059	170	425	-255	194	26	168

Source FAO, 2005 http://faostat.external.fao.org/default.jsp

Rearing of goats is mainly done for obtaining meat. Meat consumption varies widely while comparing different countries as it depends on factors like socio-economic condition, religious beliefs, cultural practices, etc. In a resource poor and 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).

But, gastrointestinal parasites are a major constraint in small ruminant production in humid tropics of Southeast Asia. The parasitic infections are worldwide problem for both small- and large-scale farmers. 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).

SIGNIFICANCE OF THE STUDY

Raising goats in Asian, European and American countries is one of the way of having financial resource of the people living therein especially in the villages. The infection of helminth parasites in goats can cause significant economic loss leading to the poor health, reduced growth, mortality of kids, etc. This study is an effort to determine the seasonal prevalence of helminth parasite in goats and the rate of infection in them.

Nepal, being a developing country depends on agriculture and animal husbandry for its bulk of economy. However, the farming technique is rather unscientific. The goat farming is also done in poor and unhygienic manner and hence is heavily infected with different parasites including Helminth parasites. In these circumstances this type of study can play a vital role. Miss Laxmi Parajuli has worked previously on the goat's intestinal helminth parasites. The present study is an illustration of the previous work in addition, revealing the prevalence of helminth parasite seasonally i.e. during and summer and winter.

This study will also prove as a roadmap for future researchers and investigators. The study will also explore the prevalence rate of the helminth parasites and will suggest some appropriate mitigative measures. Thus the study has got a great importance and significant in itself.

LIMITATION OF THE STUDY

This study was carried out to determine the prevalence of helminth parasites seasonally but the study doesn't reveal why some parasites were more predominant and others were not.

This study is limited to certain parameters and some of the parts of the study were left untouched due to time and cost factors so that future researchers can elaborate this study by approaching the untouched portion.

OBJECTIVE

The present study was done to fulfill the following objectives-

A. General Objective:

To determine the prevalence of intestinal parasites of goat (*Capra* sp.) in Khasibazar, Kathmandu.

B. Specific Objectives:

The specific objectives of the study were as follows:

i. To identify the helminthes parasites
ii. To determine the degree of seasonal prevalence of Trematodes, Cestodes and Nematodes in goats brought for slaughter purpose.
iii. To determine the rate of prevalence of gastrointestinal helminthes species
iv. To develop the recommendation for the planning regarding the control of helminth parasites in goat.

Hypothesis

H_0 = There is no significant difference in prevalence of helminthes parasites in winter and summer.

H_1 = There is significant difference in prevalence of helminthes parasites in winter and summer.

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II

LITERATURE REVIEW

LITERATURE REVIEW IN CONTEXT TO THE WORLD

Ndao *et al*., (1991) conducted an epidemiological survey on gastrointestinal helminthiasis in 51 sheep and 51 goats on Senegal from October 1990 to September 1991. All the animals examined were infected with at least one helminth species. Three trematodes (*Fasciola gigantica, Schistosoma bovis, Amphistomum* spp), 2 cestodes (*Moniezia expansa, Cysticercus tenuicollis)* and 9 nematodes were identified. The most important parasite in goat was *Trichostrongylus colubriformis* while *Haemonchus contortus* in sheep.

Nwosu *et al.*,(1996) examined a total of 120 gastro-intestinal tracts and 960 faecal samples to assess the prevalence and seasonal changes in the gastro-intestinal helminth parasites of Red Sokoto (maradi) goats slaughtered at Ibadan, Nigeria between May 1991 and April 1992. Egg types of *Strongyles, Strongyloides, Trichuris, Skrjabinema, Dicrocoelium* and *Moniezia* were encountered in 93%, 83%, 44%, 0.9%, 2.3% and 31% of the faecal samples respectively. However, only *Strongyle, Strongyloides* and *Trichuris* eggs occurred in large numbers and were more common during the rainy season than in the dry season.. Mixed infections were most prevalent. Only *Haemonchus, Trichostrongylus, Strongyloides* and *Cooperia* spp. occurred in large numbers. Irrespective of the age of the goats, higher worm counts were generally encountered during the rainy season than in the dry season.

Pathak *et al.,* (2000) collected 88 gastrointestinal tracts of goats from the slaughter house Supela, Bhilai and were also collected from the Veterinary College, of Durg district chhattisgarh and were brought for the postmortem examination during November 1999 to October 2000. The percentage of overall prevalence of parasitic infection *Paramphistomum* spp., *Cotylophoron* spp., *Moniezia* spp., *Avitellina* spp., *Haemonchus* spp., *Cooperia* spp., *Oesophagostomum* spp., *Bunostomum* spp., and *Trichuris* spp. were 80.68, 45,45, 17.04, 3.40, 26.13, 5.68, 3.40, 30.68, 5.68 and 27.27 respectively. In case of *Paramphistomum*, infection was highest in monsoon (91.8%) and lowest in winter (63.15%). In present

investigations the seasonal prevalence of gastrointestinal parasitic infection in goats showed that prevalence was highest in monsoon (94.60%), moderate in summer (87.50%) and lowest in winter (63.15%).

Silvestre *et al.,* (2000) investigated helminth infection, species diversity (proportion of each species in the community), species number, intensity of infection and anthelmintic resistance in 16 dairy-goat farms of south-western France. A total of 17 species of helminths, among which 14 nematodes, one cestode (*Moniezia* spp.) and two trematodes (*Paramphistomum daubneyi* and *Dicrocoelium lanceolatum*) were recovered in the 26 necropsied culled goats during the study.

Vatta *et al.,* (2000) conducted a longitudinal study of the pooled trematode faecal egg counts (FECs) of samples collected from goats of resource-poor farmers at Rust de Winter, Gauteng Province, Impendle, KwaZulu-Natal Province, and Kraaipan, North-West Province. The *Amphistome* FECs followed a seasonal pattern, with an increase in the counts during the warmer months of the year (September to April). The study seems to indicate a different pattern of infection in goats raised under resource-poor conditions in South Africa from that on commercial farms, where outbreaks of clinical paramphistomosis occur during autumn and winter.

Jithendran *et al.,* (2001) studied the prevalence of gastrointestinal parasites in sheep and goats of Himachal Pradesh, India and found the prevalence in sheep and goats respectively as follows: *Fasciola* 9.6%, 8.8%; *Amphistomes* 3.8%, 2.5%; *Dicrocoelium* 7.2%, 2.5%; *Schistosoma* 1.2%, 0.6%; *Moniezia* 2.7%, 1.3%; *Strongyles* 91.6%, 100%; *Strongyloides* 4.8%, 5.1%, *Dictyocaulus* 1.2%, 1.3% and *Trichuris* 14.3%, 1.3%.

Sharkhuu (2001) performed the Post-mortem examinations of 236 goats from all provinces in Mongolia for the study of helminths in goats. Thirty-nine helminth species belonging to three classes, 14 families and 23 genera were found. The prevalence and intensity of helminth infections were reported for three age groups of goats in four seasons and three geographic zones in Mongolia. Common helminth infections of goats in all zones of Mongolia were infections of *Ostertagia, Marshallagia* and *Nematodirus*. The highest

number of eggs per gram (EPG) of feces was counted in March (average 1335.3±405.3) and the lowest count was in November (54±18.6).

Faizal *et al.,* (2002) studied the benefit of gastrointestinal nematode control in cross-bred goats in the dry area of Sri Lanka by comparing the performances of three groups: group 1 animals (n=11) were left untreated against gastrointestinal nematodes; group 2 animals (n=11) were given monthly anthelmintic treatment, doramectin, during the entire study period; group 3 animals (n=11) were also given monthly doramectin treatment but only during the rainy months, October to January and again once in April. Four untreated animals and a group 3 animal suffered from parasitic gastroenteritis during the study period. When compared with the controls, the treated groups had significantly lower gastrointestinal nematode infection as indicated by faecal egg counts (P<0.01). Faecal egg counts in group 3 were significantly higher than those in group 2 (P<0.01). When compared with the controls, the treated groups had significantly greater weight gains (P<0.05). *Haemonchus contortus* and *Trichostrongylus colubriformis* were the predominant gastrointestinal nematodes identified from tracers. The worm burden varied according to the rainfall pattern, with very minimal transmission during the dry period which extends from May to August.

Wanjala *et al.,* (2002) conducted a research on prevalence of parasitic infection in small ruminants in a post oral community in Narok district, Kenya. The investigation was done in 150 sheep and 150 goat during wet season (May to June) and dry season (August to September). The findings showed that 52% of animals were infected. The most prevalent genera of helminthes identified were Strongyle group.

Woldemariam (2002-2003) conducted a study on 57 lamb and 53 kid tracers duting different seasons in mid-rift valley of Ethiopia. In this study, the predominant worms recovered from 57 lambs were *Haemonchus contortus* (91-100%) and *Trichostrongylus colubriformis* (90-100%), followed by *Oesophogostomum columbianum* (33-83%) and *Trichuris ovis* (8-33%). Similarly, *Haemonchus contortus* (95-100%) and *Trichostrongylus colubriformis* (83-100%) were predominant in 53 kid tracers, followed by *Oesophogostomum columbianum* (58-83%) and *Trichuris ovis* (41-74%). A significant difference in eggs count was observed within seasons and sites.

Besier and Love (2003) conducted a study on intestinal parasites in sheep and goats in Australia. In this study, *Haemonchus* spp., *Trichostrongylus* spp. and *Ostertagia* spp. were predominant helminth parasites.

