PREVALENCE OF GASTROINTESTINAL PARASITES IN SMALL RUMINANTS IN GURBHAKOT MUNICIPALITY SURKHET, NEPAL

A thesis submitted in partial fulfillment for the requirement of Master's degree of science in Zoology

Submitted by:

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Submitted to:

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DECLARATION

I hereby declare that the work presented in this thesis entitled "**Prevalence of gastrointestinal parasites in small ruminants in Gurbhakot Municipality Surkhet, Nepal**" has been done by myself and has not been submitted elsewhere for the award of any degree. All the sources of information have been specially acknowledged by reference to the author (s) or institution (s).

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RECOMMENDATION

This is to recommend that the thesis entitled "**Prevalence of gastrointestinal parasites in small ruminants in Gurbhakot municipality, Surkhet, Nepal**" has been carried out by Rekha Shahi for the partial fulfillment of a Master's Degree of Science in Zoology with a 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 institution.

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LETTER OF APPROVAL

On the recommendation of supervisor **Lecturer, Mr. Janak Raj Subedi,** this thesis submitted by **Miss Rekha Shahi** entitled "Prevalence **of gastrointestinal parasites in small ruminants in Gurbhakot municipality, Surkhet, Nepal**" is approved for the examination and submitted to Tribhuvan University in partial fulfillment of the requirements for Master's Degree of Science in Zoology with special paper Parasitology.

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CERTIFICATE OF ACCEPTANCE

This thesis work submitted by **Miss Rekha Shahi** entitled **"Prevalence of gastrointestinal parasites in small ruminants in Gurbhakot municipality, Surkhet, Nepal"** has been accepted as a partial fulfillment for the requirements of Master's Degree of Science in Zoology with special paper Parasitology.

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LIST OF ABBREVIATIONS

Abbreviated form	Detail of abbreviations
Df	degree of freedom
CDZ	Central Department of Zoology
Et al.	And his associates
GI	Gastro intestinal
GIT	Gastrointestinal tract
IAAS	Institute of Agriculture and animal science
Ml	Millilitre
Mm	Milli meter
MoAD	Ministry of Agriculture Development
MoAC	Ministry of Agriculture and Cooperatives
Nacl	Sodium chloride
P value	Probability value
Rpm	Revolution per minute
Sp	Species

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ABSTRACT

Small ruminants play a significant role in the sustainability of rural communities all over the world and are essential resources for raising living conditions in many rural households in emerging nations. One of the earliest domesticated species is the goat (*Capra hircus*), a member of the bovidae family and caprinae subfamily. Goats were one of the first animals that humans domesticated. A domesticated quadrupedal ungulate ruminant mammal from the family bovine, sheep (*Ovis aries*) are raised primarily for their wool and meat. The purpose of the study was to identify the eggs, oocysts, and larvae of parasitic protozoa and helminths parasites in fecal matter, to determine sex and age wise prevalence and to study the seasonal prevalence. Total 300 samples (150 goats and 150 sheep) were collected from winter and summer season. Samples were examined in lab through direct smear, sedimentation and floatation technique. Overall prevalence was found to be 79%. 13 genera of parasites were identified including 4 class, where *Eimeria* species (42.3%) was predominant among all followed by *Strongyloides* sp. (39%), *Balantidium* sp. (17%), *Entamoeba* sp. (5.6%), *Strongyle* sp. (24.3%), *Haemonchus* sp. (14.3%), *Trichostrongylus* sp. (22.6%), *Trichuris* sp. (15.6%), *Ascaris* sp. (5.3%), *Paramphistomum* sp. (7.3%), *Fasciola* sp. (9.6%), *Dicrocoelium* sp. (2%), *Taenia* sp. (5%). Sheep (81.3%) showed higher prevalence of parasitic infection than goats (76%). In goats, age wise prevalence was (65%) in young and (77.69%) in adult. While in sheep, age wise prevalence was high in adult (84.96%) and low in young (52.94%). Sex wise prevalence in goats was (80%) in female and (65%) in male. In sheep, sex wise prevalence was (83.89%) in female and (71.87%) in male. Seasonal prevalence in goats was higher in summer (85%) than winter (65.71%). Similarly, in sheep high prevalence was seen in summer (88.75%) and low in winter (72.85%). Statisticaly, there was no significant difference ($p>0.05$) between distributions of parasites among age and sex. While, there was significant difference ($p<0.05$) between distribution of parasites and season in both sheep and goats Pasteur management, selective deworming, and maintaining hygiene to minimize overstocking, in severe conditions farmers need to consult the veterinarian. These can help to develop a tailored parasite control program for small ruminants.

1. INTRODUCTION

1.1 Background

Small ruminants are vital resources for improving living standards in many rural households in the developing world, and their cultivation plays an important part in the sustainability of rural communities worldwide (Nardone *et al*., 2004). Small ruminants are an important source of cash generation and livelihood for resources in poor farming communities in Nepal (Joshi *et al*., 2001). Nepal is an agricultural country where 65.5% of the population is contributing 35% of the GDP. Crops, folder trees, and cattle compose Nepal's agriculture system with animals providing meat, milk, and dung (Neupane *et al.*, 2018).In Nepal, buffalo account for around 64% of all meat consumed, with goat meat accounting for 20%, pork accounting for 7%, chicken accounting for 6%, and sheep accounting for 3% (Joshi *et al.*, 2001).

The goat (*Capra hircus*), a Bovidae family and Caprinae subfamily member is one of the oldest domesticated species. Humans tamed goats as one of the first animals (Boyazoglu *et al.*, 2005). They have a worldwide distribution with higher concentrations in tropical areas and dry zone (Di Cerbo *et al*., 2010). The population of goats in 2011/12 was 807,267 that is increased to 9, 512, and 958 in 2020/21 similarly; the population of sheep was 793,267 in 2011/12 that is also increased by 13,442,614 indicating the goat and sheep farming in our country an integral part of people within the country (MoAD, 2018). Goat skin is used to create a variety of goods, including gloves, boots, and other items that call for a soft hide. One of the nicest wools in the world, cashmere is produced by cashmere goats and is particularly soft and silky because it grows under the guard hairs (Rizal, 2010). *Eimeria, Giardia, Entamoeba, Haemonchus, Nematodirus*, *Paramphistomum, Chabertia, Taenia, Moniezia, Oxyuris, Toxocara, Trichuris*, *Trichostrongylus, Fasciola* and other parasites have been reported in goats. Nearly all tropical and subtropical nations are affected by these types of parasites, which are the main cause of declining domestic animal health and output (Ntonifor *et al*., 2013).

Sheep (*Ovis aries*) is a domesticated quadrupedal ungulate ruminant mammal that belongs to the family Bovine, specially reared for wool and meat. antelopes, gazelles, goats and sheep, and other relatives fall into this family (Grzimek, 1990). According to MoAC (2020/21). The primary sheep farming area is found in Europe and Asia at Latitudes 35-55 degrees in North and South America, New Zealand, and Australia at latitudes 30-45

degree south (Morris, 2017). According to MoAd (2020/21), Karnali province has the highest number of sheep production 307,102 in number and wool production is also higher. Sheep can produce quality carcasses on roughage alone, making them suited to different places where grain production is not profitable (Vohra *et al*., 2020). Sheep dung is valuable fertilizer and because sheep are grazed on marginal lands, their droppings are the only way to improve plant growth (Gompo *et al*., 2021). The sheep are occasionally employed in medical research, particularly in cardiovascular physiology studies like heart failure (Recchia & Lionetti, 2007). hypertension Haemonchosis, Ostertagiasis, Strongyloidiasis, Oesophagostomiasis, Bunostomiasis, and Trichostrongylosis are the most common gastrointestinal parasites illness in sheep (V. Singh *et al*., 2013a).

The demand for sheep and goat meat is increasing daily and our country's production can't meet the demand recently. Every year a large number of goats and sheep are imported from neighboring countries that made a huge impact on our country's trade balance. In this situation, small ruminant has a distinct comparative advantage over other enterprises in Nepal's high hills and mountains because they can exploit vast natural resources that are inaccessible to other livestock species (L. N. Pandey & Gyawali, 2012). Goats and sheep are key components of farming because of less investment, short production cycles, growing faster, and being capable of adapting to the environment more easily than any other cattle (Lebbie, 2004).

1.2 Gastrointestinal parasites

Gastrointestinal parasite infection has been always a major problem for animal health because it causes major economic losses, particularly in the tropics and sub-tropical countries (Bah & Keita, 2022). Gastrointestinal parasites not only affect health but also reproductive health which leads to loss of wool, decreased weight, digestive disturbance, poor reproductive performance, and also increased susceptibility to other infections (Khajuria *et al*., 2012). These parasites cause both acute infections with a rapid onset and high mortality levels and chronic infections, that are commonly subclinical and lead to insidious and very important economic losses (Singla, 1995) through the reduction of weight gain, reduced in wool and milk production as well as poor reproductive performance (Scott & Sutherland, 2009). The gastrointestinal nematodes are considered major constraints affecting the production performance of sheep and goats throughout the world including India (B. Kumar *et al*., 2016). Some sheep GI parasites are of public

health concern, they have been implicated in Zoonotic transmission to humans either directly or indirectly by ingestion of contaminated food or water (Ralph *et al*., 2006). These types of infections are typically spread by ingestion of infective eggs/oocysts or larvae or through skin penetration (M. M. Ibrahim *et al*., 2008). The most common gastrointestinal parasites in goats are helminth and coccidian (Waruiru *et al*., 1993).

