# CHAPTER-I

## INTRODUCTION

In Bangladesh, livestock is one of the most potential sub-sectors of agriculture which plays an indispensable role in promoting human health and national economy of the country. Livestock not only assists to upgrade the financial condition but also makes a substantial contribution to human nutrition. However, livestock is an integral part of farming system which has a better contribution to enhance the economy of Bangladesh. Large ruminants (Cattle and Buffalo) and small ruminants (sheep and goat) constitute the major portion of livestock. The present population of livestock is 23.12 million cattle, 1.39 million Buffalo, 24.15 million goat and 3.07 million sheep **(DLS, 2010-11)**. The total contribution of livestock sub-sector to Gross Domestic Product (GDP) in Bangladesh is approximately 7.23% and livestock in agricultural production 17.32% (Anonymous, 2007). It also generates 13% of foreign currency and provides 20% fulltime employment and 50% partial employment of rural population (Alam, 1993). In this country, 80% rural people are involved with livestock farming (Siddiki *et al*., 2009). Most animals are reared in houses under the traditional husbandry practices where small ruminant especially goat and sheep are mainly reared for several reasons including meat, wool and skin production **(Hossain *et al*., 2004)**. The production and productivity of animals are greatly hampered by different diseases including gastrointestinal parasitic infections.

Gastrointestinal parasitism is a world-wide problem (Regassa *et al.,* 2006). It is thought to be one of the major constraints that hinder the development of livestock population and also adversely affects the health and productivity of animals (Kakar *et al*., 2008 and Irfan, 1984). The losses caused by parasitic infections are in the form of lowered general health condition, retarded growth rate, diminishing the working efficiency, decrease milk and meat production, abortion, cost associated with preventive measures and reduces the disease resistance capability, which may ultimately lead to higher mortality (Chavhan *et al.,* 2008 and Silvestre *et al.,* 2000). Gastrointestinal parasitic infections especially Fascioliasis, Haemonchosis, Trichostrongylosis, Oesophagostomiasis and Monieziosis impaired the growth and productivity of goats (Speedy, 1992). It was observed that 25% kids and 43% adult goat die of gastrointestinal parasitism under both rural and farm condition (Rahman *et al*., 1975**).** Moreover, the country losses lots of money annually due to mortality, stunted growth, production loss, abortion and poor quality skin due to ectoparasitc infestation ( Dewan *et al*., 1979). Despite significant losses by gastrointestinal parasitism, the problems are often neglected and overlooked as majority of the infected animals show a number of little obvious

clinical signs throughout their productive life and their effects are gradual and chronic (Raza *et al.,* 2010).

Nevertheless, among the gastrointestinal parasitic diseases, haemonchosis caused by *Haemonchus spp* which is a predominantly a highly pathogenic and economically important disease of sheep and goats (Maqsood *et al*., 1996 and Nwosu *et al.,* 2007). It is a serious health problem, which causes lower production due to high morbidity, mortality and cost of treatment and control measures. These parasites are common blood feeders that cause anaemia and reduced productivity and can lead to death in heavily infected animals (Githigia *et al.,* 2001). It has been estimated that each worm sucks about 0.05 ml of blood per day or responsible for continuous seepage of blood from feeding site resulting severe anemia and death of the individual (Urquhart *et al.,* 2000). The prevalence of haemonchosis is higher in compare to other gastrointestinal parasites. It is primarily a disease of tropical and sub tropical regions of the world. The high humidity at least the microclimate of the faeces and the herbage is essential for larval development and their survival. Different studies showed a positive correlation between the occurrence of *H. contortus* infection and climatic condition. Significantly highest infection rate was recorded during rainy season (72.57%) followed by summer (66.46%) and winter (51.54%) seasons. The infection was recorded peak in the July (84.42%) and lowest in January (46.15%) (Shahiduzzaman *et al.,* 2003).