Regasa *et al.,* (2003-2004) conducted a study on epidemiology of gastro-intestinal parasites of ruminants in Western Oromia, Ethiopia. The study showed that the overall prevalence of gastro- intestinal parasites were 84.1% in goats. Nematodes of group Strongyle and *Eimeria* were most prevalent parasites encountered in this area.

Muraleedharan (2005) observed the gastrointestinal parasites of livestock in a central dry zone of Karnataka, India and reported the prevalence of gastrointestinal parasites among cattle (18.22%), buffaloes (20.85%), sheep (39.34%) and goats (46.12%) of southern taluks of central dry zone of Karnataka during drought period. *Strongyles* were the most common nematode. *Fasciola*, *Amphistomes*, *Moniezia* and *Entamoeba* infections were low among livestock but *Fasciola* infection was not seen in sheep. *Eimeria* infection was found comparatively higher in sheep than goats. Ova of *Gongylonema* were recorded from one cattle and *Strongyloides* were observed only in sheep. Low incidence of *Trichuris* infection was noticed in cattle, sheep and goats. *Strongyle* infection in livestock was found higher during southwest monsoon.

Umur *et al.,* (2005) investigated the gastro-intestinal (GI) organs of 50 goats in Burdur region, Turkey for the prevalence of GI nematodes and the seasonal activity of the parasites. All the animals examined (100%) were found to be infected with GI nematodes. Twenty-two nematode species were identified and a total of 53,759 nematodes were collected from the infected goats. The number of parasites per goat ranged from 65 to 4811 (mean 1075.18), while the number of nematode species per animal ranged from 1 to 12 (mean 6.34). The most frequently detected nematodes in the goats were *Ostertagia circumcincta* (78%), *Marshallagia marshalli* (72%), *Nematodirus abnormalis* (66%), *Trichuris ovis* (60%), *N. spathiger* (52%), *T. skrjabini* (50%) and *Trichostrongylus vitrinus* (40%). 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.

Yadav *et al.,* (2005) reported the highest incidence of gastro-intestinal neatodiasis in goats followed by buffalo and cattle in India. *Haemonchus* spp, *Trichostrongylus*, *Bunostomum, Oesophagostomum* and *Strongyloides* species were the main parasites recovered from the intestine of sheep, goats and buffaloes.

Waruiru *et al.*, (2005) conducted a study on gastro-intestinal parasitic infection of sheep and goats in semi-arid area of Machakos district, Kenya. The overall prevalence were *Strongyloides* (51.6%), *Fasciola* spp. (31.5%), *Coccidia* (28%), *Moniezia* (2.5%). *Haemonchus* (58%) was the most prevalent nematode followed by *Trichostrongylus* (29%) and *Oesophagostomum* (13%).

Opara *et al.,* (2005) conducted a study on occurrence of parasitic helminthes among small ruminants reared under traditional husbandry system in Owerri, south east Nigeria. In this study, out of 2,550 small ruminants examined, 71.4% were goats which had helminth infection rates of 90.1%. Nematode infection was consistently high and gave infection rate of 78.4%, while trematodes and cestodes were recorded 13% and 8.7% respectively. Among trematodes *Paramphistomum* infection was 86.7%, among nematodes Strongyloides 63.2% and among cestodes. *Moniezia* 50% were the highest.

Di Gerbo *et al.*, (2006) carried out a survey of parasites in goat farms in Bergamo province, north Italy from May 2005 to Jan, 2006. Fecal samples of 836 adult female goats from 31 dairy goat farms were examined. *Strongyloides* sp. showed higher values of preavalence in goats housed in summer while *Nematodirus* in winter in goats at pasture. *Strongyloides* occurred more frequently in autumn in stabled goats.

Lima *et al.,* (2006) studied the faecal samples collected from 20 goats in Paulista, Pernambuco, Brazil, from August 1998 to July 1999.they were subjected to eggs per gram faeces (EPG) determination and nematode larvae culture. It was shown that 82% of the samples were positive for helminths. *Strongyloides, Moniezia* and *Trichuris* spp. ova were obtained in 72.8, 8.4 and 2.0% of the samples, respectively, while third stage larvae of *Haemonchus, Trichostrongylus* and *Oesophagostomum* spp. were obtained from 75.13, 24.32 and 0.54% of the samples, respectively. The medium number of *Haemonchus* and

Trichostrongylus spp. larvae per gram faeces was higher in the rainy months. There was a significant correlation between EPG and temperature, EP and rainfall and EPG and the number of *Haemonchus* spp. larvae per gram faeces. *Haemonchus* spp. was present throughout the study period.

Mungube *et al.,* (2006) estimated the prevalence and economic losses caused by *F. gigantica* and *F. hepatica* in the ruminant production systems of Taveta division of Kenya in a retrospective appraisal of the slaughter records on the total number of animals slaughtered and livers condemned over the period 1989 to 2004. Liver condemnation rates differed significantly between bovines, caprines and ovines ($p \leq 0.05$) for *F. gigantica* (26%, 6.6% and 5.2%, respectively) and for *F. hepatica* (0.4%, 22% and 28%, respectively). The total loss through condemnation of both *F. gigantica* and *F. hepatica* infested livers was 4 408 272 KES (Kenyan shillings) (US$ 72 272). The proportion of loss in bovines, caprines and ovines, was 76%, 17% and 7%, respectively.

Regassa *et al.,* (2006) conducted a study to determine the prevalence and risk factors associated with gastrointestinal parasitism in western Oromia, Ethiopia during 2003–2004. A total of 757 ruminants (257 cattle, 255 sheep, and 245 goats) were included in the study using standard coprological parasitological procedure. The study showed that the overall prevalence of gastrointestinal parasites was 69.6% with 50.2%, 75.3%, and 84.1% in cattle, sheep, and goats, respectively. *Strongyles* and *Eimeria* were the most prevalent parasites encountered in the area. Season and age were shown to have association with prevalence but not with EPG while no association was revealed between prevalence and EPG with sex and body condition of the animal.

Rehman *et al.,* (2006) assessed the month-wise prevalence of gastrointestinal trematodes, nematodes and cestodes in Damani sheep and goat in Pakistan. A total of 96 positive gastro-intestinal tracts (48 each) of sheep and goats were examined. Trematode infection was 16.66% both in sheep and goats in May, whereas in June, July and August it increased to 25% in sheep. A similar increase was recorded in June and July in goats which dropped to 8.33% in August. Highest custodial infections in sheep and goats were recorded in June (33.33%) and August (41.16%), respectively. The lowest recorded nematodal infections in

sheep were observed in June (41.66%), which increased in July (50%), May (58.33%) and August (58.33%). In goats, the lowest records were observed in June (41.66%), with an equal increase in May and August (i.e. 50%).

Uddin *et al.,* (2006) investigated the prevalence of *Amphistome* parasites in Black Bengal goats slaughtered at different slaughterhouses of Mymensingh district, a total of 144 gastro-intestinal tracts were examined during the period of July 1998 to June 1999 in the Department of Parasitology, Bangladesh Agricultural University, Mymensingh. Out of 144 Black Bengal goats, 105 (72.92%) were infected with a single or multiple species of amphistomes. In present investigation, three species of amphistomes viz *Paramphistomum cervi*, *Cotylophoron cotylophorum* and *Gastrothylax crumenifer* were identified. The highest infection was observed with *Paramphistomum cervi* (65.28%) and lowest infection with *Cotylophoron cotylophorum* (36.11%). Mixed infections with two or more species of amphistomes were found in 60.42%. The prevalence of amphistomes was very high all the year round and the rate of infection was 83.64%, 69.23% and 64.0% during monsoon, winter and summer season respectively.

Yadav *et al.,* (2006) studied faecal samples (n=520) from sheep (n=245) and goats (n=275) from R.S. Pura, Bishnah and Samba tehsils of Jammu district which revealed a total of 83.07% gastro-intestinal parasite infection. 83.24%, 80.00%, 84.72% and 80.55% infection was observed in sheep, lambs/hoggets, goats and kids, respectively. *Strongyles* (44.62%) were predominant followed by *Amphistomes* (8.07%), *Eimeria* sp. (6.73%), *Fasciola* sp. (3.08%), *Trichuris* sp. (3.08%), *Dicrocoelium* sp. (1.92%), *Strongyloides* sp. (1.15%) and *Moniezia* sp. (0.96%). Mixed infection with one or more gastro-intestinal ova was also detected in 13.46% of animals. Seasonal variation was recorded throughout the year and was highest during rainy season (88.54%) followed by summer (83.15%) and winter (76.01%).

Menkir (2007) carried out a two year epidemiology study of helminths of small ruminants. The study involved the collection of viscera from 655 sheep and 632 goats from 4 abattoirs in eastern Ethiopia. A further more detailed epidemiology study of gastro-intestinal nematode infections used the Haramaya University (HU) flock of 60 Black Head Ogaden sheep. The parasitological data included numbers of nematode eggs per gram of faeces

(EPG), faecal culture L3 larvae, packed red cell volume (PCV), adult worm and early L4 counts, and FAMACHA eye-colour score estimates, along with animal performance (body weight change). There were 13 species of nematodes and 4 species of flukes present in the sheep and goat, with *Haemonchus contortus* being the most prevalent (65–80%), followed by *Trichostrongylus* spp. The nematode infection levels of both sheep and goat followed the bi-modal annual rainfall pattern, with the highest worm burdens occurring during the two rain seasons (peaks in May and September).