Helminth has a major role in declining goat and sheep production around the world. Goats and sheep have shared many gastrointestinal helminth parasites but in comparison, sheep develop strong immunity than goats to gastrointestinal parasites (Vlassoff *et al*., 2002). Because of this reason, goats have greater parasites prevalence with high egg output (Macaldowie *et al*., 2003). Helminthiasis, particularly parasite gastro-enteritis, poses a severe health risk and limits small ruminant productivity due to morbidity, mortality, treatment costs, and control efforts (Nwosu *et al*., 2007). Environmental variables such as humidity, temperature, and precipitation have a substantial impact on the development and survival of pre-parasitic stages (R. R. Kumar *et al*., 2011). In most of the world, pastured and free-ranging goats are susceptible to helminthiasis, a clinically significant disease caused by internal parasites (helminths) (Nabi *et al*., 2014). Goats can suffer harmful effects from nematodes, flukes, and lungworm that results in severe output losses although tapeworm doesn't cause noticeable sickness (Howell *et al*., 2008). Gastrointestinal nematode infections have the highest infection rate in sheep and goats which affects the survival and productivity of sheep. In Nepal, Nematode parasites like *Nematodirus* species, *Trichostrongyloid* species, and *Haemonchus* species are most common; Kushwaha, 2000; Dhital, 2006). Another widely spread nematode is the *Oxyuris* species causes Oxyuriasis in a variety of small ruminants (Karki *et al*., 2012; Bashir, 2009). Nematodes have a long cylindrical body and tapered ends and have a thick covering of waxy cuticles for protection. The buccal cavity, cuticle layer, and digestive system have continuous connections (Jacobs *et al*., 1999). Trematodes are flatworms that have an underdeveloped digestive system and both male and female reproductive organs in the same individual (Saari *et al.*, 2019). Trematode eggs are normally expelled from the host in the feces; however, in some trematodes, like some trematodes such as *Schistosoma hematobium* passed in urine or sputum (*P westermani*) (Bungiro & Cappello, 2004). Cestodes are found in gut of ruminants that are acquired by consuming contaminated food or water. The genus *Moniezia*, that has a global distribution and genus *Taenia* found in rumen of domestic as well as wild carnivore animals are included in this category (Karki,

2005). Domestic animals like sheep, goats, buffalo, and cows are raised in Gurbhakot for milk, meat, and dung and are considered major sources of income for farmers in that area. Farmers lack information about goat and sheep parasitic disease causes, mode of transmission, and their carelessness toward GI parasites of goats, as well as conventional husbandry practices, make them incur large economic losses every year.

1.3 Objectives

1.3.1 General objective

- Prevalence of gastrointestinal parasites in small ruminants in Gurbhakot municipality Surkhet, Nepal.

1.3.2 Specific objectives

- To identify the eggs, oocyst, and larvae of protozoan and helminth parasites in fecal material.
- To determine sex and age-wise prevalence.
- To study the seasonal prevalence of gastrointestinal parasites.

1.4 Significance of the study

Nepal is an underdeveloped country. Animal husbandry is still a major source of income for people in remote areas. Farmers are more attracted to sheep and goat farming as compared to others because of less investment and more profit. But the advanced farming technique is quite degrading because of parasitic infections such as a helminth, and protozoan parasites. In such cases, this study plays a vital role to understand the parasitic infection in Gurbhakot, Surkhet. This work will be useful in developing strategic deworming programs for goats and sheep by designing effective control measures against gastrointestinal parasites. The current study can aid in the knowledge advancement of upcoming researchers and investors.

2. LITERATURE REVIEW

Many scientists from all over the world have paid their interest towards the advancement of goat farming as well as sheep farming and its management due to its high food and market value. GIT nematode infestation in livestock results in high mortality rate performance of goats and sheep reproductive and production systems have been greatly affected by GIT nematodes (Asmare *et al*., 2016).

Pedreira *et al*. (2006) reported a 100% prevalence of parasitic infection in sheep. Identified genera were *Chabertia, Teladorsagia, Oesophagostomum, Trichuris, Trichostrongylus, Haemonchus, Nematodirus, Cooperia, Trichuris,* and *Trichostrongylus sp.* Parasitic prevalence was reported to be 65.7% in the study made by Asif *et al*. (2008) from Rawalpindi Pakistan. Sheep (72%) showed a higher prevalence than goats (63.7%). In contrast, Gadahi *et al*. (2009) reported a 63.50% prevalence rate from examined samples of goats and sheep from Rawalpindi and Islamabad. While in this study goats have a higher prevalence (66.45%) Based on the fecal examination done by Varadharajan & Vijayalakshmi (2009), 61.50 % of samples were found positive for gastrointestinal parasites. Along with this, the highest prevalence was in the rainy season (68.36%) and the lowest in summer (55.30%). Sheep (66.33%) showed high prevalence than goats (57.67%). *Haemonchus* sp was found predominant in both goats and sheep.

While the study made by Ruhoollah *et al*. (2021) in the district of Dir Upper Khyber Pakhtunkhwa province of Pakistan found 281 (89.20%) samples were found positive for gastrointestinal parasites including 94% in sheep and 82.43% in goats. In sheep, *Strongyloides* was found predominant followed by *Haemonchus contortus, Trichuris ovis,* and *Fasciola hepatica*. Similarly, in goats, *Strongyloides* sp showed the highest prevalence followed by *Haemonchus, Trichuris,* and *Fasciola*. Sheep showed more parasitic prevalence than goats. Raza *et al*. (2013) reported a 51% prevalence of helminth parasites and 21% of nematode parasites in sheep from a study conducted from Jatoi district of Muzaffargarh Pakistan. Mulugeta *et al*. (2010) reported prevalence rate 91.30% in sheep 95% in goats from Ethiopia. 8 genera of nematodes were identified with *Haemonchus* sp (67.5%) predominant and 2 genera of cestode were identified with *Avetellina* sp (39.5%) predominant. While in Southern Ethiopia. Emiru *et al* (2013) reported 84.3% prevalence rate in sheep and a 78.7% prevalence rate in goats. Similarly, Sissay *et al*. (2007) reported

13 species belonging to 9 genera were reported in eastern Ethiopia. Study made by Aragaw & Gebreegziabher (2014) also reported high prevalence in sheep 93.1% as compared to goats 91.5% from Hawassa, Ethiopia. Dagnachew *et al*. (2011) reported 47.67% of prevalence of gastrointestinal parasites in Northwest Ethiopia.

Kumar *et al*. (2011) analysed fecal samples from goats and sheep from 4 state of India showed 55.06% prevalence in goat and 58.65% prevalence rate in sheep. *Haemonchus Contortus* was most common gastrointestinal nematode in goat and sheep. Lone *et al*. (2012) reported highest prevalence of nematode *Haemonchus* (82%) along with 12 identified genera. *Moniezia* (48%) was highest in prevalence among cestodes and among trematode *Fasciola* (60%) was most prevalent. While study made by Pathak & Pal (2008) revealed 85.22% prevalence of goats from Durg district of Chhattisgarh. *Paramphistomum* sp was predominant among all. Other 9 genera of species were identified. Monsoon season showed highest prevalence and lowest in winter. Study carried on Sikkim by Rahman *et al.* (2012) revealed only 20% of samples were found positive for either single or multiple infections. Age-wise prevalence was higher (>2 years), 1-2 years age group and below (<year). Summer season has highest prevalence rate and lowest in spring season. *Strongyle* infection was highest followed by *Strongyloides* sp, *Moniezia* sp, *Nematodirus* sp, *Amphistomes* sp, *Dicrocoelium* sp and *Trichuris* sp.

Khajuria *et al*. (2013) revealed that 67.24% of goats and sheep positive for helminth infection in Jammu. Age-wise prevalence was higher in young than adult. Parasitic infection was seemed to be higher in monsoon than winter. *Strongyles Trichurids* and *Strongyloides* were nematodes species identified and *Amphistomes, Fasciola*, and *Dicrocoelium* were trematode species identified. There was no the difference between infection rate of sheep (68.54%) and goats (65.54%). Admasu & Nurlign (2014) revealed 56.25% prevalence among sheep and goats. Sheep were more infected than goats. Different types of helminth parasites with the prevalence of nematodes, *Paramphistomum* sp, *Moniezia* sp, and mixed infection (Nematodes and *Moniezia* sp) in both sheep and goats were recorded.

The study conducted by N. Ibrahim *et al*. (2014) revealed higher infection in sheep (89%) than goats (87.1%) from Jimma town. Prevalence of *Haemonchus* sp, *Ostertagia* sp, *Strongylid* sp, *Chabertia* sp, and *Bonustomum* species was higher in goats and in sheep *Trichostrongyloid* sp, *Oesophagastamum* sp, *Trichuris* sp, and *Moniezia* sp were higher. 9

different genera of species were identified. Agbajelola *et al*. (2015) reported 66% of parasitic infection through floatation technique analysed in sheep, goats and cattle's of northern Nigeria. Jan *et al* (2015) reported 60% parasitic infection in sheep from Peshawar Pakistan. Velusamy *et al*. (2015) revealed 67% sheep and 35% goats infected with gastrointestinal parasite the highest prevalence was found in coccidian followed by *Strongyles, Moniezia, Trichuris* and least prevalence with *Amphistome* in both sheep and goats. Nana (2016) reported 60.57% of nematode prevalence in sheep from Gurage zone in southern Ethiopia with most common *Strongyle, Strongyloides, Trichuris* and *Ascaris* species. Islam *et al*. (2017) reported 74.8% prevalence from Mymensingh Bangladesh in goats and sheep. This study showed higher prevalence in goats than sheep. Females were more infected than males. Various parasites were *Fasciola, Paramphistomum, Oesophagostomum, Strongyloides, Haemonchus, Trichostrongylus, Trichuris, Eimeria*, and *Balantidium.* Rahman *et al*. (2017) revealed prevalence higher in nematodes, trematodes, protozoa, and trematodes from study conducted in Tangali Bangladesh in various fecal samples of goats and sheep. Seasonal prevalence was higher in the rainy than winter.