The geo-climatic conditions of the country also favour the growth, development and survival of various parasites. Occurrence of gastrointestinal parasitic infections varies greatly depending upon the diverse intrinsic and extrinsic epidemiological and biological factors associated with them (Sardar *et al.,* 2006). Epidemiological pattern of the parasitic diseases in the different agro-climatic zones of the country usually provides a basis for developing strategic and tactical control measures against them. Several epidemiological studies have been conducted on gastrointestinal parasitism of goats in different regions of the country but, limited investigation was done on gastrointestinal parasitic diseases of goat in Chittagong. Moreover, the current study comprises three different veterinary hospitals of three different areas namely S.A. Quaderi Teaching Veterinary Hospital of Chittagong Veterinary and Animal Sciences University (CVASU), Central Veterinary Hospital (CVH), Dhaka and Veterinary Hospital of Bangladesh Agricultural University (BAU). The hospitals were selected due their geographical location as well as heavy patient load in those hospitals. Considering the above facts, the present study was undertaken to fulfill the following

objectives:

- To investigate the prevalence of gastrointestinal parasitic infections in various goat breeds in three districts (Dhaka, Chittagong & Mymensingh) including C.V.H, S.A.Q.T.V.H & BAU Hospital in Bangladesh.
- To determine the effect of different factors such as, breed, age, sex, seasons etc. in the occurrence of such diseases.

# CHAPTER-II

## REVIEW OF LITERATURE

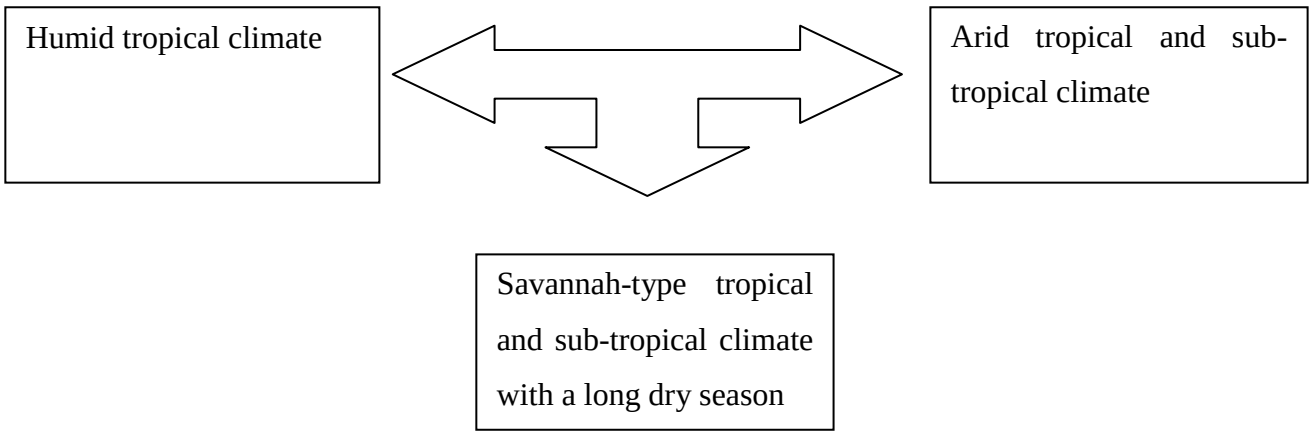
Gastrointestinal (GI) parasitism is a very common and economically important condition affecting domestic livestock species worldwide (Krecek 1992 and Waller, 2004 and Miller *et al*., 1987). Pertinent literatures on gastrointestinal parasitism, prevalence in goat and bionomics of *Haemonchus controtus* were reviewed in this chapter. The main purpose of this chapter is to provide up-to-date information concerning the research work which is addressed here. Important information related to the present study was represented below under the following headings:

- Gastrointestinal parasites: Epidemiology, Factor affecting the size of gastrointestinal parasitic infections
- Diagnosis of gastrointestinal parasitism.
- Prevalence of gastrointestinal parasites in goat in Bangladesh
- Prevalence of gastrointestinal parasites in goat in other countries of the world.

## 2. Gastrointestinal Parasitism

### 2.1 Epidemiology

The development and survival pattern of infective larvae in the environment differs according to the climate. Three broad types of climate are found in tropical and sub-tropical regions:



The humid tropical climate characterizes much of West Africa as well as the regions surrounding Lake Victoria and parts of coastal eastern Africa. It is also the climate of much of southeastern Asia, Central America and northern South America.