Nwosu *et al.,* (2007) carried out a survey to determine the prevalence and seasonal abundance of the egg and adult stages of nematode parasites of sheep and goats in the semi-arid zone of north-eastern Nigeria between January and December 2002. Faecal samples collected from 102 sheep and 147 goats and examined by the modified McMaster technique revealed that 44 (43.1%) and 82 (55.8%) of the samples, respectively, contained at least one nematode egg type. Three nematode egg types were recovered with *Strongyle* egg type (22.5% in sheep and 35.4% in goats) being the most prevalent followed, respectively, by *Trichuris* (5.9% in sheep and 4.1% in goats) and *Strongyloides* (4.9% in sheep and 4.1% in goats) egg types. Mean faecal egg counts were generally moderate in both sheep (1052+/-922 *Strongyle*, 1000+/-590 *Strongyloides* and 380+/-110 *Trichuris* eggs, respectively, per gm of faeces) and goats (2092+/-3475 *Strongyle*, 958+/-854 *Strongyloides* and 683+/-512 *Trichuris* eggs, respectively, per g of faeces). The prevalence and counts of *Strongyle* nematode eggs showed a definite seasonal sequence that corresponded with the rainfall pattern in the study area during the period. In both sheep and goats, counts of *Strongyle* egg type increased with the rains and reached peak levels at about the peak of the rainy season in September. The other egg types encountered during the study did not show much variation with the season of the year.

Odoi *et al.,* (2007) investigated the burden and risk factors of gastrointestinal nematode parasite infections in sheep and goats kept in smallholder mixed farms in the Kenyan Central Highlands. 370 small ruminants were sampled from 66 smallholder mixed farms in agro-ecological zones 1 (humid) and 3 (semi-humid) in the Kenyan Central highlands. Fecal samples were collected at each visit from each animal. Fecal egg counts (FEC) were performed using the modified McMaster technique. Study investigated the burden and risk

factors of gastrointestinal nematode parasite infections in sheep and goats kept in smallholder mixed farms in the Kenyan Central Highlands.

Ijaz *et al.,* (2008) carried out a study to find out the infection rate of gastrointestinal tract (GIT) helminths and its association with diarrhoea in goats in Lahore, Pakistan. For this purpose, 300 faecal samples from goats suffering from diarrhoea presented at the Outdoor Hospital, Department of Clinical Medicine and Surgery, UVAS Lahore and various private as well as government hospitals located in Lahore were examined coprologically for the presence of helminths. The result revealed that an overall infection rate of GIT helminths was 63.33% in goats. When compared the class wise infection rate, highest infection rate of nematodes (42.67%) was observed, followed by trematodes (16.67%) and cestodes (4%).

Rajapakse *et al.,* (2008) collected and examined the gastrointestinal tracts of 218 crossbred goats representing the dry zone of Sri Lanka during a year study period.217 (more than 99%) of the animals examined were infected with one or more species of nematodes. Five species of nematodes were found in the abomasum and intestines. They were *Oesophogostomum columbiamum* (88%), *Haemonchus contortus* (81%), *Trichostrongylus columbriformis* (76%), *Trichostrongylus axei* (59%) and *Trichuris ovis* (59%).

Saiful Islam *et al.,* (2008) carried out a year-round study on 136 Bengal sheep and 224 Bengal goats with the aim to compare the species diversity and prevalence of infections with protozoa, flukes, tapeworms and nematodes parasitizing gastrointestinal tract and lungs of the small ruminants from various parts of Bangladesh. The prevalence of internal parasitic infections was higher in goats (74.55%) than in sheep (55.88%). Liver fluke (*F. gigantica*) was more prevalent in goat (14.28 %) than in sheep (8.82%) whereas tapeworm infection was more frequent in sheep (24.26%) in comparison to goat (16.52%). Goats (33.48%) showed eight times higher prevalence of *Muellerius capillaris* (lungworm) infections than sheep (4.41%) did. The most prevalent gastrointestinal nematode in both host species was *Trichostrongylus* followed by the occurrence of *Haemonchus*. A total of 10 different types of internal parasites were identified of which 9 were common for both species. The most

commonly occurring parasites in both species include *Eimeria, Trichostrongylus, Haemonchus, Moniezia* and *Fasciola*.

LITERATURE REVIEW IN CONTEXT TO NEPAL

Thakur *et al.,* (1992) reported that the prevalence of the parasitic infection was 100% in goats during the month of July in western Nepal.

Jha *et al.,* (1993) analyzed the autopsy record of 266 goats carried out at Pakhribas agriculture centre, Dhankuta and attributed 6.4% mortality in goats due to GI nematodes and 3.7% and 1.2% mortality due to fascioliasis and paramhistomiasis respectively.

Mahato (1993) reported *Fasciola* prevalences of 57.9% in buffalo, 44.8% in cattle, 22.4% in goats and 18.2% in sheep in the hills of Nepal. In the Terai area, prevalences were 51.4% in cattle, 4.3% in buffalo and 13.3% in goats.

Joshi (1994) recorded 28% mortality in goats due to gastro-intestinal nematodes in a sedentary flock at low hill village of a western Nepal in which *Haemonchus contortus* was the main worm species involved.

Thakuri (1994) found that the major clinical problem in goat was parasitic diseases which accounted for about 74% of total treated cases of 20,499. Helminth parasites recorded in the hill district were 34% trematodes, 65% nematodes and 1% cestodes.

Joshi (1995) carried out a detail study on sheep and goats in western hills of Nepal. In the study, during 12 months period, a total of 4,090 fecal samples were analyzed frump both migratory and sedentary systems. Prevalence of worn infection ranged between 60-100% in ewes, 7-97% in lambs, 15-100% in adult goats and 6-100% in goat kids.

Dhakal *et al.,* (1996) reported the prevalence of gastrointestinal nematodes in sheep and goats in Pathivara VDC of Sankhuwasawa district to be 100% and 85% respectively.

Acharya (1999) carried out a study on GI parasites of goat and sheep of IAAS livestock farm and recorded *Haemonchus, Ostertagia, Chabertia, Strongyloides, Trichostrongylus, Oesophogostomum* and *Cooperia*.

Joshi (2000) conducted a study for a period of 1 year on epidemiology and clinical significance of gastrointestinal nematodes on the health and production of goats raised under the sedentary and migratory management in the hills and mountains in Nepal. The findings showed that the worm burden in the migratory goats was considerably higher than that in the sedentary (management) goats throughout the year. *Ostertagia* was the predominant nematode genus present in migratory system followed by *Trichostrongylus* spp, with a lower proportion of *Haemonchus*. In sedentary system, however, the predominant genus was *Trichostrongylus* followed by *Haemonchus*.

Nirmal (2000) conducted a study of major diseases of goats in far western region of Nepal. In the study, 71% cases were found as parasitic diseases, among which 54.6% due to *Strongyloides* and 61% due to coccidians.

Kushwaha (2000) conducted an investigation of goat diseases under commercial rearing system from May 1999 to April 2000 in Surkhet. In the study the prevalence percentage of parasitic disease was 44% of which 88% was due to *Strongyloides* spp., 2% was due to *Ostertagia* spp., 7% was due to *Haemonchus* spp. and 1% due to *Coccidia* spp.

Devkota (2005/2006) conducted a study on outbreak of parasitic gastroenteritis in goats under sedentary management in a low hill village of western Nepal. In this study, *Heaemonchus contortus* was the most prevalent species.

Jaiswal (2006) carried a study on fascioliasis in ruminants at Dhanusa district based on examination for fecal sample brought to DLSO, Janakpur from June 15 to November 15, 2005. A total of 2655 fecal samples were examined out of which 70.70% were positive for overall parasitic infestation. Among these, prevalence of fascioliasis was found to be 43.43%, followed by paramphistomiasis 38.09% and roundworms 13.43%. The prevalence

of *Fasciola* infection found in goat was 31.25%, in cattle 49.36% and in buffalo was 56.02%.

Dhital (2006) conducted a study to determine the prevalence of gastrointestinal parasites in goats at the IAAS livestock farm and Manglapur VDC- 2, Chitwan. A total number of 7 gastrointestinal parasites were found from goats. Among them Strongyles types (*Haemonchus, Trichostrongylus, Bunostomum, Cooperia and Ostertagia*) and Nematodirus were the common parasites, whereas *Trichuris, Moniezia* and *Oesophagostomum* spp. were less common. The fecal samples examination showed that out of 20 samples collected from goats of IAAS farm, 90% were positive for eggs of one or more types of GI parasites, whereas out of 32 samples collected from Manglapur VDC-2, 76.66% were positive for eggs of these parasites.

Parajuli (2007) studied intestinal helminth parasite of goat (*Capra hircus*) and found 181 (81.53%) positive samples among 222 total samples from Khasibazar of Kalanki, Kathmandu.

III

MATERIALS AND METHODS

Study Area

Our country, Nepal being a richest country in the world in terms of biodiversity is well known in the world. It's a unique nation having every possible habitat for living beings. It is located at 80° 4' to 88° 12' east longitude and 26° 22' to 30° 27' north latitude. It is one of the land-locked countries in Asia without any accesses to sea or ocean. Measuring 885 km. and 193 km. lengthwise and widthwise respectively it covers an area of 147,181 sq. km.

Kathmandu, the capital of Nepal is situated at an approximate elevation of 4,265 ft. (1300 m). It is highly industrialized and populated city of Nepal where people from every part of the country are living.

Goat being purely herbivore animal is widely consumed by almost all religious and ethnic groups. It is regarded as a main source of animal protein in the form of meat. The total goat population and meat production is estimated to be 6.6 million and 0.4 metric tons respectively. This contributes to 19.4 percent of total meat production of the nation (MOAC, 2002).