Singh *et al*. (2017) reported 83.08% samples positive for parasitic infections in Punjab from fecal samples of sheep and goats. Female showed high parasitic prevalence than males. Adults (> 6 months) were more infected with parasites than young (<6 months).Seasonal prevalence was higher in monsoon followed by winter and then summer. Based on the fecal samples examined by Dappawar *et al*. (2018) reported 52.32 % prevalence in sheep and 51.89% prevalence in goats of Marathawada India. Monsoon season showed higher prevalence and lowest in summer. Identified parasites were *Strongyloides* sp, *Strongyles* sp, *Trichuris* sp, *Moniezia expansa*, *Eimeri*a sp, *Moniezia benedetti*, etc. In sheep they found age risk factor where kids were more infested with endoparasites than adults while in goats young were more infested with end parasites than adult. Chakrabortty *et al*. (2023) reported 65.4% prevalence of gastrointestinal parasites of goats from Natore Bangladesh. 6 genera of different species were identified with *Strongyloides* species highest prevalence and *Trichuris* species least prevalent.

Bhowmik (2020) reported 66.36% samples positive for gastrointestinal parasites in goats and sheep from Chattogram, Bangladesh. Species-wise prevalence was higher in sheep than goats. *Fasciola* sp, *Paramphistomum* sp, *Moniezia* sp, *Strongyles* sp, *Strongyloides* sp, *Trichuris* sp, and *Eimeria* sp were identified parasites. *Strongyles* were found high in

sheep and *Fasciola* was high in goats. Win *et al*. (2020) reported highest prevalence of parasites in small ruminants from Myanmar. Sheep showed highest prevalence rate than goats. *Eimeria* species showed highest prevalence followed by *Trichostrongyle* species, *Trichuris* species and *Moniezia expansa*. Paul *et al*. (2020) reported 79.6% of parasitic infection in small ruminants from Malaysia. Gofwan *et al*. (2021) reported 78.8% prevalence of parasites where goats showed highest prevalence rate than sheep. Age risk factor was higher in adult animals than young animals. Sheep was infected more in wet season and in dry season goats were infected more in number. AbdulAziz & Ahmed (2023) reported 7 genera of species in sheep from Jigawa state, Nigeria. *Ascaris lumbricoides* was most dominant and *Fasciola* species was least dominant. Male showed higher prevalence rate than females.

Daniel *et al*. (2014) reported 86.2% of prevalence in sheep from Boke districts, Ethiopia. Bah and Keita (2022) reported 86% parasitic infection rate in goats and sheep of Jarra district, Gambia. Goats showed high parasitic infection than sheep. 10 types of genera of species were identified in both goats and sheep. García *et al.* (2022) reported that *Strongyloides* sp was most predominant in all seasons and showed the highest prevalence in summer (out of 85% of fecal samples analyzed) and absence in winter. *Nematodirus* was observed in all 3 seasons but the absence of *Nematodirus* was in 35% of fecal samples in the spring and summer seasons. Hassan and Jibrin (2022) reported 84.16% prevalence of gastrointestinal parasites from sheep and goats from Nigeria. Male goats show higher infection rate than females. In both goats and sheep ale showed higher prevalence than females. Age wise prevalence was higher in adults as compared to sheep in both goats and sheep than in young. Kalwaghe *et al*. (2022) examined goats from different regions of Maharastra and found 74.66% prevalence. Age-wise prevalence was higher in adults than below 1-year age group.

Similarly, study made by Sutar *et al*. (2010) revealed 62.75% prevalence. Season wise prevalence was higher in winter than summer. A study conducted by (Martins *et al*., 2022, p. Martin) reported *Strongyle* nematode with the highest infection rate followed by *Eimeria* sp, *Moniezia expansa*, and *Strongyloides papillosus* in sheep from Brazil. While Radavelli *et al*. (2014) reported 88.9% of samples of goats positive with parasitic infection. Salehi *et al* (2022), reported 53.33% parasitic infection in fecal samples of sheep from Iran. Highest prevalence was shown in *Trichostrongyloidae* (46.61%) followed by *Fasciola* (9.96%), *Chabertia* (5.98%), *Ostertagia* (5.58%), *Trichuris* (5.58%),

Toxocaridae (4.78%), *Haemonchus* (4.78%), *Oesophagostomum* (4.78%), *Cooperia* (3.19%), *Dicrocoelium* (3.19%) and *Strongyloides* (2.39%). Sebro *et al*. (2022) found 74.41% samples positive for gastrointestinal parasites in goats and sheep from An-Lemo Hadiya zone in southern Ethiopia. Sheep were found infected with more parasitic infection rather than goats. Sex wise prevalence was higher in females than males. Raza *et al*. (2013) reported 51% prevalence of helminth parasites from cattle of Punjab Pakistan.

Mohamed *et al*. (2023) reported 50.24% parasitic prevalence in goats and sheep of Minya Egypt. Sex-wise prevalence was higher in females than males. Young showed more parasitic prevalence than adults. Seasonal prevalence was higher in summer than winter. While Mohamdy (2023) examined fecal samples of sheep from Kalubia Egypt reported highest seasonal prevalence in autumn and lowest prevalence in summer. Sheep more than 6 month to 1 year showed relatively high infection rate than sheep > 2 years.

Small ruminants research has been extensively studied worldwide scale but there are less study done in Nepal. While research on gastrointestinal parasites of goats have conducted in some parts of Nepal but very few research have been done regarding gastrointestinal parasites of sheep in our country. Dhital (2006) reported 90% prevalence from IAAS Livestock farm from Chitwan and found *Ostertagia, Bunostomum, Cooperia, Trichostrongylus, Haemonchu*s, and *Nematodirus* were the most common species identified.

While Tripathi (2015) reported (67.92%) prevalence of gastrointestinal parasites of goats in Kapilvastu. Season-wise prevalence showed high prevalence in summer rather than winter including parasites like *Toxocara* predominant followed by *Trichostrongylus, Chabertia, Oesophagostomum, Capillaria, Strongyloides, Trichuris, Haemonchus, Bunostomum, Cooperia, Ostertagia, Strongyle, Nematodirus* and other. A study conducted Rana (2018) showed an 80% prevalence along with 15 genera of parasites belonging to 5 classes from Dang in sheep. *Haemonchus* was the predominant species with the highest prevalence. Followed by *Strongyloides* sp, *Strongyle* sp, *Trichostrongylus* sp, *Oesophagostomum* sp, *Fasciola* sp, *Bunostomum* sp, *Trichuris* sp, *Paramphistomum* sp, *Moniezia* sp, *Nematodirus* sp, *Chabertia* sp, *Eimeria* sp, *Entamoeb*a sp and *Ascaris* sp. The rainy season has a higher prevalence than the summer season. Sukupayo & Rayamajhee (2018) examined 150 fecal samples of goats from Roshi municipality revealed 17.35% of samples positive with at least one or more parasites. Highest

prevalence was found in *Fasciola* sp and the least prevalence was found in *Haemonchus* sp. Age-wise prevalence was highest in more than 6-month goats. Sex-wise prevalence was higher in females than males.

Das *et al* (2019) reported 67.92% of GI parasites in goats from fecal samples examined from Kapilvastu. Nematodes showed higher prevalence followed by cestode. Ghimire & Bhattarai (2019) found 87.25% prevalence of GI parasites in goats from Kathmandu. *Eimeria* was found predominant followed by *Strongyle, Trichuris, Paramphistomum, Giardia*, *Blastocystis*, *Capillaria, Strongyloides*, *Moniezia*, *Fasciola*, *Cyclospora*, *Ascaris, Entamoeba*, *Balantidium, Cryptosporidium* and *Trichomonas.* Sah *et al* (2020) made a study on 100 fecal samples of ovine fasciolosis in Jumla Nepal and found 34% ovine fascioliasis in fecal test 6.7% in slaughtered sheep and 23.5% in post martum examinations. Purja (2015) reported 100% prevalence among goats of Pokhara along with 13 genera of gastrointestinal parasites. While study made by Khanal (2019) reported 66% prevalence of gastrointestinal parasites in goats from Arghakhanchi, Nepal. 7 genera of parasites were found including *Eimeria* species highest in prevalence and *Fasciola* with lowest prevalence rate. Shrestha & Karmacharya (2016) conducted survey in Lumle Nepal reported Nematodiasis most prevalent. Adhikari *et al* (2017) reported 13.89% of prevalence of *Haemonchus contortus* from goats of Chitwan. Male showed higher prevalence than females. *Haemonchus contortus* was highest in age group below in year and lowest above 2 years.

3. MATERIALS AND METHODS

3.1 Study area

The study was conducted in Botechaur which lies in Gurbhakot Municipality Surkhet. Surkhet is a part of Karnali province, and one of the ten districts of Karnali lying at 28°36'0"N, 81°36'0"E. The district area is 2,488.63sq.km (960.87 sq. mi). It had 288527 population in 2001 and 350,804 in 2011. Birendranagar is the district headquarters of Surkhet and the capital of Karnali state of the new federal republic. Gurbhakot municipality is an urban municipality located in the Surkhet district of Karnali province of Nepal. According to the 2011 Nepal census, the total population of the municipality is 43,765 and the total area of the municipality is 228.62 square kilometers (88.27 sq. mi). The municipality is divided into total of 14 wards. Malarani, Dharapani, and Sahare VDC were incorporated with Subhaghat Gangamala municipality in 2017 when the government canceled all old administration systems and introduce new 753 local-level administrative bodies (www.mofaga.gov.np)