The parasites' eggs or larva developed into in the fecal material or in environment to make themselves accessible to ingestion by ruminants, the larvae have to migrate or be transported from the faces in which they were deposited on the ground to any nearby herbage. Such movement occurs in two ways: horizontal migration/transport and vertical migration/transport. Embryonation and hatching of the eggs depends on light, temperature, humidity and oxygen and this process does not take place while the eggs are in the faecal mass. The development of larvae in the environment depends upon warm temperature and adequate moisture. In most tropical and sub-tropical countries, temperatures are permanently favourable for larval development in the environment. Exceptions to this are the highland and mountainous regions throughout the world and the winters of southern Africa and Latin America where temperatures may fall below those favourable for the development larvae. The ideal temperature for larval development of many species in the microclimate of the tuft of grass or vegetation is between 22° and 26°C. Some parasite species will continue to develop at temperatures as low as 5°C, but at a much slower rate. Development can also occur at higher temperatures, even over 30°C, but larval mortality is high at these temperatures. The ideal humidity for larval development in this microclimate is 100%; the minimum humidity required for development is about 85%. The survival of larvae in the environment depends upon adequate moisture and shade. Desiccation from lack of rainfall kills eggs and larvae rapidly and it is the most lethal of all climatic factors. (Hansen and Perry, 1990).

**2.2 Factors affecting the size of gastrointestinal infections**

The size of any gastrointestinal nematode infection depends on the following five main factors:

- The number of infective larvae/eggs ingested by the host, which in turn is influenced by the climate, the amount of protection provided by vegetation, the livestock density and the grazing pattern of the ruminants present.
- The rate at which acquired resistance develops in the host, which is influenced by the species of the parasite and host, genetic factors, nutrition and physiological stress (e.g., parturition).

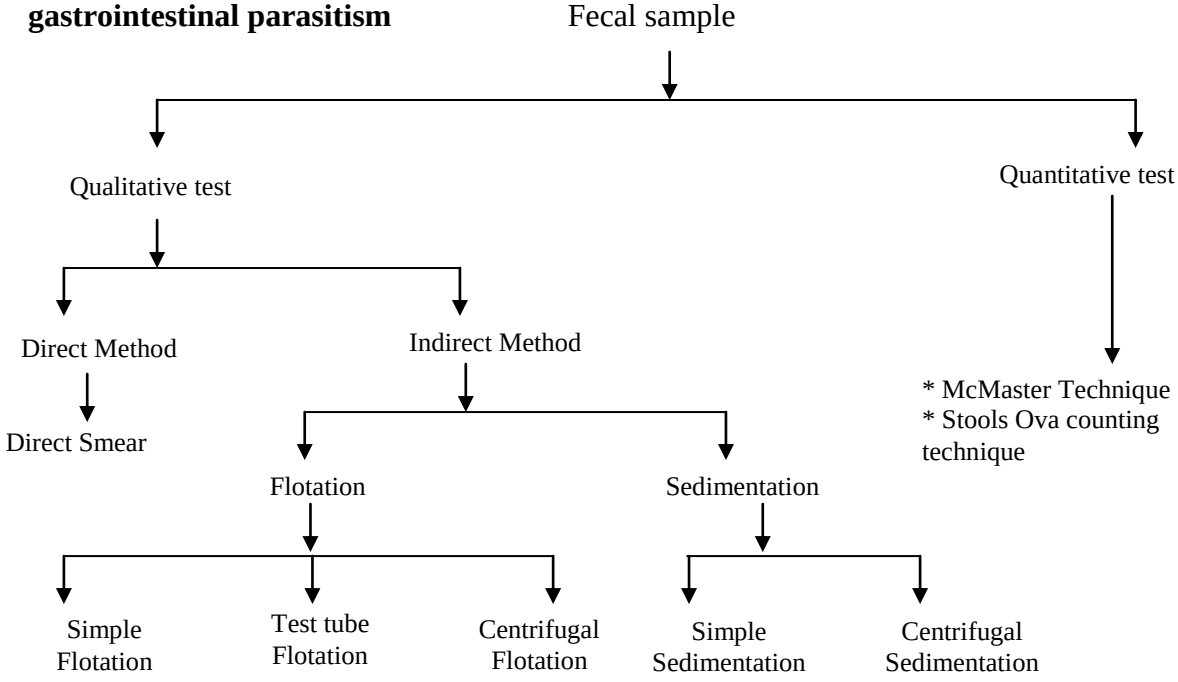
- The intrinsic multiplication rates of the species of parasites present which are controlled by the fecundity, pre-patent period, environmental development and survival rates of these species.
- Management, particularly grazing patterns (Radostits *et al.*, 1994).
- Geographical distribution and availability intermediate hosts
- Use of anthelmintics, including the timing and frequency of administration. (Radostits *et al.*, 1994 and Hansen and Perry, 1990)