Kalanki, the specific study area is located at ward No. 14 of Kathmandu Metropolitan city. The marketing of goat is done from here in Khasibazar, Kalanki to all other parts of Kathmandu. Goats are brought here from almost all parts of Nepal and also from some parts of our neighboring country India like Lucknow and Bahraich (Utter Pradesh) mainly on three particular days viz. Sunday, Tuesday and Thursday. The means of their transportation are mainly trucks but buses are also used. The carrying capacity of each truck is 200-250 goats.

This study was carried out for determining the seasonal prevalence of helminthes in goat. The site of sample collection was Kalanki, Khasibazar from where those were transported to Central Veterinary Laboratory for the laboratory diagnosis.

Study design

Laboratory based diagnosis.

Study period

December/January 2007/08 and May/June/July 2008.

Sample size

The total number of samples taken during winter and summer were 100 and during summer were 124. Altogether 224 samples were taken for examination. The samples were collected from Kalanki, Khasibazar, Kathmandu.

Precautions and Preservation

To ensure the better condition during the sample collection, the following mentioned precautions were taken.

- Only fresh samples were collected.
- The samples were collected in air-tight container to prevent desiccation.
- Samples from ground were avoided.
- 3-4 drops of 10% formalin was used to fix the samples.
- Sampling was done randomly.

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Laboratory apparatus and materials

a. Motor and Pestle
b. Test tube
c. Cotton
d. Cover slip
e. Slides
f. Glass rod
g. Centrifugal machine
h. Gloves
i. Centrifuge tube
j. Tea strainer
k. Microscope
l. Pasteur pipette
m. Refrigerator
n. Dropper
o. Rack

Chemicals

a. Formalin (10%)
b. Zinc sulphate solution (33%)
b. Distilled water
d. Methylene blue

Stool Examination

The examination of stool samples was done by using differential floatation technique, sedimentation and Stoll's counting method.

Flotation 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 flotation liquid.42ml of 33% zinc sulphate solution was added to the 3gm of stool sample. The sample was grinded with the help of pistil and motor and filtered with a teastainer. 15ml plastic tube was used to pour the filtered solution. Then it was centrifuged at 1000 rpm for 5 minutes. To form convex surface at the top of the tube, some more zinc sulphate solution was added. Due to this cover slip touch the solution and after few minutes, the cover slip was taken off and placed on the slide for the examinations at 10X.

Sedimentation technique

This technique is used for detecting trematodes eggs as they are but heavier than the other eggs. The eggs get deposited at the bottom of the test tube after the centrifugation with zinc sulphate solution. With the help of pipette, a drop of deposited material was taken on the slide. On it, a drop methylene blue was added and was examined under a microscope at 4X and 10X.

Stoll's counting method

According to Doctor Tom Nola, University of Pennsylvania, 2004, Stoll's counting method is the easiest quantitative method to count eggs present in the microscopic field without using Mcmaster technique. To 42ml of water, 3gm of feces was added in a beaker. 3gm of feces was pushed through a sieve into water using a tongue depressor. The remaining water was pushed out from the feces than and water feces mixture was stirred. Out of this mixed suspension, 0.15ml was taken on two slides and was spread over. Both slides with long

cover slips were examined for counting eggs. The numbers of eggs per gram of feces were counted by multi number of eggs with 100.

Key for trematodes, cestodes and nematodes

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IV
RESULT

Helminth parasitic infection is the common problem of goats and other domestic animals all over the world. This work has been done in order to identify the eggs of various types of helminth parasites. It also includes which parasite is found more in which season. Beside this, the study also includes the degree of infection. This particularly deal with the rate of infection i.e. what number of parasites are able to cause infection or to what extent the particular helminth parasite is pathogenic. All this will serve as a medium for solving the problem of helminth parasites. Thus the study has been divided into the following major parts.

1. General prevalence of helminth parasites.
2. Seasonal prevalence of trematodes, cestodes and nematodes in Nepal
3. Class wise seasonal Prevalence:
4. Identification of eggs of helminth
5. Degree of infection.

1. General prevalence of helminth parasites

During examination of samples of summer and winter 158 hosts were found to be infected out of 224 hosts. Overall outcome of the study was 70.53% prevalence. This study showed 20.25% trematode infection, 46.83%cestode infection and 91.3% nematode infection. The total numbers of genera observed during examination were 21 in number. 3 genera of trematodes, 2 genera of cestodes and 16 genera of nematodes were observed (Table 1).The general and overall prevalence percentage of each species is given in the following table.

Table 3. Observed genera of different classes with prevalence percentage

S.N	Class	Genera of Helminth	Percentage
1	Trematoda	*Dicrocoelium*	2.53
2		*Fasciola*	12.65
3		*Schistsoma*	5.06
4	Cestoda	*Moniezia*	24.05

5		*Taenia*	22.78
6	Nematoda	*Ancylostoma*	1.26
7		*Ascaris*	7.59
8		*Bunostomum*	2.53
9		*Capillaria*	6.32
10		*Chabertia*	32.91
11		*Diactophyma*	1.26
12		*Dictyocaulus*	35.44
13		*Gnathostoma*	7.59
14		*Haemonchus*	17.72
15		*Necator*	1.26
16		*Oesophagostomum*	36.70
17		*Ostertagia*	12.64
18		*Oxyuris*	5.06
19		*Strongyloides*	26.58
20		*Trichostrongylus*	5.06
21		*Trichuris*	6.32

Highest prevalence was shown by *Oesophagostomum* (36.7%) and lowest prevalence was shown by *Ancylostoma*, *Diactophyma* and *Necator* (1.26%).

Graphical presentation of observed genera of different classes of helminthes

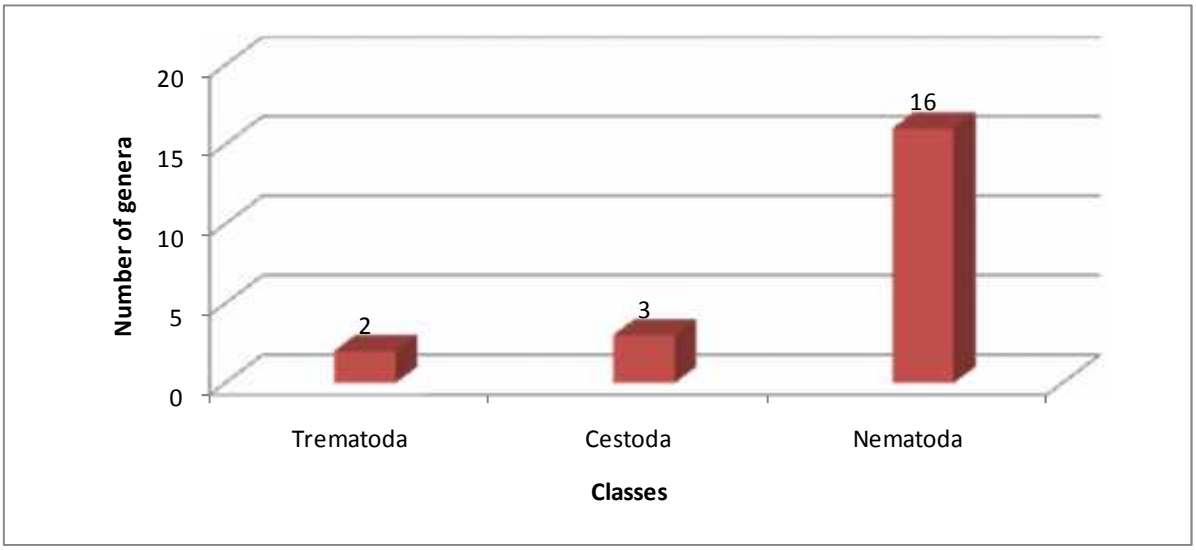

Fig: 4. Observed genera of different classes of helminthes

2. Seasonal prevalence of helminth parasites in goats

After collection of 100 samples in winter and 124 samples in summer from the study area, the examinations of the samples were carried out. The examinations of samples were done using the floatation and sedimentation technique. Out of 100 samples of winter, 46 samples were positive (46%) and that of summer samples 112 samples were found positive (90.3%). The rate of prevalence of helminth was found more during summer i.e. 90.3% than in winter i.e. 46%. The difference in the prevalence of different genus of helminth parasites during both the seasons altogether were found statistically significant (χ^2 =52.31, P<0.05, d. f. = 1).

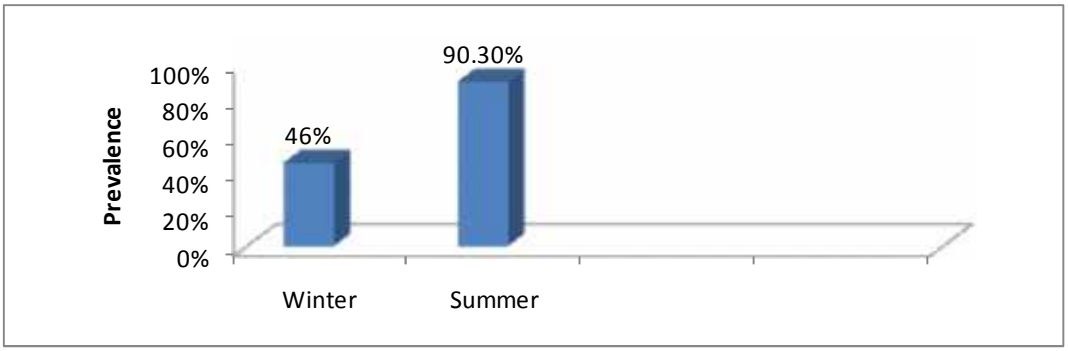

Fig: 5. General Seasonal prevalence of helminth parasites in goats

3. Class wise seasonal Prevalence:

During examination of the samples overall 21 genera were observed. But on seasonal basis 15 (71.42%) genera were recorded during winter and 19 (90.47%) genera were observed during summer.