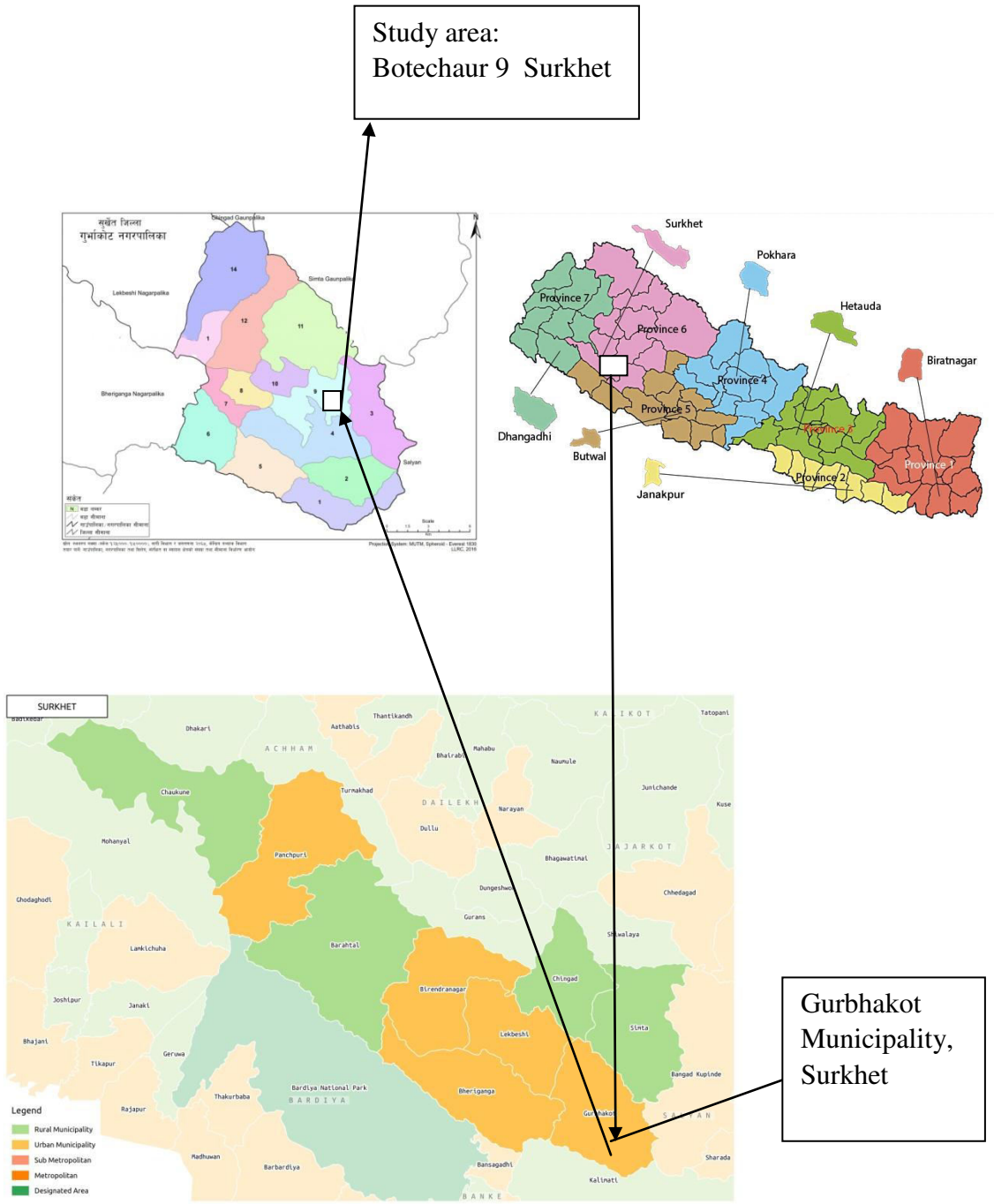

Fig 1: Map of Gurbhakot municipality (Sources: https://www.nepalarchives.com/map-of-gurbhakot-municipality-surkhet-nepal/)

Fig 2: Map of Nepal with Province (Sources: https://kpadhne.com/nepal-map-with-provinces/)

Fig 3: Map of Surkhet (Sources: https://ehrpinspection.nra.gov.np/maps?district=59)

3.2 Methods:

The method used to examine samples was sedimentation technique and floatation techniques and direct smear methods.

3.2.1 Flotation technique

This technique is used widely for the detection of nematode and cestode eggs. As eggs of cestode and nematodes seem to be very small in size and light soo the technique makes sure eggs float in floatation liquid. 3gm of fecal sample were taken in a beaker and added 15ml of saturated sodium chloride solution then sample was grinded lightly with the help of spatula and filtered the solution by tea strainer. The filtrate solution was poured into a centrifuge tube of 15ml and tube was filtered with more sodium chloride solution and centrifuged at 2000 rpm for 5 minutes. After centrifugation more saturated sodium chloride was added to develop convex surface at the top of the tube and 1-2 drop of methyl blue (to stain) was added and a cover slip was placed for 5 minutes and then cover slip was removed and place on a slide and examined at various magnifications (10×10=100X) and (10×4=40X). The photographs of eggs, cysts and larvae of parasites were taken and identified based on color, shape and size (Soulsby, 2012).

3.2.2 Sedimentation technique:

This technique is used for detecting trematodes eggs. It provides better results as the eggs of trematodes are a bit heavier than any other eggs. Sediments of centrifuged content are taken for eggs detection. Saturated salt solution was removed gently from the test tube after examining the floatation portion and poured the sediment content into watch glass and stirred the content gently to mix it. 1-2 drop drops from mixture was taken to prepare another slide. The specimen was stained with iodine wet mounts solution. In this was two sides were prepared from one samples (one from floatation and one from sedimentation) were examined under (4×10=40X) and (10×10=100X) with objectives of microscopes to detect eggs of protozoan, helminths or cysts of gastrointestinal parasites (Soulsby, 2012).

3.2.3 Direct smear method

The fecal sample was brought to the Central Department of Zoology, Tribhuvan University, and Kritipur Kathmandu. Then the samples were crushed with help of mortar. A small drop of iodine was dropped in the slide. Then the sample was kept over iodine and

a smear was prepared. The prepared smear was observed under an electric microscope under different magnifications (10×10=100X) and (10×4=40X) (Soulsby, 2012).

3.3 Study Design:

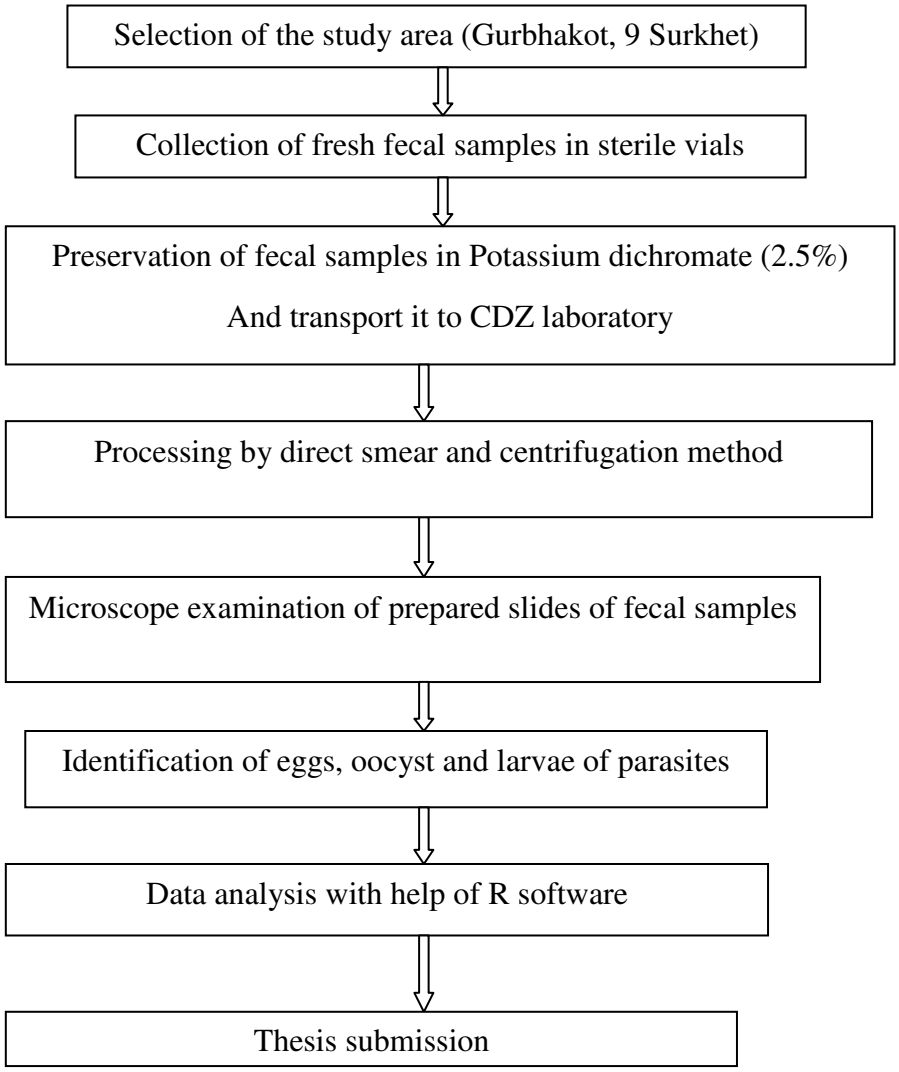

Fig 3: Flowchart showing study design

3.4 Sample size:

Samples were taken in the summer season and winter seasons 150 from goat (sex, age) variation and 150 from sheep (sex, age) variation respectively. Altogether 300 samples were taken for examination. The samples were collected from Gurbhakot municipality Surkhet.

3.5 Collection and preservation of samples:

Fecal samples were collected in the morning time. Fecal samples were collected immediately after voiding to avoid contamination. About 3 gm of feces was collected from each sheep and goat by hand picking method with the help of disposable gloves and it was transferred into sterile vials applying appropriate precautions. The same process was repeated for all fecal samples. Necessary information was noted down in copy like sample number, collection date, sex, etc. then the sample was preserved in 2.5% potassium dichromate helps to maintain the morphology of parasites (Soulsby, 2012).