**2.3 Diagnosis of gastrointestinal parasitism**

To diagnose gastrointestinal parasitic infections of ruminants, the parasites or their eggs/larvae must be recovered from the digestive tract of the animal or from faecal material. These are subsequently identified and quantified. The following are the main tasks involved in this process:

- Collection of faecal samples
- Separation of eggs/larvae from faecal material and their concentration
- Microscopical examination of prepared specimens
- Preparation of faecal cultures
- Isolation and identification of larvae from culture (Baermann's apparatus techniques)

**The following Qualitative and Quantitative tests were used for the diagnosis of gastrointestinal parasitism**




(Urquhart *et al.*, 1996**;** Hansen and Perry, 1990; Soulsby, 1982).

### 2.4.1 Prevalence of gastrointestinal parasitism in goats in Bangladesh

**Howlader *et al.* (2012)** conducted a survey on the prevalence of gastro-intestinal tract (GIT) parasites in 20 Black Bengal goats (*Capra hircus*) of 18 months of age. The study was conducted in Sylhet Government Goat Development Farm, Bangladesh during the period of February to May of 2011. Irrespective to sex, using McMaster method for egg per gram of feces (EPG) disclosed that the percentage of *Haemonchus contortus, Strongyloides papillosus, Trichuris ovis, Trichostrongylus vitrinus., Oesophagostomum columbianum* and mixed infections were prevalent as 30%, 16.67%, 10%, 6.67%, 13.33%, and 23.33%, respectively.

**Nuruzzaman *et al.* (2012)** carried out a study to estimate the prevalence, species composition and worm burden of abomasal nematodes of goats slaughtered at different abattoir of Thakurgaon district from November 2009 to April 2010. During the study period, 250 abomasums of goats were examined according to standard procedures. Two species of nematodes were identified in goats abomasums with an overall prevalence of 74.00% (*n* = 250). The specific prevalence rate for *Haemonchus contortus* (58.00%) was higher than *Trichostrongylus axie* (16.00%).

**Hassan *et al.* (2011)** conducted an investigation was carried out to measure the prevalence of ecto and endoparasites in semi-scavenging Black Bengal goat (capra hircus) at Pahartali thana under Chittagong district, Bangladesh during the period of February to May/2006.The overall prevalence of gastrointestinal helminthes in goat were 63.41% (N=317).In these positive samples *Strongyloides spp.* (51.74%) was more prevalent and *Moniezia spp.* and *Capillaria* spp were least prevalent. Age was evident as risk factor where older goats (>24 months) were more infected by endoparasites than younger ones (<24 months).

**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*.

**Mohanta *et al.* (2007)** conducted a study on Prevalence, population dynamics and pathological effects of intestinal helminths in Black Bengal goats were studied by examining 150 viscera collecting from different slaughter houses of Mymensingh district from the period of November 2005 to May 2006 in the Department of Parasitology and Pathology, Bangladesh Agricultural University, Mymensingh, of which 94.67% goats were infected with one or more species of helminths. A total of 5 species of helminth parasites were identified such as *Oesophagostomum columbianum* (92%), *Trchuris ovis* (56.66%), *Schistosoma indicum* (38%), *Moniezia expansa* (10.66%) and *Moniezia benedeni* (2.66%). Single infection was observed in case of *O. columbianum* (16%) and *S. indicum* (2.66%). Single sex infection was established by *S. indicum* male (5.33%). Overall mean parasitic burden was 34.02±2.20. Mean parasitic burden was the highest in case of *O. columbianum* (29.91±2.00) followed by that of *T. ovis* (5.70±0.47), *S. indicum* (4.66±0.42), *M. expansa* (2.59±0.54) and *M. benedeni* (1.00±00). Prevalence of intestinal helminth was significantly ($P<0.05$) higher in winter (100%) than that in summer (89.33%)

**Uddin *et al.* (2006)** investigated on 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 that 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%. Age had a significant ($p<0.01$) influence on the prevalence of amphistomes in goat. A higher prevalence (89.58%) was observed in older animals followed by young animals (78.57%), whereas a lower prevalence (45.0%) in growing animals.The prevalence increased with the increase of age. The females (75.0%) were found more (1.44 times) susceptible to amphistomes infection than the males (67.5%).