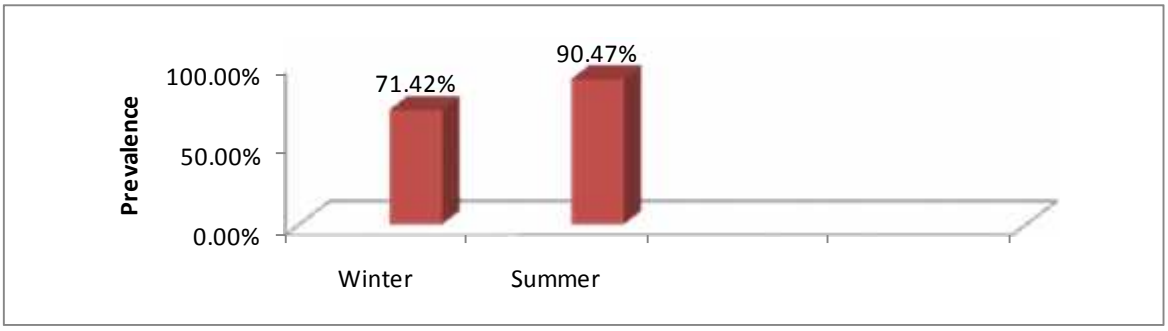

Fig: 6. Genera wise seasonal Prevalence

Seasonal prevalence of Trematode of goat:

Altogether, 32 (20.25%) samples were found positive for trematodes. Among winter samples 10 (10%) were found positive for trematodes and 22 (17.74%) samples of summer were found positive out of 112 samples. Out of 10 positive Trematode samples of winter, 4 (4%) samples were positive for *Dicrocoelium* and 6 (6%) samples were found positive for *Fasciola* sp. Similarly out of 22 positive samples of summer,14 (11.29%) samples were found positive for *Fasciola* sp. and 8 (6.45%) samples positive for *Schistsoma* sp. The difference in the prevalence of different genus of trematodes during summer and winter was found statistically insignificant (χ^2 =1.98, P<0.05, d. f. = 1).

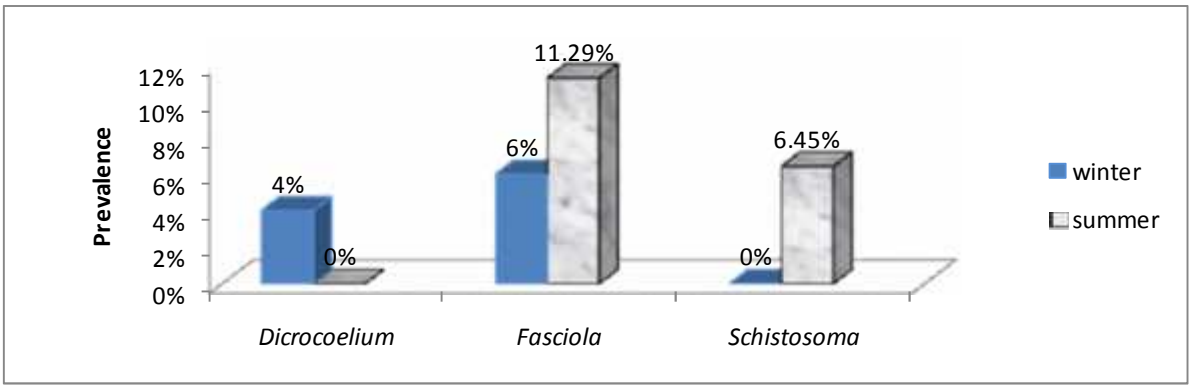

Fig: 7. Seasonal prevalence of Trematode of goat

Seasonal prevalence of cestode genera

The combined number of samples found positive during both the seasons were 74 (46.83%) out of 224 samples. The prevalence rate during winter was 28% i.e. 28 samples were positive out of 100 samples and that of summer was 37.09% i.e. 46 samples out of 112 were found positive. During winter 2 genera were observed viz. *Moniezia* in 16 samples (16%) and *Taenia* in 12 (12%) samples. Similarly in summer *Moniezia* was observed in 22 (17.74%) samples and *Taenia* was identified from 24 (19.35%) samples, out of 124 samples. The difference in the prevalence of different genus of cestodes during summer and winter result statistically insignificant (χ^2 = 0.75, P<0.05, d. f. = 1).

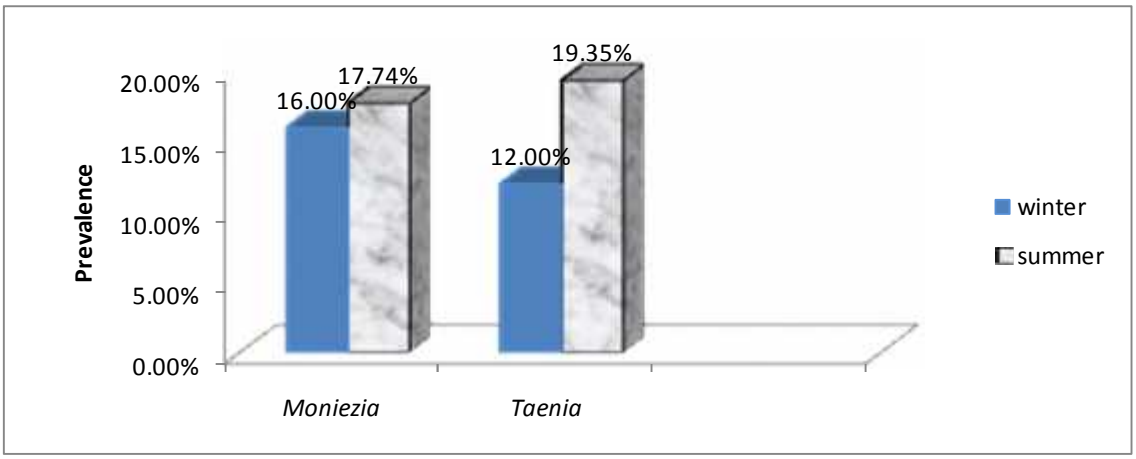

Fig: 8. Seasonal prevalence of cestode genera

Seasonal prevalence of nematodes

59 (59%) samples of winter were found positive for nematodes. 84 (67.74%) samples were found positive during summer. 11 genera were observed during the winter from 30 (30%) positive samples. Similarly 19 genera were observed during examination of 112 positive summer samples. 82 (65.08%) samples were found positive. The overall prevalence of nematodes during both seasons was 91.2%. The difference in the prevalence of different genus of nematodes during summer and winter result statistically insignificant ($\chi^2 = 0.151$, $P<0.05$, d. f. = 1).

Table 4. Prevalence of nematodes during winter

S.N	Nematode genera	During winter	Prevalence
1	*Oesophagostomum*	14	14%
2	*Chabertia*	10	10%
3	*Haemonchus*	10	10%
4	*Strongyloides*	6	6%
5	*Ascaris*	4	4%
6	*Gnathostoma*	4	4%
7	*Capillaria*	2	2%
8	*Diactophyma*	2	2%
9	*Dictyocaulus*	2	2%
10	*Trichostrongylus*	2	2%
11	*Trichuris*	2	2%

Table 5. Prevalence of nematodes during summer

S.N	Nematode genera	During summer	Prevalence
1	*Dictyocaulus*	54	43.54%
2	*Oesophagostomum*	44	35.48%
3	*Chabertia*	42	33.87%
4	*Strongyloides*	36	29.03%
5	*Ostertagia*	20	16.12%
6	*Haemonchus*	18	14.51%
7	*Ascaris*	8	6.45%
8	*Capillaria*	8	6.45%
9	*Gnathostoma*	8	6.45%
10	*Oxyuris*	8	6.45%
11	*Trichuris*	8	6.45%
12	*Trichostrongylus*	6	4.83%
13	*Bunostomum*	4	3.22%
14	*Ancylostoma*	2	1.61%
15	*Necator*	2	1.61%

4. Identification of eggs of Helminth:

During examination of winter samples 46% samples were found positive among 100 samples and 90.3% samples of summer were found positive among 124 samples. The total numbers of eggs identified were listed below in the table.

Table 6. Observed genera of different classes

S.N	Class	Genera of Helminth
1	Trematoda	*Dicrocoelium*
2		*Fasciola*
3		*Schistsoma*
4	Cestoda	*Moniezia*
5		*Taenia*
6	Nematoda	*Ancylostoma*
7		*Ascaris*
8		*Bunostomum*
9		*Capillaria*
10		*Chabertia*
11		*Diactophyma*
12		*Dictyocaulus*
13		*Gnathostoma*
14		*Haemonchus*
15		*Necator*
16		*Oesophagostomum*
17		*Ostertagia*
18		*Oxyuris*
19		*Strongyloides*
20		*Trichostrongylus*
21		*Trichuris*

Identification of eggs of helminths were done on the basis of their morphology and characters. Identification of eggs of helminthes in brief were done as follows:

Trichuris sp

Classification

Family - Trichuridae

Genus - *Trichuris*

Description of the eggs:

Eggs are 70-80 by 30-42 μm in size, brown in color, contain unsegmented embryo, barrel shaped with transparent plug at either pole

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Dictyocaulus sp

Classification

Family - Dictyocaulidae

Genus - *Dictyocaulus*

Description of the eggs:

Eggs are 82-88 by 30-33 μm in size, ellipsoidal, contain fully developed larva when laid or first stage larva may pass.