3.6 Identification, measurement, and data analysis:

Identification was done on the basis of shape and size of published literature journals and books (Soulsby, 2012), articles published by Ghimire & Bhattarai (2019), Income *et al*., (2021), Rana (2018). The differentiation of all species of nematodes eggs was done by only based on morphological characteristics of eggs. Eggs and cysts were measured by using ocular and stage micrometer. For our study, prevalence was measured as a percentage of host individuals infected with particular parasites. For this study prevalence was measured in percentage of host individual with particular parasites. Data was recorded and entered in Microsoft excel. Diagrammatic representation was shown through bar graph and pie chart. Statistical analysis was done in R studio.

3.7 Photographs during field and lab work





4 RESULTS

4.1 General prevalence of parasites

Out of the total of 300 fecal samples analyzed from both summer and winter seasons through sedimentation, floatation, and direct smear technique, 236 samples were found positive for at least one or more parasites.

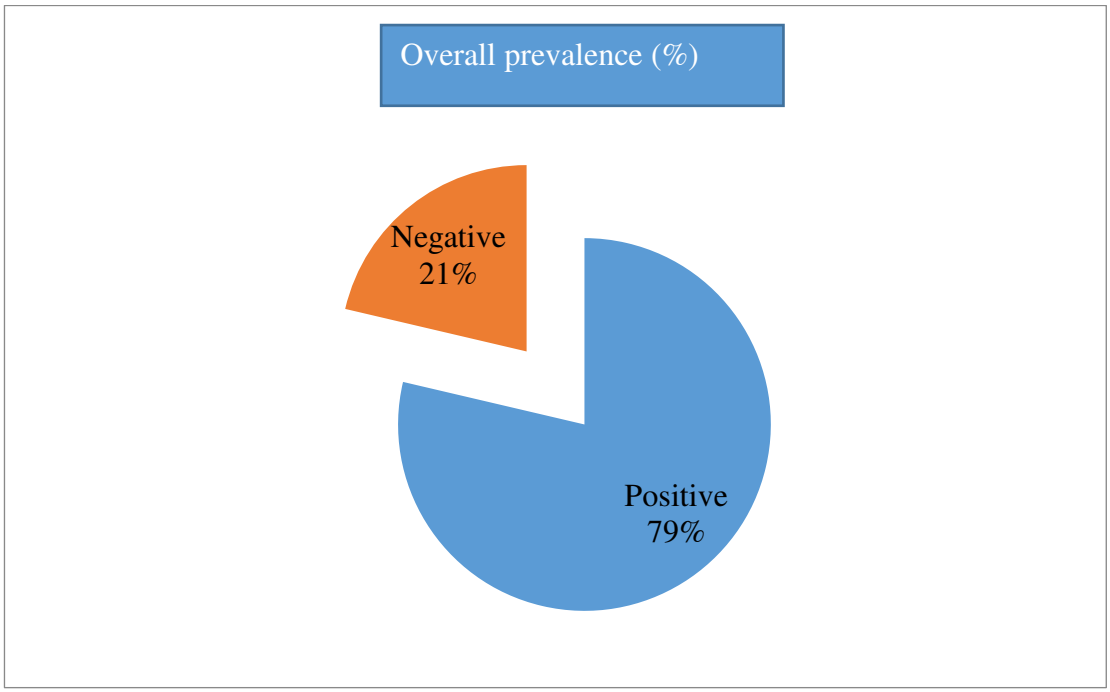

Fig 4: Overall prevalence in sheep and goats

4.2 Class wise prevalence

Out of 300 samples examined from both winter and summer seasons, 13 genera of parasites were identified and genera identified were *Eimeria* sp. (42.3%), *Balantidium* sp. (17%), *Entamoeba* sp. (5.6%), *Strongyle* sp. (24.3%), *Haemonchus* sp. (14.3%), *Trichostrongylus* sp. (22.6%), *Strongyloides* sp. (39%), *Trichuris* sp. (15.6%), *Ascaris* sp. (5.3%), *Paramphistomum* sp. (7.3%), *Fasciola* sp. (9.6%), *Dicrocoelium* sp. (2%), *Taenia* sp. (5%) and unidentified sp. were (5.6%)

.

Table 1: Overall prevalence of gastrointestinal parasites

S.N.	Class	Genera	No of infected animals	Prevalence rate (%)
1	Protozoa	*Eimeria* sp.	127	42.3%
2		*Balantidium* sp.	51	17%
3		*Entamoeba* sp.	17	5.6%
4	Nematoda	*Strongyle* sp.	73	24.3%
5		*Haemonchus* sp.	43	14.3%
6		*Trichostrongylus* sp.	68	22.6%
7		*Strongyloides* sp.	117	39%
8		*Trichuris* sp.	47	15.6%
9		*Ascaris* sp.	16	5.3%
10	Trematoda	*Paramphistomum* sp.	22	7.3%
11		*Fasciola* sp.	29	9.6%
12		*Dicrocoelium* sp.	6	2%
13	Cestode	*Taenia* sp.	15	5%
14		Unidentified sp.	17	5.6%

4.3 Prevalence of parasites in goats

150 samples from goats were collected from both seasons. Out of which 114 samples were found positive with prevalence rate 76%.

4.4 Class-wise prevalence in goats

Total 150 samples of goats were examined, 3 genera of parasites including Class protozoa, nematoda and trematoda were identified. Identified parasites in goats were *Eimeria* sp. 38%, *Entamoeba* sp. 11.3%, *Balantidium* sp. 5.3%, and *Strongyloides* sp. 43%, *Strongyle* sp. 29.3%, *Trichostrongylus* sp. 19.3%, *Haemonchus* species 8%, *Ascaris* sp. 3.3%, *Trichuris* sp. 10.6%, *Paramphistomum* sp. 6% and *Fasciola* sp. 8.6%.

Table 2: Class-wise prevalence in goats

S.N.	Class	Genera	No of infected animals	Prevalence (%)
1	Protozoa	*Eimeria* sp.	57	38%
2		*Entamoeba* sp.	17	11.3%
3		*Balantidium* sp.	8	5.3%
4	Nematoda	*Strongyloides* sp.	65	43%
5		*Strongyle* sp.	44	29.3%
6		*Trichostrongylus* sp.	29	19.3%
7		*Haemonchus* sp.	12	8%
8		*Ascaris* sp.	5	3.3%
9		*Trichuris* sp.	16	10.6%
10	Trematoda	*Paramphistomum* sp.	9	6%
11		*Fasciola* sp.	13	8.6%

4.5 Prevalence of parasites in sheep

A total of 150 fecal samples of sheep were examined from both season. 122 samples were found positive with at least one or more parasites with prevalence rate 81.33%.

4.6 Class-wise prevalence in sheep

Total 150 samples of goats were examined 4 genera of parasites including Class protozoa, nematoda, trematoda and cestoda were identified. Identified parasites in sheep were *Eimeria* sp. 46.6%, *Balantidium* sp. 28.6%, *Strongyloides* sp. 34.6%, *Strongyle* sp. 19.3%, *Trichostrongylus* sp. 26%, *Haemonchus* sp. 20.6%, *Ascaris* sp. 7.3%, *Trichuris* sp. 20.6%, *Paramphistomum* sp. 8.6%, *Dicrocoelium* sp., *Fasciola* sp. 10.6% and *Taenia* sp. 10%.

Table 3: Class-wise prevalence in sheep

S.N.	Class	Genera	No of infected animals	Prevalence (%)
1	Protozoa	*Eimeria* sp.	70	46.66%%
2		*Balantidium* sp.	43	28.66%
3				
4	Nematoda	*Strongyloides* sp.	52	34.66%
5		*Strongyle* sp.	29	19.33%
6		*Trichostrongylus* sp.	39	26%
7		*Haemonchus* sp.	31	20.66%
8		*Ascaris* sp.	11	7.33%
9		*Trichuris* sp.	31	20.66%
10	Trematoda	*Paramphistomum* sp.	13	8.66%%
11		*Fasciola* sp.	16	10.66%
12		*Dicrocoelium* sp.	6	4%
13	Cestoda	*Taenia* sp.	15	10%

4.7 Age-wise prevalence in goats

Out of 150 samples examined from both seasons, 20 young goats (<6month) and 130 adult goats were examined. Prevalence of gastrointestinal parasites in young goats was 65% and in adult goats 77.69%.

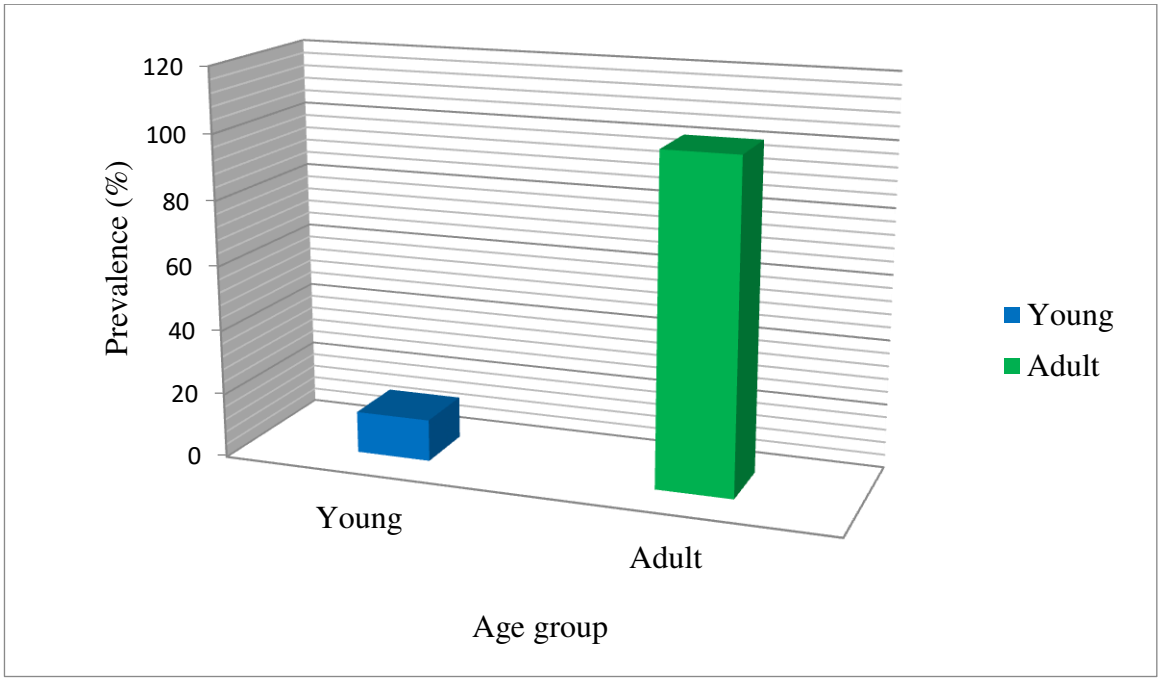

Fig 5: Age-wise prevalence in goats

4.8 Age-wise prevalence in sheep

Out of 150 samples examined from both seasons, 17 young (<6month) and 133 adult sheep were examined. Prevalence of gastrointestinal parasites in young sheep was 52.94% and in adult sheep was 84.96%.