**Shahiduzzaman *et al.* (2003)** conducted a study to seasonal influence on the occurrence of *Haemonchus contortus* parasite on 672 slaughtered Black Bengal goats during one period from july 2002 to June 2003.An overall 65.63% goats had *H.contortus* infection and significantly (P<.01)higher infection rate was recorded in female(70.43%)than male (58.61%) goats.

**Mondal *et al.* (2000)** conducted a study to determine association of grassland with parasitic diseases of livestock in Bangladesh; the Tracer animals (two cow calves and two goats) were released for a month in grassland used for communal grazing of livestock near school premise in kanthal, Mymensingh, Bangladesh. After slaughtering of the tracer animals, their gastrointestinal tract examination revealed six species of nematode and one cestode.The nematode spices were *Haemonchus contorsus, Trichostrongylus axei, Mecistocirrus digitatus, Oesophagostomum* spp, *Trichuris* spp *and Bunostomum* spp. The cestode was one of the genus *Moniezia.*

**Kamal *et al.* (1991)** conducted a study to determine the prevalence of gastro intestinal nematodes in the Chittagong hilly area of Bangladesh. A total of 870 goats from Nikhongchari FSR site of Bandarban to examine the GI nematodes. The parasites which were encountered were as follows: *Haemonchus* spp, *Bunostomum* spp, *Oesophagostomum* spp and *Strongyloides* spp. The overall infection rate was 78.41% where prevalence of *Haemonchus* spp was most prevalent.

### 2.4.2 Prevalence of gastrointestinal parasitism in goat or other in different countries of the world

**Tehrani *et al.* (2012)** conducted a study to determine the prevalence of *Haemonchus contortus* in slaughtered sheep's at Urmia abattoir located in the North West of Iran. A total of 2421animals were slaughtered and examined from July 2010 to July 2011 in Urmia abattoir. In case of sheep, 225 out of 2421 were positive and prevalence of *Haemonchus contortus* infestation was 9.3%. Sex wise prevalence of *Haemonchus contortus* in sheep was 33.08% (76/229) in male and 66.22% (149/225) in female. The females indicated significantly (P<0.05) higher prevalence (66.22%) as compared to males (33.08%).

**Khajuria *et al.* (2012)** conducted a study on seasonal prevalence of gastrointestinal helminthiasis in sheep and goats of middle agro-climatic zone of Jammu province. A total of 1920 faecal samples where 960 sheep and 960 goats of stationary flocks of the middle agro-climatic zone of Jammu province were examined. The author recorded 67.24 % animals

were positive for helminthic infections. The prevalence of different nematodes were *Strongyles* (50.1 %), Trichurids (12.1 %) and *Strongyloides* spp (4.2 %). Trematode ova recorded were of amphistomes (8.3 %), *Fasciola* spp (8.2 %) and *Dicrocoelium* spp (5.4 %). No significant difference was observed between the infection level in sheep (68.54 %) and goats (65.94 %) which could be attributed to mixed grazing and sharing of pastures/sheds. Significantly ($p < 0.05$) higher infection was observed in monsoon as in compare to winter. Strongyles were predominant during all the seasons but significantly ($p < 0.05$) higher infection was observed in monsoon as compared to winter. Copro-culture studies revealed that *Haemonchus contortus* (61.18 %) predominated during all the seasons, followed by *Trichostrongylus* spp (13.67 %), *Ostertagia* spp (12.17 %), *Strongyloides* spp (4.14 %), *Oesophagostomum* spp (3.84 %) ad *Bunostomum* spp (3.83 %).