Dioctophyma sp

Classification

Family - Dioctophymidae

Genus - *Dioctophyma*

Description of the eggs:

Eggs are 71-84 by 46-52 μm in size, barrel-shaped, brownish yellow in colour and shells are pitted except at the poles.

Oxyuris sp

Classification

Family - Oxyuridae

Genus - *Oxyuris*

Description of the eggs:

Eggs are 90 by 42 μm in size, elongate, slightly flattened on one side, provided with a plug at one pole

***Trichostrongylus* sp.**

Family - Trichostrongyloidae

Genus - *Trichostrongylus* sp.

Description of Eggs:

Eggs are 79 – 92 um by 32 – 49 um in size, oval and bilaterally symmetrical, shell has a thin and transparent outer chitinous layer and a thin inner lipoid layer embryonic mass multi-segmented and varies from 16 – 32 in number.

***Strongyloides* sp.**

Family - Strongylidae

Genus - *Strongyloides* sp

Description of Eggs:

Eggs are 40 – 64 by 20 – 40 um in size, ellipsoidal, thin shelled, embryonated when laid.

***Chabertia* sp.**

Family - Trichonematidae

Genus - *Chabertia* sp.

Description of Eggs:

Eggs are 90–105 by 52–55 um in size, oval shaped, laid in morula stage.

***Ortertagia* sp.**

Family - Trichostrongylidae

Genus - *Ostertagia* sp.

Description of Eggs:

Eggs are 80 – 100 by 40 – 50 gm in size, elliptical in shape, contain fully developed larva within laid.

***Bunostomum* sp.**

Family - Necatorinae

Genus - *Bunostomum* sp.

Description of Egg:

Eggs are 79 – 106 by 47 – 50 um in size, elliptical, have blunt ends and clearly pigmented embryonic cells.

***Dictyocaulus* sp.**

Family - Dictyocaulidae

Genus - *Dictyocaulus* sp.

Description of Egg:

Eggs are 82 – 88um by 33 – 30um in size, ellipsoidal, contain fully developed larva when laid or first stage larva may pass

***Haemonchus* sp**

Family - Trichostrongylidae

Genus - *Haemonchus* sp.

Description of Egg:

Eggs are 70 – 85 um by 41 – 48 um in size, embryo 16 – 32 celled when laid.

***Ascaris* sp.**

Family - Ascaridae

Genus - *Ascaris* sp.

Description of Eggs:

Eggs are 40 – 90 um in diameter, sub-globular, laid in morulla stage.

Hookworm

Family - Ancylostomatidae

Genus - *Ancylostoma* sp.

Description of Eggs:

Eggs are 125 – 195 by 60 – 92 um in size. They are eight celled when laid.

***Trichuris* sp.**

Family - Trichuridae

Genus - *Trichuris* sp.

Description of Eggs:

Eggs are72-74 by 39-42 um in size, embryonated and oval with a plug.

Gnathostoma

Family – Gnathostomidae

Genus - *Gnathostoma*

Description of the Eggs:

Eggs are 70 – 80 by 30 42 um in size, brown in colour contain unsegmented embryo, barrel shaped with transparent plug at either pole.

***Capillaria* sp.**

Family - Capillaridae

Genus - *Capillaria* sp.

Description of Eggs:

Eggs are 30 – 63 um in size, barrel shaped, contain unsegmented embryo, colourless shell.

***Oesophagostomum* sp.**

Family - Trichonematidae

Genus - *Oesophagostomum* sp.

Description of the Eggs.
Eggs are 70 – 76 um by 36 – 40 um in size, strongyle like

***Moniezia* sp.**

Family - Anoplocephalidae

Genus - *Moniezia* sp.

Description of Eggs:

Eggs are 56 – 67 um in diameter, triangular globular or quadrangular in shape, contain a well-developed pyriform apparatus

***Taenia* sp.**

Family - Tenidae

Genus - *Taenia* sp.

Description of Eggs:

Eggs are 24 – 41 um in diameter, spherical in shape, brown to dark-yellow in colour, thick shelled and contain an onchosphere.

***Dirocoelium* sp.**

Family - Dicrocoelidae

Genus - *Dicrocoelium* sp.

Description of Eggs:

Eggs are 36 – 45 by 23 – 30 um in size, dark brown in colour, opercerlated, usually with a flattened side, contains miracidium when passed in the faeces.

***Fasciola* sp.**

Family - Fasciolidae

Genus - *Fasciola* sp

Description of Eggs:

Eggs are 130 – 197 by 63 – 104 um in size, oval shaped, yellowish in colour, consists of embryonic mass and shell, operculum usually indistinct

***Schistosoma* sp.**

Family - Schistosomitidae

Genus - *Schistosoma* sp.

Description of Eggs:

Eggs are 200 um by 70 – 90 um in size, spindle shaped, flattened at one side, greatly elongated with straight slender terminal spine.

5. Degree of infection

Table7. Degree of infection

S.N	Class	Genera	Light infection		Moderate infection		Heavy infection	
			Winter	Summer	Winter	Summer	Winter	Summer
1	Trematoda	*Dicrocoelium*	2	-	-	-	-	-
2		*Fasciola*	6	14	-	-	-	-
3		*Schistsoma*	-	8	-	-	-	-
4	Cestoda	*Moniezia*	12	-	-	-	2	-
5		*Taenia*	14	24	-	-	-	-
6	Nematoda	*Ancylostoma*	-	2	-	-	-	-
7		*Ascaris*	2	8	-	-	-	-
8		*Bunostomum*	-	4	-	-	-	-
9		*Capillaria*	-	4	-	-	-	-
10		*Chabertia*	6	32	-	2	-	8
11		*Diactophyma*	2	-	-	-	-	-
12		*Dictyocaulus*	2	40	-	2	-	8
13		*Gnathostoma*	2	8	-	-	-	-
14		*Haemonchus*	6	16	-	-	-	-
15		*Necator*	-	2	-	-	-	-
16		*Oesophagostomum*	8	32	-	8	-	4
17		*Ostertagia*	-	20	-	-	-	-
18		*Oxyuris*	-	8	-	-	-	-
19		*Strongyloides*	2	38	-	-	-	-
20		*Trichostrongylus*	2	6	-	-	-	-
21		*Trichuris*	2	8	-	-	-	-

Degree of infection (eggs per gram of feces)

Interpretation table of fecal egg counts in goat

	Light infection	Moderate infection	Heavy infection
Mixed infection with *Haemonchus*	50-800	800- 1200	1200+
Mixed infection without *Haemonchus*	300-800	800-1000	1000+
Pure *Haemonchus*	100-2000	2000-7000	7000+
Pure *Trichostrongylus*	100-500	500-2000	2000+
Pure *Oesophagostomum*	100-800	800-1600	1600+

Mixed infection with *Haemonchus* and without *Haemonchus*

Table8. Mixed infection

Month	Light infection		Moderate infection		Heavy infection	
	With *Haemonchus*	Without *Haemonchus*	With *Haemonchus*	Without *Haemonchus*	With *Haemonchus*	Without *Haemonchus*
Winter	6	12	-	-	-	-
Summer	6	38	-	2	10	20

Single infection versus mixed infection

The current study was carried out on the seasonal basis. Out of 100 samples taken, during winter 46 were found positive and out of 46 positive samples, 34 were found to have singleinfection. The highest rate of single infection was due to *Oesophagostomum* 13.04%, *Fasciola* 13.04%, *Moniezia* 13.04%, *Chabertia* 8.69% followed by 4.34% of *Haemonchus, Trichostrongylus, Capillaria, Taenia* and *Strongyloides.* Similarly during summer, single infection was noted from 12.5% (14/112) samples. Here too *Taenia* and *Fasciola* with 3.57% showed higher rate of infection. *Strongyloides* and *Chabertia* too were found equally infective with 3.57%.

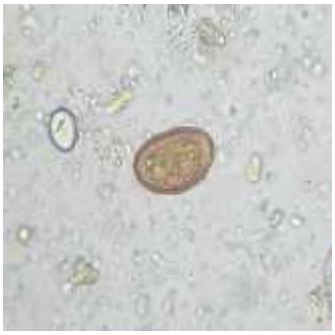
Table9.Single Infection

S.N.	**Name of genera**	**Total Single infection**		**Positive samples**	
		Winter	**Summer**	**Winter**	**Summer**
1.	*Oesophagostomum*	32	14	6	-
2.	*Capillaria*	32	14	2	-
3.	*Haemonchus*	32	14	2	-
4.	*Strongyloides*	32	14	2	4
5.	*Trichostrongylus*	32	14	2	-
6.	*Chabertia*	32	14	4	2
7.	*Fasciola*	32	14	6	4
8.	*Moniezia*	32	14	6	-
9.	*Taenia*	32	14	2	4

Along with single infection, mixed infection was equally important and was more prevalent in summer samples. Among the 46 positive samples of winter, mixed infection was observed in 12 (26%) samples. While out of 112 positive samples of summer, mixed infection was showed by 98 (87.5%) samples. In each microscopic field, 2 to 16 genera of different species were observed. Light infection during winter was observed in *Taenia* 30.43% while in summer higher intensity of light infection was shown by *Dictyocaulus* 35.71%. The highest moderate intensity of infection was observed only among the summer samples by *Oesophagostomum*17.39%. Similarly the highest moderate intensity of infection out of the winter samples was shown by *Moniezia* 4.34%. During summer heavy infection was shown by *Chabertia* and *Dictyocaulus* equally 7.12%.