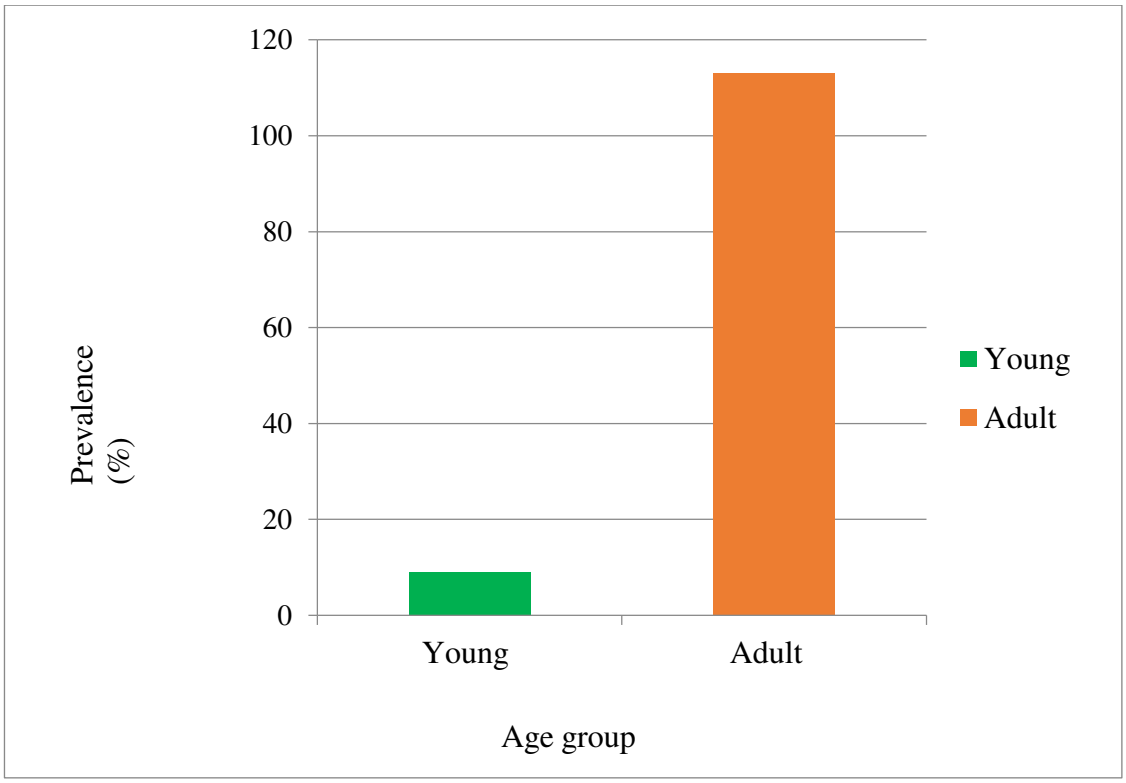

Fig 6: Age-wise prevalence in sheep

4.9 Sex-wise prevalence in goats

Out of 150 samples examined from goats, 110 females and 40 males were examined. Females (80%) were found infected more with gastrointestinal parasites than males (65%). There is no significant difference between distribution of parasites between males and female ($\chi 2$= 3.61, df =2, p-value= 0.1638)**.**

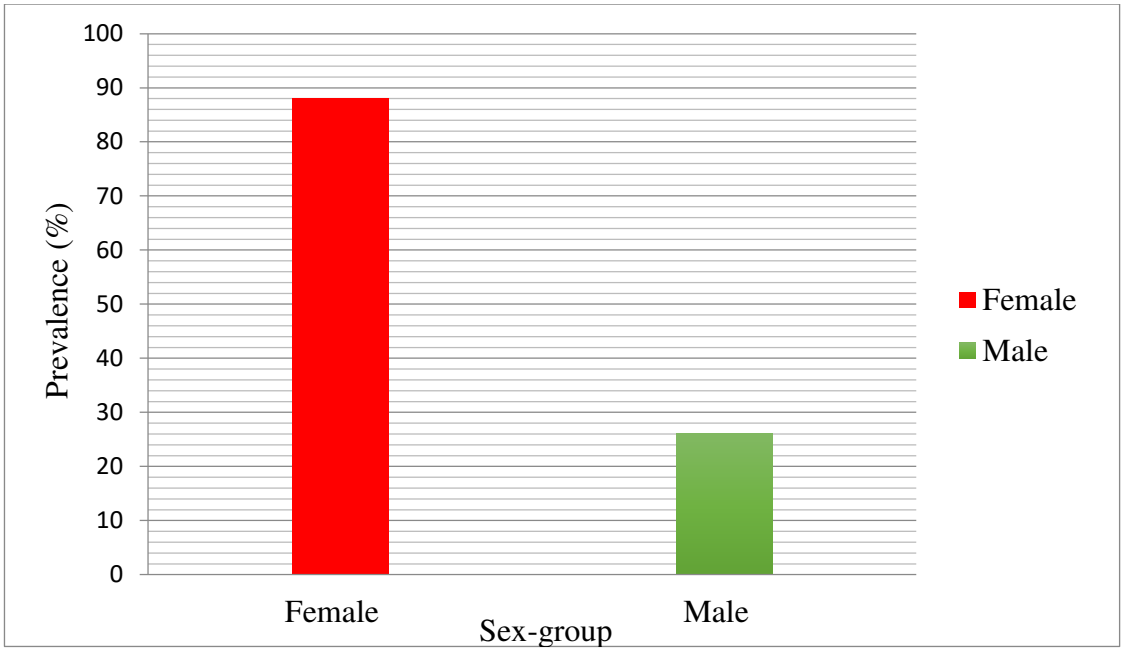

Fig 10: Sex-wise prevalence in goats

4.10 Sex-wise prevalence in sheep

Out of 150 samples (118 female and 32 male) examined from sheep, prevalence of gastrointestinal parasites in female was 83.89% and males was 71.87%. Statistically, there was no significant difference between distribution of parasites in males and females ($\chi 2$= 2.39, df =2, p-value= 0.3017).

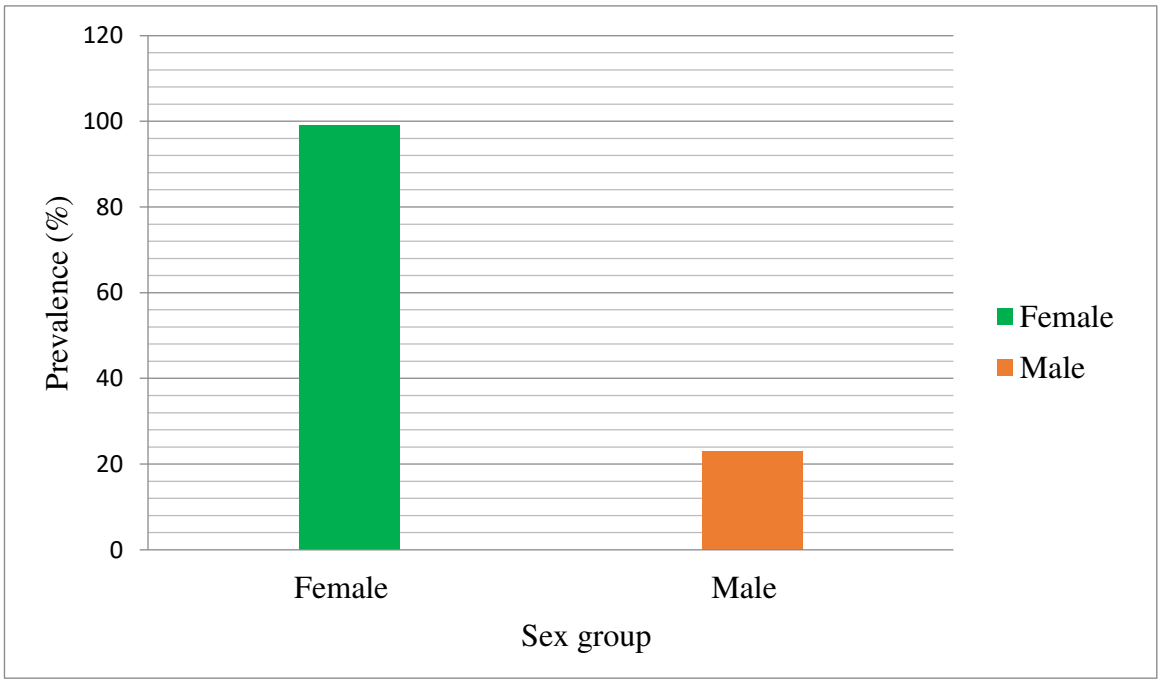

Fig 11: Sex wise prevalence in sheep

4.11 Seasonal prevalence of parasites of goats in winter and summer

Out of 70 samples from winter and 80 samples from summer, the prevalence of gastrointestinal parasites in winter season was 65.71% and in summer season was 85%. Statistically, the distribution of parasites between summer and winter was significant ($\chi 2$= 7.61, df =2, p-value= 0.02223)