Coelho et al. (2012) carried out a survey on occurrence of gastrointestinal parasites in goat kids. Faecal samples were analyzed to determine egg and oocyst counts per gram of feces (EPG and OPG, respectively while fecal culturing was performed to identify nematode genera. From fecal samples, helminth eggs and *Eimeria* spp. oocysts were found in 93.06% (188/202) and 77.22% (156/202), respectively.The following genera were identified: *Cooperia* in 11.88% (24/202), *Haemonchus* in 51.98% (105/202), *Oesophagostomum* in 9.4% (19/202), *Strongyloides* in 5.94 (12/202) and *Trichostrongylus* in 20.79% (42/202) of the samples from fecal cultures. The following *Eimeria* species were found: *E.alijevi* in 25.24% (51/202), *E. arloingi* in 7.42% (15/202), *E. caprina* in 2.97% (6/202), *E. caprovina* in 10.39% (21/202), *E. christenseni* in 4.45% (9/202), *E. joklchijevi* in 11.38% (23/202), *E. hirci* in 9.4% (19/202) and *E. ninakohlyakimovae* in 28.71% (58/202) samples whereas among the gastrointestinal parasites, the genus Haemonchus and two Eimeria species (*E. ninakohlyakimovae* and *E. alijevi*) were predominants.

**Kantzoura *et al.* (2012)** carried out an investigation on prevalence and risk factors of gastrointestinal parasitic infections in small ruminants in the Greek temperate mediterranean environment. A total of 557 fecal samples were collected. Helminth eggs were detected in 44 (7.9%) samples. Strongyle-type eggs were found in 19 (3.4%) samples, *Nematodirus* spp. eggs in 6 (1.1%) samples, *Trichuris* spp. eggs in 16 (2.9%) samples, *Fasciola hepatica* in 3 (0.5%) samples, and *Dicrocoelium dendriticum* in 1 (0.2%) sample. Coccidian oocysts were found in 36 (6.5%) samples.

**Zeryehun (2012)** carried out a cross sectional study in sheep and goats kept under extensive management system in and around Haramaya, Southeastern Ethiopia, during the period from July 2010 to June 2011 with the aim of determining the prevalence, the status of gastrointestinal (GIT) helminthosis and the risk factors associated with it. For this purpose 768 fecal samples were collected from 384 sheep and 384 goats. Parasitological methods

including floatation, sedimentation and copro-culture were employed in the study. Examination revealed that an overall prevalence of 61.4% in the small ruminants where as 67.75% in sheep and55.47% in goats harbor one or more genera of helminths with nematodes, 59.89% being the most prevalent helminths.

**Terefe D *et al.* (2012)** conducted a study to determine the prevalence and intensity of internal parasites infecting pure and cross-bred Boer goats to determine the risk factors associated with the parasites at Adami Tulu Agricultural Research Center, Ethiopia. The study covered five months from November 2009 to March 2010. During this period, faecal samples from 192 goats (104 pure Boer goats and 88 cross-bred goats) were examined using several carpological parasitological procedures. Examination revealed that the prevalence of helminthes was recorded as *Strongyloides* spp. (4.7%), *Moniezia* spp. (7.8%), *Skrjabinema* spp. (11.5%), Strongyle -type species *(*49.5%) and *Eimeria* spp. (100%).

**Koinari *et al.* (2012)** conducted an investigation on infection levels of gastrointestinal parasites in sheep and goats in Papua New Guinea. Faecal samples were collected from a total of 165 small ruminants (110 sheep and 55 goats) from February to April 2011. Coproscopy revealed that 128 animals (72% of sheep and 89% of goats) were infected with one or more species of gastrointestinal parasites. The gastrointestinal parasites found and their prevalence in sheep (S) and in goats (G) were as follows: Strongyle 67.3% (S), 85.5% (G); *Eimeria* 17.3% (S), 16.4% (G); *Strongyloides*, 8.2% (S), 23.6% (G); *Fasciola*, 5.5% (S), 18.2% (G); *Trichuris*, 1.8% (S), 3.6% (G); and *Nematodirus*, 1.8% (S), 3.6% (G). Two additional genera were found in goats: *Moniezia* (9.1%) and Dictocaulus (3.6%).

**Dagnachew *et al.* (2011)** made an investigation on the prevalence and risk factors associated with small ruminant helminthiasis in north Gondar zone, northwest Ethiopia from November-January, 2008. A total of 558 small ruminants (458 sheep and 100 goats) were examined using standard parasitological procedure. The study revealed that the overall prevalence of helminthiasis was 47.67%. The species level prevalence of helminthiasis was 46.07% and 55% in sheep and goats respectively. Strongyles were the most prevalent parasites encountered in the area followed by Fasciola.