Plate 1

EGGS OF TREMATODES OBSERVED

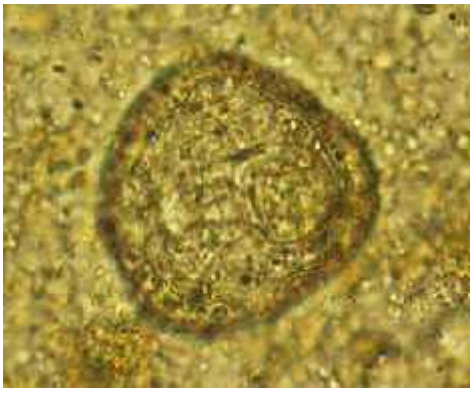


a. *Dicrocoelium* (10X×4X)

b. *Fasciola* (10X×10X)

c. *Schistosoma* (10X×10X)

EGGS OF CESTODES OBSERVED



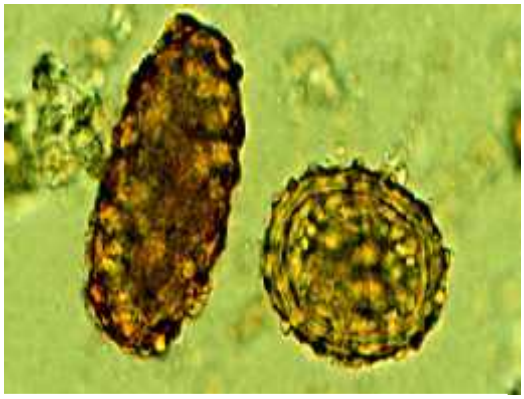
d. *Moniezia* (10X×10X)

e. *Taenia* (10X×10X)

Plate 2

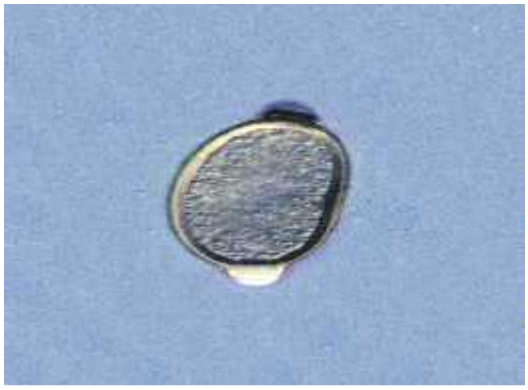
EGGS OF NEMATODES OBSERVED

f. *Ancylostoma* (10X×10X)

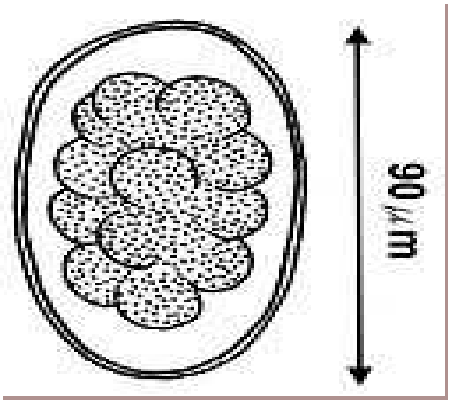


g. *Ascaris*(10X×10X)

h. *Bunostomum* (10X×10X)



i. *Capillaria* (10X×10X)

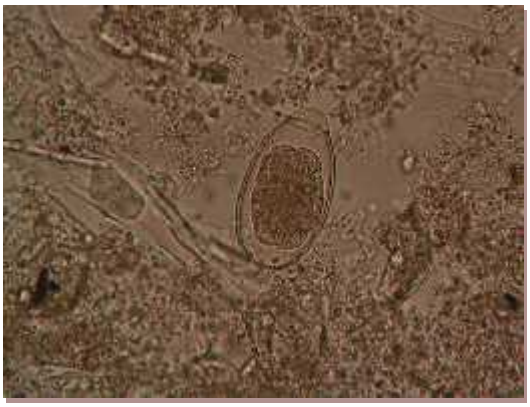


j. *Chabertia* (10X×10X)

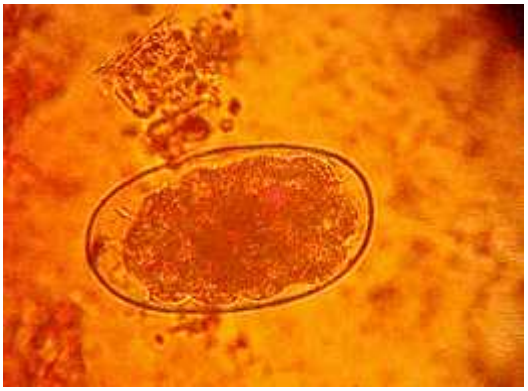
k. *Diactophyma* (10X×10X)

Plate 3

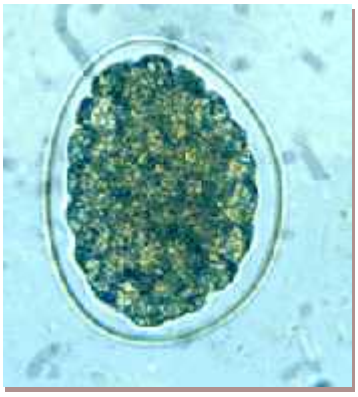
l. *Dictyocaulus* (10X×10X)



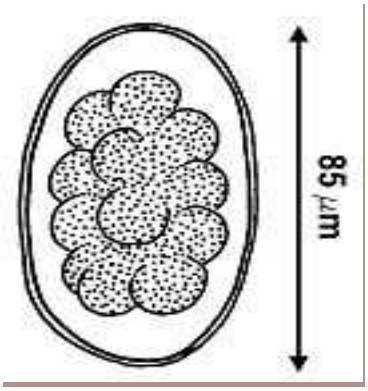
m. *Gnathostoma* (10X×10X)



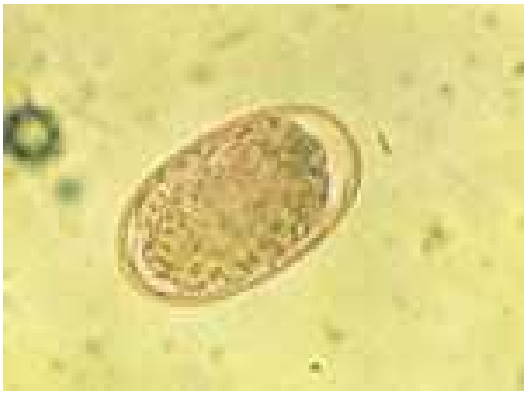
n. *Haemonchus* (10X×10X)



o. *Necator* (10Xx10X)



p. *Oesophagostomum* (10X×10X)



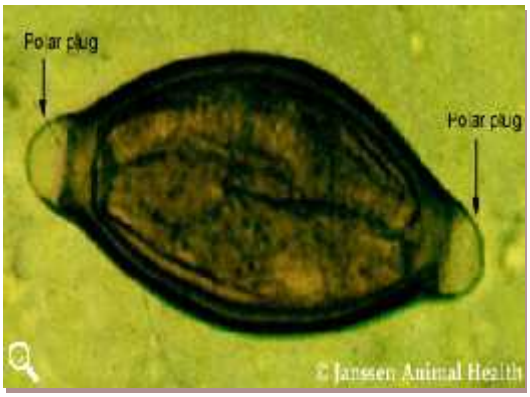
q. *Ostertagia* (10X×10X)

Plate 4

r. *Oxyuris* (10X×10X)

s. Strongyloides (10X×10X)

t. *Trichostrongylus* (10X×10X)



u. *Trichuris* (10X×10X)

Plate 5

v: Herd of goats at Khasibazaar, Kalanki

w: Collecting the fecal samples

x: Microscopic observation of fecal sample

y: Taking aid of expert

V

DISCUSSION AND CONCLUSION

The present study was carried out to determine the seasonal prevalence of intestinal helminthes parasites of goats. It is thought that that the prevalence of gastro intestinal parasites is considerably influenced by the climatic conditions and as far as possible the evidence for the distribution and prevalence of the diseases is presented by geographical area, roughly corresponding to climatic conditions. Generally the warm and humid conditions, which prevail in much of South-East Asia, provide good conditions for many gastro intestinal parasites to flourish. Continuous high rainfall throughout the year in pars of the region means that there is no season during which the parasites are not a problem. (Tiyo et al 2008). The present investigation was carried out in the month of December \ January and May\ June \ July. The site of collection of samples was Khashi-bazar, Kalanki of capital city of Nepal. From the present study, 46% samples of winter were found positive out of 100 samples and 90.3% samples were found positive out of 124 samples. The numbers of samples found positive during winter and summer for Trematoda were 10 and 22, for Cestoda, 28 and 46 and for Nematoda were 58 and 268. (The number of samples exceeds the total number of samples taken due to multiple infections).

In the present study 2 genera of Trematoda, 2 genera of Cestoda and 11 genera of Nematoda were observed during winter. Similarly from the summer samples, 2 genera of Trematoda, 2 genera of Cestoda and 15 genera of Nematoda were identified. *Fasciola* was common during winter and summer among Trematodes but *Dicrocoelium* was found only during winter and *Schistosoma* was observed during summer only. In both the seasons *Moniezia* and *Taenia* genera of Cestode were observed. However very little difference was observed intheir prevalence during both seasons. In case of Nematodes, 11 genera were observed in winter samples, namely- *Ascaris, Capillaria, Chabertia, Diactophyma, Dictyocaulus, Gnathostoma, Haemonchus, Oesophagostomum, Strongyloides, Trichostrongylus* and *Trichuris.* Where as in summer samples, 15 genera of nematodes were observed as *Ancylostoma, Ascaris, Bunostomum, Capillaria, Chaberita, Dictyocaulus, Gnathostoma, Haemonchus, Necator, Oesophagostomum, Oestertagia Strongyloides, Trichostrongylus* and

Trichuris. Dicrocoelium and *Diacotphyma* were not found in summer. Similarly *Schistosoma, Ancylostoma, Bunostomum, Ostertagia, Oxyuris* and *Necator* were not observed during winter.