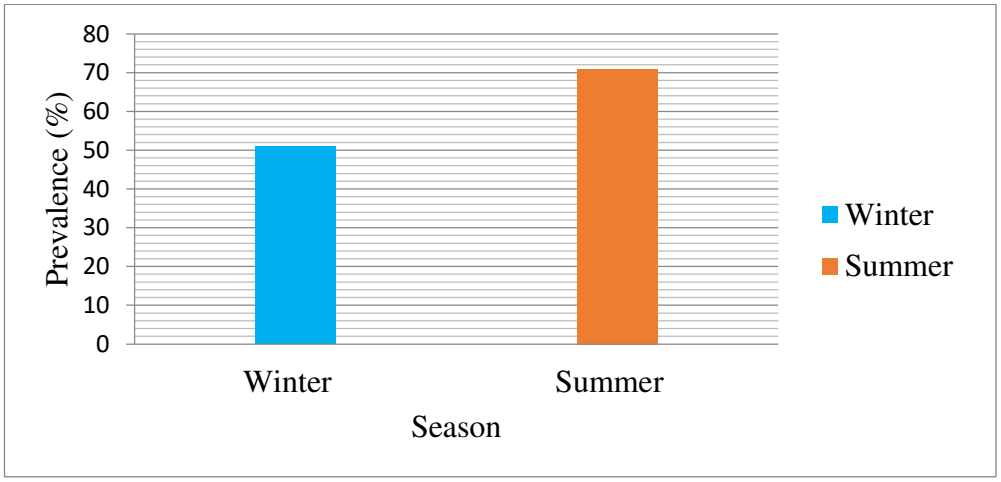

Fig 12: Seasonal prevalence of parasites in goats

4.12 Seasonal prevalence of parasites of sheep in summer and winter

Out of 70 samples from winter and 80 samples from summer, the prevalence of gastrointestinal parasites in winter was 72.85% and summer was 88.75%. Statistically, distribution of parasites in summer and winter was not significant ($\chi 2$= 6.2111, df=2, p-value= 0.0448).

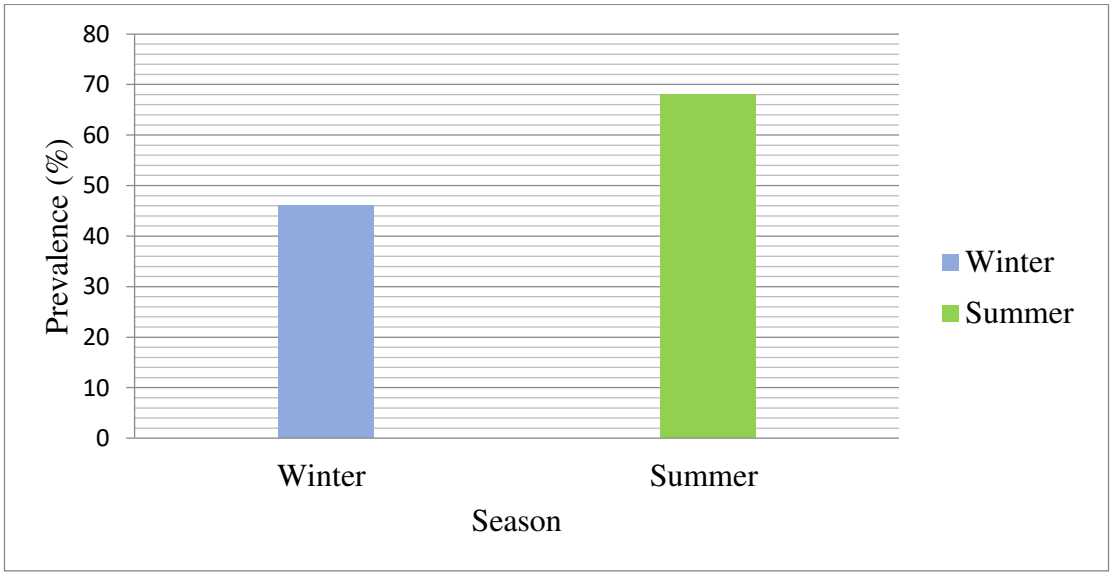

Fig 13: Seasonal prevalence between winter and summer in sheep

Identified photos of parasites of goats at various magnifications (4×10=40X) and (10×10=100X)

Photo 1: *Entamoeba* sp. (36×24µm)

Photo 2: *Dicrocoelium* sp. (36×23µm)

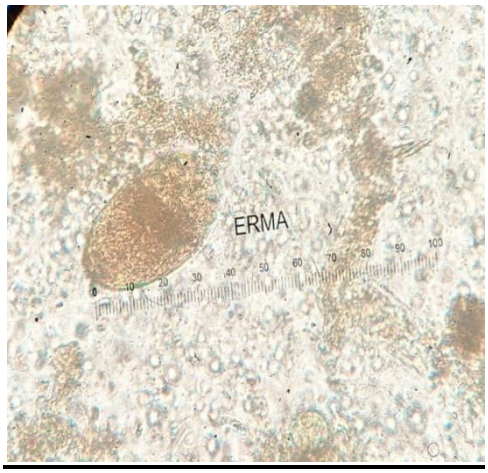

Photo 3: *Paramphistomum* sp. (141×82µm)

Photo 4: *Trichuris* sp. (55×23µm)

Photo 5: *Trichostrongylus* sp. (100×41µm)

Photo 6: *Strongyle* sp. (98.6×49µm)

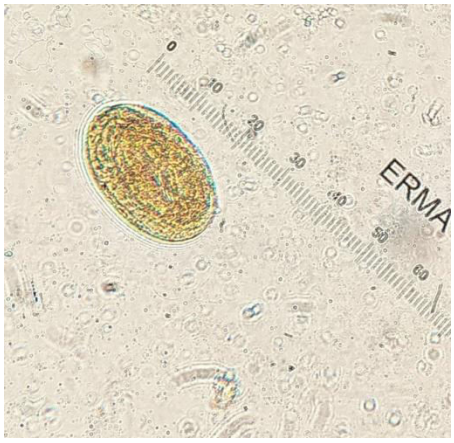

Photo 7: *Strongyloides* sp. (72×31.2µm) Photo 8: *Eimeria* sp. (30.5×16µm)

Identified parasite photos of sheep at (4×10=40X) and (10×10=100X)

Photo 1: *Strongyloides* sp. (76.8×38.4µm) Photo 2: *Fasciola* sp. (134×62µm)

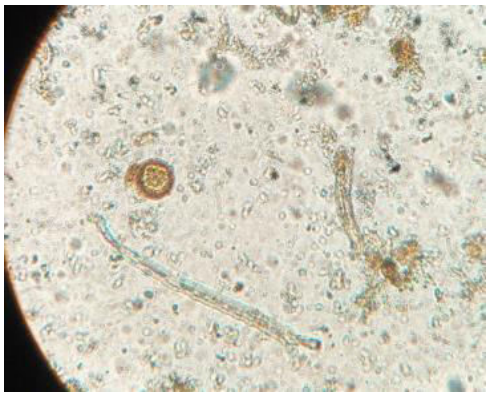

Photo 3: *Balantidium* sp. (67µm) Photo 4: *Taenia* sp. (24×24µm)

Photo 5: *Ascaris* sp. (62.4×52.8µm)

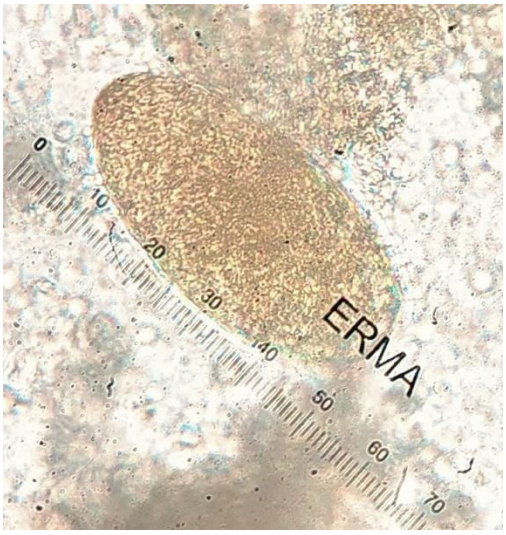

Photo 6: *Paramphistomum* sp. (146×74µm)

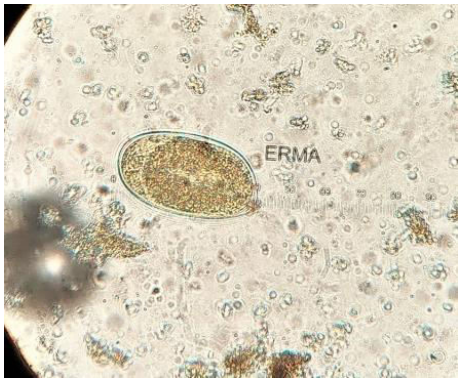

Photo 7*: Strongyle* sp. (128×62.5µm)

Photo 8: *Trichuris* sp.

5 DISCUSSION

The present study revealed 79% of the prevalence of gastrointestinal parasites among sheep and goats of Gurbhakot municipality 9 Surkhet. The prevalence of parasitic infections in ruminants varies across the world. It is thought that the prevalence of gastrointestinal parasites is considerably influenced because the grazing behavior of small ruminants as grazing behavior may increase the risk of infection among them. Other reasons may be Overcrowding, lack of rotational grazing, and climatic and seasonal factors may also influence the survival and development of parasites outside the host. As warm and moist which prevail in much of Botechaur 9 Surkhet may favor a good environment for larvae of parasites which can lead high infection rate in small ruminants (López-Rodríguez et al., 2023).