**Radfar *et al., (*2011)** conducted a study about Raeini breed is the most productive Cashmere goat in Iran. Helminthes infections cause major economic losses globally to the livestock industries and farming communities. The objective of this study was to determine the seasonal

prevalence and intensity of *Eimeria* and gastrointestinal helminths parasitic infections in Raeini goats in Iran. A total of 438 faecal samples were randomly taken from clinically healthy goats in Raeini Goats Research Center of Iran. Faecal samples were collected from each goat once and eggs per gram of faeces (EPG) and faecal oocysts counts (OPG) were estimated using the modified McMaster technique. Oocysts were found in 391 (89.27%) goats. Five species of *Eimeria* including, *E. arloingi*, *E. parva*, E.ninakohlyakimovae, *E. christenseni*, *E. faorei* and one *Eimeria* spp were identified in faecal samples. *E.arloingi* (92.07%) predominated in all categories and was followed by *E. parva*, *E. ninakohlyakimovae* and*E. christenseni*. *Trichuris* spp. egg was the only nematode egg which was found in 196 (44.75%) faecal samples. The prevalence of gastrointestinal helminthes infections during autumn and winter were significantly higher than summer ($P<0.05$). The association between the prevalence of *Eimeria* oocysts and gastrointestinal nematode infection and the age or sex categories was not significant ($P>0.05$).

**Biu *et al.* (2009)** conducted faecal survey of ova/oocysts of gastrointestinal parasites of ruminants on the University of Maiduguri research farm between January and November 2006 using saturated sodium chloride floatation and formol ether sedimentation techniques. A prevalence rate of 47.0%, 54.0% and 58.0% was obtained for cattle, sheep and goats respectively ($p>0.05$).The younger ruminants were more infected (cattle: 50.0%; sheep: 54.7%.; and goats: 58.1%) compared to the older ruminants (cattle: 44.0%, sheep: 52.8% and goats: 57.9%) ($p>0.05$). Female ruminants were also more infected (cattle: 52.0%; sheep: 60.4%, and goats: 62.7%) compared to the males (cattle: 52.0%; sheep: 46.8% and goats: 51.2%) ($p>0.05$). Goat breeds of Borno white and Sokoto red had 54.2% and 59.6% infection rates respectively ($p>0.05$).

**Gadahi *et al.* (2008)** conducted a study From August 2004 to May 2008, a total of 400 submitted faecal samples comprising of 90 samples from sheep and 310 from goats of Rawalpindi and Islamabad were analyzed to confirm the presence of gastrointestinal parasitic infection. 254 (63.50%) samples were found positive for endo-parasites. Among the samples from sheep 48 (53.33%) and 206 (66.45%) from goats were detected positive for gastrointestinal parasites. *Trichuris, Haemonchus, Coccidia, Nematodirus* and *Fasciola* were found with prevalence of 40.00, 28.88, 27.77, 11.11 and 4.44 per cent respectively in sheep. In case of goat the incidence of *Haemonchus*, *Coccidia*, *Trichuris*, *Nematodirus*,

*Trichostrongylus*, *strongyloides* and *Fasciola* were 64.19, 43.87, 35.48, 13.00, 4.51, 3.22 and 0.66 %, respectively.

**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 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%).

**Solismaa *et al.* (2008)** found Onchocerca sp. Microfilariae (mf), 240 µm long, range 225-260 µm,5.4 µm thick in 37% of the skin biopsies of 209 cattle from their experimental study on investigation of filarial nematodes in cattle, sheep and horses in Finland.

**Asif *et al.* (2008)** carried out a study to determine the prevalence of various endoparasites in at twin cities of Rawalpindi and Islamabad and collected a total of 338 fecal samples (86 from sheep 252 from goats) from August 2004 to December 2005. Of the total samples examined, 65.7% were found positive for endoparasites. The prevalence of gastrointestinal parasites tended to be higher ($p = 0.059$) in sheep 62 (72%) than in goats 160 (63.7%). The endoparasites identified in sheep included *Haemonchus* (80.64%), *Coccidia* (51.61%), *Trichuris* (32.25%), *Nematodirus* (29.03%) and *Fasciola* (4.38%) while only *Haemonchus* (75%), *Trichuris* (62.5), and *Coccidia* (57.5%) were recovered from the fecal samples of goat.