Schistosoma of trematode genera is reported for the first time in goats from Nepal in the present study. Similarly, in Nematode genera *Ancylostoma*, *Necator*, and *Gnathostoma* are also reported for the first time in goats of Nepal in this study. Although, *Ancylostoma* and *Gnathostoma* were reported in goats from other parts of world, it was not reported from Nepal previously. So it was for the first time *Ancylostoma* and *Gnathostoma* were reported from Nepal. *Necator* too is encountered from the goats of Nepal for the first time. It is also known as the new world hook worm. Therefore, during the above mentioned particular study period four genera, namely- *Gnathostoma*, *Ancylostoma*, *Necator* and *Schistosoma* were reported from the goat of Nepal for the first time.

The seasonal prevalence of trematode genera found in goats was *Dicrocoelium* 4%\0.0%, *Fasciola* 6%\11.29% and *Schistosoma* 0.0%\6.45% during winter and summer respectively. Similarly, the prevalence rate of cestodes and nematodes during winter and summer were recorded as follows- *Moniezia* 16%\6.45%, *Taenia* 12%\19.35%, *Ancylostoma* 0.0%\1.61%, *Ascaris* 4%\6.45%, *Bunostomum* 0.0%\3.22%, *Capillaria* 2%\6.45%, *Chabertia* 10%\33.87%, *Diactophyma* 2%\0.0%, *Dictyocaulus* 2%\43.54%, *Gnathostoma* 4%|6.45%, *Haemonchus* 10%\14.51%, *Oesophagostomum* 14%\35.48%, *Oestertagia* 0.0%\16.12%, *Oxyuris* 0.0%6.45%, *Strongyloids* 6%\29.03%, *Trichostrongylus* 2%\4.83%, *Trichuris* 2%\6.45% and *Necator* 0.0%\1.61%. in overall *Oesophagostomum* (36.7%) was the most encountered species followed by *Dictyocaulus* (35.44%) and *Chabertia* (32.91%) and among the least prevalence species were Necator, *Ancylostoma* and *Diactophyma* (1.26%).

The present study exhibited 6.0% and 11.29% prevalence rate of fascioliasis during winter and summer respectively. The increase in their prevalence during summer may be due to increase in humidity and availability of favorable temperature. High prevalence of *Fasciola* was reported from Surkhet among goats (Ghimire, 1987), followed by 58 percent from Chitwan district (Dhakal and Kharel, 1988), 31.25 percent infection from Dhanusa district

(Jaisawal, 2006), 31.5 percent from Kenya (Waruiru, Otieno and Mutune, 2005) and 8.8% from Himanchal Pradesh, India (Jithendran and Bhat, 2001).

Similarly, the prevalence of *Dicrocoelium* was reported to be 2.5% by Jithendran and Bhat, 2001and in the present study its prevalence was reported to be 4% during winter. Ndao and his fellow researchers reported *Schistosoma* in 1991, Jithendran (1993-1997) and Jitendran *et al*., (2001). In the presence study 6.45% *Schistosoma* was encountered in summer samples only. Their prevalence during summer only might be due to favorable condition during mid-summer/summer.

Among Cestodes, *Moniezia* was reported by Ndao *et al*., (1991), Jithendran (1993-1997), Silvestre *et al*., (2000), Mondal *et al*., (2002), Jitendran *et al*., (2001), Waruiru *et al*., (2005), Opara *et al*., (2005), Dhital (2006) and Parajuli (2007). In the presence study 16% and 17.74% prevalence was recorded during winter and summer respectively. Overall prevalence rate of Cestodes in the current study was found to be 33.03% and seasonally it was 28% in winter and 37.09% in summer. Presence of suitable temperature and moisture serve best for the breeding and development of the helminthes parasites. So this could be the reason behind excessive prevalence of certain helminthes parasites.

A research by Wanjala *et al*., (2002) in the month of May/June and August/September showed 52% infection. While this study had shown overall 70.53% infection, the main genera prevalent in the study were *Fasciloa*, *Moneizia*, *Dictyocaulus*, *Oesophagostomum*, *Chaberdia* and *Strongyloides*. Whereas Yadav *et al*., (2005) reported the highest incidence of *Haemonchus*, *Trichostrongylus*, *Bunostomum*, *Oesophagostomum* and *Strongyloides*.

Opara *et al*., (2005) showed 90.1% helminth infection in Owerri, South-east Nigeria. Similar results were found in the summer samples in the present study as well. While on the other hand the infection of helminth during winter was found to be 46%. More or less similar results were reported by Acharya (1999).

The comparison of the presence study with the study carried out by Kushwaha (2000) showed vast difference. *Strongyloides* infection in the present study was recorded as 29.03% and 6% respectively during summer and winter with the average of 18.7% whereas it was

reported much greater i.e. 88% by Kushwaha. In the present study, the prevalence rate of *Ostertagia* (16.12%) and *Haemonchus* (10%/14.51%) was much higher than the former one i.e. 2% and 7% of *Ostertagia* and *Haemonchus* respectively.

During the study, out of 100 samples taken, during winter 46 were found positive and out of 46 positive samples, 34 were found to have single infection and 12 had multiple infection. Similarly during summer, single infection was noted from 12.5% (14/112) samples and mixed infection was shown by 98 (87.5%) samples. The study showed that the rate of multiple infections (69.62%) was far greater than the single infection (30.38%). The abundance of multiple infections mainly during summer might be due to availability of suitable temperature and moisture. It also might be due to exposure of goats to highly infected pasture land, contaminated water or infected fodder.

Menkir (2007) of eastern Ethiopia reported highest prevalence rate of *Haemomchus* followed by *Trichostrongylus* in goats and sheep. The worm burden was recorded highest during two rain seasons (peak in May and September). Thirteen species of nematodes and four species of flukes were reported. Present study had shown highest prevalence of *Oesophagostomum, Dictyocaulus*, *Chabertia* and *Strongyloids*. Somewhat similarity was seen incase of no. of species of nematodes i.e. 16 spp. observed in present study. Regarding worm burden, the present study showed similarity during month of May/June/ July.

A research work by Ijaz *et al*., (2008) on goats of Lahore, Pakistan showed highest infection rate of nematodes (42.67%) followed by trematodes (16.67%) and cestodes (4%). But present study showed extremely higher overall prevalence rate of nematodes (91.2%), cestodes (46.83%) and trematodes (20.25%). The highest prevalence match with *Oesophagostomum* only. The difference in the result could be due to the variation in weather conditions and humidity in atmosphere.

According to Islam *et al*., (2008) the most commonly occurring gastrointestinal parasites in goats and sheep were *Emeria, Trichostrongylus, Haemonchus, Moniezia* and *Fasciola.* Similarly present study depicted *Oesophagostomum, Dictyocaulus*, *Chabertia* and *Strongyloids* as the most prevalent helminth parasites of goats.

VI

RECOMMENDATIONS

On the basis of outcome of the present study, following measures are recommended:

- For the prevention of spread of gastro-intestinal parasites, the contamination of pastures should be prevented by treating the hosts with anthelmintics.
- The pastures can be made free of helminth parasites by breaking their life cycle by eradicating inter mediate host, snail through biological control method.
- Immigration of goats and other animals should be done after fulfilling the quarantine terms and conditions.
- The sheds should not be kept wet, moist or humid. These all prove as heaven to helminth parasites for their growth and development.
- Treatment of infected hosts with anthelmintics and diagnosis could be done by taking help of nearby veterinary personnel.
- Awareness among the livestock farmers, public butchers and goat dealers regarding the ill effect of infection and zoonotic diseases by helminth parasites should be created.
- Impure water should not be supplied.
- Further research work should be carried out.

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CONTENTS

CHAPTER III

MATERIALS AND METHODS

CHAPTER IV

- : Egg of *Ancylostoma*
- : Egg of *Ascaris*
- : Egg of *Bunostomum*
- : Egg of *Capillaria*
- : Egg of *Chabertia*
- : Egg of *Diactophyma*
- : Egg of *Dictyocaulus*
- : Egg of *Gnathostoma*
- : Egg of *Haemonchus*
- : Egg of *Necator*
- : Egg of *Oesophagostomum*
- : Egg of *Ostertagia*
- : Egg of *Oxyuris*
- : Egg of *Strongyloides*
- : Egg of *Trichostrongylus*
- : Egg of *Trichuris*

- Single and Multiple Infections

CHAPTER V

DISCUSSION AND CONCLUSION

CHAPTER VI

RECOMMENDATION

REFERENCES

ABBREVIATIONS

51

CBS - Central Bureau of Statistics

CDZ - Central Department of Zoology

CTVM - Centre for Tropical Veterinary Medicine

CVL - Central Veterinary Laboratory

DLSO - District Livestock Service Office

FAO - Food and Agricultural Organisation

GDP - Gross domestic production

GI - Gastro Intestinal

IAAS - Institute of Agriculture and Animal Science

MOAC - Ministry of Agriculture and Cooperatives

PVC - Packed Red Cell Volume

TU - Tribhuvan University

VDC - Village Development Committee

VEC - Veterinary Epidemiology Centre