Our study agrees with other researchers like Gofwan *et al*. (2021), and Paul *et al*. (2020) who reported 79.6% and 78.8% in sheep and goats from Nigeria and Malaysia. The prevalence of gastrointestinal parasites is connected to agroclimatic factors such as pasture quantity, temperature, humidity, and host grazing behavior (Mehmood *et al*., 2017). Studies made by Mohamed *et al*. (2023), Varadharajan & Vijayalakshmi (2009), Admasu & Nurlign, (2014), Rahman *et al.* (2017), Dagnachew *et al.* (2011) who reported 50.24%, 63.50%, 56.25% and 20%, 47.67% prevalence of gastrointestinal parasites in both goats and sheep from Pakistan, Northwest Ethiopia, and Sikkim, Gondar zone Ethiopia which was comparatively lower than our study.

The prevalence rate can be low because of the possibility that adverse environmental conditions for the establishment and growth of most helminths and protozoan species that are blamed for the decrease in the infection of gastrointestinal helminths (Dalton, 2021). While higher prevalence was revealed by researchers like Singh *et al*. (2013), Ruhoollah *et al*. (2021), Yadav *et al*. (2006), Sivajothi & Reddy (2018) who reported 83.08%, 89.20%, 83.07%, 91.27% of prevalence from sheep and goats of Punjab India, Pakistan, Jammu, Andra Pradesh India. The high prevalence may be due to the age differences of investigated animals, as well as environmental and regional factors of the studied area (Mulugeta *et al* ., 2010).

Our study revealed 13 genera of parasites identified including 4 classes where Eimeria species (42.33%) was predominant among all followed by Strongyloides sp. (39%),

Balantidium sp. (17%), *Entamoeba* sp. (5.66%), *Strongyle* sp. (24.33%), *Haemonchus* sp. (14.33%), *Trichostrongylus* sp. (22.6%), *Trichuris* sp. (15.6%), *Ascaris* sp. (5.33%), *Paramphistomum* sp. (7.33%), *Fasciola* sp. (9.66%), *Dicrocoelium* sp. (2%), *Taenia* sp. (5%).

Gadahi *et al*. (2009), Islam *et al*. (2017), revealed 8 and 9 genera of parasites which were lower than our study. Rana (2018) reported 14 genera of parasites which is similar to our study. Our study revealed *Eimeria* sp. (42.33%), *Strongyloides* sp. (39%), and *Strongyle* sp. (24.33%) most dominant among all samples. Ghimire & Bhattarai (2019), and Emiru *et al*. (2013), reported *Eimeria* sp. With the highest prevalence rate 80.75%, 54.1%, from Kathmandu, Southern Ethiopia, that was similar to our findings. The prevalence of *Strongyle* sp. was similar to a study made by Rana (2018), and Nwosu *et al*. (2007) with a prevalence rate of 25.45%, and 22.5% from, Dang Nepal, Nigeria.

The prevalence of gastrointestinal parasites in the present study revealed 76%. The most prevalent enteric disease affecting goats was coccidiosis and it was discovered to be caused by the gastrointestinal tract species *Eimeria* (Kaur *et al*., 2019; Agyei *et al.*, 2004) which was the most dominant species among goats. Higher prevalence than our study was made by researchers like Dhital (2006), Ghimire & Bhattarai (2019), Pathak & Pal, (2008b), and Opera *et al*. (2005) who reported 90%, 87.25%, 85.22%, 90.1% from Chitwan, Kathmandu, Chattisgadh and Nigeria. The reason for the higher prevalence of parasites may be because of different deworming practices and management techniques, hosts, sex, age, seasons and climatic conditions could have a big impact on the findings;Daniel *et al*., 2014). Lower prevalence was made by researchers like Tariq *et al*. (2010), Sukupayo & Rayamajhee, (2018) who reported 54.3%, and 17.35% in goats of India, Roshi municipality Nepal.

The prevalence of gastrointestinal parasites in sheep in our study was 81.33% which agrees with previous reports done by Rana (2018) who reported 84.3%, 80%, prevalence from sheep from Gechi districts, Dang Nepal. Sheep seem to be more suspected of gastrointestinal parasites because they graze closer to the ground consuming shorter and more nutritious vegetation. This type of behavior increases their exposure to parasite larvae to get contact (Pandey *et al*., 1994). While higher prevalence was made by researchers like Pedreira *et al*. (2006), Almalaik *et al.* (2008), Mulugeta *et al*. (2010), and Ibrahim *et al*. (2008) who reported 100%, 99.9%, 91.32%, and 89.3% prevalence in sheep

from Spain, Tulus, Sudan, Bedelle. The age difference between investigated animals and the geographic and environmental location of the study area can be the reason for the high prevalence (Mulugeta *et al*., 2010). The high prevalence seen in many places may be attributed to starvation, poor stock management or lack of cleanliness, and instant exposure to contaminated grazing pasture (Getachew *et al*., 2016).

In goats, age-wise prevalence seems to be higher in adults (77.69%) and comparatively lower in young (<6 months) ones (65%). Parasitic infections can be seen more in adults than young in our findings this may be because of grazing on greater pasture contaminated with flocks and various stress factors like daily travel, gestation, and climate (Radostits *et al.*, 2006). Young animals are less infected because they rely mostly on milk for nutrition; they are less susceptible to parasite infestations (Yadav *et al* ., 2006). In sheep, young sheep showed (52.94%) a prevalence of parasitic infections while in adult sheep parasitic infection rate was (84.96%).

Our study agrees with the findings of Nwosu *et al.* (2007), and Singh *et al.* (2013) who analyzed results regarding adult sheep getting more infected with parasites as compared to young ones. But Dappawar *et al.* (2018) reported younger animals have more parasitic prevalence than adults from a study done in Marathawada which is different from our study. This may be because there may be less development of immunity or maybe more susceptibility in lambs against infections.

Female goats (80%) were infested with more parasites than male goats (65%). There was no significant difference (p>0.05%) between the distribution of parasites along with the sex group. Usually, sex-wise prevalence seems to be higher in females because females are brought on by stress and an immune-compromised immune system during pregnancy, parturient paresis and lactation, level of hormones prolctin and progesterone also made females more susceptible to infections (Dabasa *et al*., 2017). In sheep, 83.89% of females were infected with parasites while in males 71.87% were infected with parasitic infections. There was no significant difference between the distribution of parasites along with sex (p>0.05). our study agrees with a study done by Islam *et al*. (2017) who also reported females have more infections than males because of some factors like Pregnancy, stress, Lactation, etc (Dabasa *et al*., 2017).

Our study doesn't agree with the study made by Dappawar et al. (2018), Mulatu *et al.* (2012), and Lashari & Tasawar (2011) as they reported that males were more susceptible

to parasitic infections than females. This might be because male sheep and female sheep were allowed to graze together in the same pasture ground, giving them an equal chance to become infected another reason may be females were more resistance to infection than males after puberty, although there is no differences before puberty (Kanyari Kanyari *et al*., 2017).

Seasonal prevalence in goats was higher in the summer season (85%) while in the winter season was (65.71%). There were significant differences between the distribution of parasites and seasons ($p<0.05$). High prevalence in the Summer season than in winter may be due to favorable environmental conditions for the growth and development of gastrointestinal parasites and their stages (Islam *et al* 2017). Our study agrees with the findings of Pathak & Pal, (2008a) who reported high prevalence of parasites in the summer season (87.50%) than in the winter season (63.15%) which supported our results. The reason for low prevalence in the winter season may be animals' reduced grazing hours, which serves to reduce the likelihood of contact between hosts and parasites (Katoch *et al*., 2000).

But Sutar *et al*. (2010) reported a high prevalence in the winter season (60.83%) and a low in the summer season (51.53%) from Maharastra. This may be because parasitic organisms have temperature-dependent developmental stages either within hosts or environment, temperature changes may have a direct impact on how ubiquitous the organisms in the area Zajac & Garza (2020). In sheep seasonal prevalence was high in the summer season with a prevalence rate of 88.75% and low in the winter season 72.85%. There were significant differences between the distribution of parasites and seasons ($p<0.05$). The climatic condition promotes bacterial growth that gives free-living larvae food. The increase in the infection rate across the season in summer season may be caused by periparturient egg numbers increasing (Radostits et al., 2006). Our results have similar findings to researchers like Shah *et al*. (2018) who also reported the highest prevalence in the summer season than the winter season. While lowest prevalence was reported in the summer season from a study made by Mohamdy, (2023) and higher in the winter season. Low prevalence may be because of environmental circumstances for parasites' larval growth. The incidence is lower than our study may due to the existence of unfavorable climatic or environmental variables that could promote prolonged survival and development of most nematode infective larval stages (Mehmood *et al.*, 2017).

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The present analysis of fecal samples revealed a 79% prevalence of gastrointestinal parasites in Gurbhakot 9 Surkhet. From our study, 13 genera of parasites including 4 classes (1 protozoan and 3 helminths) were identified where *Eimeria* sp. (42.33%) was predominant among all species, *Strongyloides* sp. and *Strongyle* sp. were other species mostly found in both animals. Sheep (81.33%) showed a higher prevalence of parasitic infection than goats (76%). Age-wise prevalence was higher in adult animals in both sheep and goats. While sex-wise prevalence was also higher in females than males. In both animals, season prevalence was higher in summer and lower in winter. Pasteur management, selective deworming, and maintaining hygiene to minimize overstocking, in severe conditions farmers need to consult the veterinarian. These can help to develop a tailored parasite control program for small ruminants.

6.2 Recommendations

Based on our conclusion, it was recommended that:

- Molecular techniques should be applied for species-level identification.
- Good husbandry practices should be employed.
- In the summer season, our result showed a higher infestation of parasites. So, for the control of parasitic infestation, treatment of Pasteur, control of grazing, and looking of antihelminthic needs to be done.
- Our study was done in the winter and summer seasons, to know the major impact on seasons other season samples should be included.

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