**Almalaik *et al.* (2008)** conducted a research on the prevalence and dynamics of some gastro intestinal parasites of sheep and goats in Tulus area based on post mortem examination the author collected GI tracts of 79 sheep and 161 goats obtained from abattoir from March'2006 to February'2007 which were examined for presence of GI parasites. In the study, Prevalence of seven Nematodes was 99.8% and *Monizia expansa* 0.2% in sheep. In the goats, *Strongylus papilosus* (26.5%), *Haemonchus contortus* (26%), *Trichostrongylus columbriformis* (24.4%) *Skrjabinema ovi s* (11.6%) *0esophagostomum columbrianum* (9.9%), *Gaigeria pachyscelis* (1%) *Trichris globulosa* (0.6%) and *Cooperia pectinata* (0.1%).

**Mulugeta *et al.* (2008)** conducted a study on GIT parasites of small ruminants during

November 2007 to May 2008. In that study, a total of 384 fecal samples (219 sheep and 165 goats) were collected for qualitative and quantitative fecal examinations and 43 post mortem examinations in butcher house (23 sheep and 20 goats) were performed. The study found that 200 (91.32%) sheep and 153 (93.29%) goats were found to harbor eggs of GIT helminthes. Post mortem examination revealed that 21 (91.30%) sheep and 19 (95%) goats were found to be infected with two or more of GIT helminth parasites. Eight genera of nematodes with prevalence of 67.5% *Haemonchus* spp, 46.1% *Trichuris* spp, 48.8% *Trichostrongylus* spp, 48.8% *Oeophagostomum* spp, 30.3% *Bunostomum* spp,25.6% *Ostertagia* SPP, 20.9% *Chabertia* spp and 16.3% Strongyloid in both species in sheep and goats. Similarly two types of Cestodes were recovered with a prevalence of 24.8 % *Monezia* spp and 39.5% *Avetellina* species

**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.

**Sissay *et al.* (2007)** conducted a survey on the prevalence and seasonal incidence of interal parasites infections in sheep and goats in eastern Ethiopia for 2 years (May 2003-April). Samples were collected from 655 sheep and 632 goats including viscera organs like liver, lungs, heart, kidneys and the gastro-intestinal tract. It was observed that *Cysticercus ovis (Taenia ovis), Cysticercus tenuicollis (T. hydatigena)* and hydatid cysts (*Echinococcus*

*granulosus* were most prevalent metacestodes (larval cestodes). The overall prevalence was 26% for *C. ovis*, 79% for *C. tenuicollis*, and 68% for hydatid cysts. Similarly, for goats, the corresponding prevalence was 22%, 53% and 65%.The prevalence of these tapeworms were 61%, 20%, 24% and 39%, respectively. Similarly, the overall prevalence of these parasites in goats was 53%, 21%, 27% and 36%, respectively.

**Lima *et al.* (2003)** 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.

**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.

**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/hogget, 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%).

**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.

**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.

**Kumsa *et al.* (2004)** carried out a study to determine the worm burden of abomasal nematodes of small ruminants of Ogaden region slaughtered at Elfora export abattoir. A total of 196 abomasums of animals (114 sheep and 82 goats) were examined. An overall prevalence rate of 91.2% and 82.9% *Haemonchus species* was recorded in sheep and goats, respectively. Likewise, an overall prevalence of 37.7% and 40.2% *Trichostrongylus axei* was recorded in sheep and goats, respectively. Adult male *Haemonchus* worms collected from sheep were identified as 95.1% *H. contortus* 3.4%, *H. placei* 1.2%. Similarly, male *Haemonchus* recovered from goats were identified as 96.5% *H. contortus*, 3.0% *H. placei and* 0.5% *H. longistipes.*

**Regasa *et al.* (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.

**Woldemariam (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.

**Umur *et al.* (2006)** 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.

**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.

**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).

**Pathak *et al.* (2008)** 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%).

**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.

**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.

**Koudela B *et al.* (1998)** conducted a observational study to determine coccidial infections in goats of 13 farms in the Czech Republic. The prevalence of oocysts of *Eimeria* species was determined in weaned kids (less than 3 months old), but not served goats (from 3 months to 1 year) and adult goats (1 year or more). Nine species of *Eimeria* were identified in fecal samples by Sheather's sugar flotation technique. The overall prevalence of Eimeria oocysts in fecal specimens was 92.2%. Among them *Eimeria arloingi* was the most common species with an overall prevalence of 84%, followed by *E. hirci* (63%) and *E. ninakohlyakimovae* (56%). Other species present were *E. christenseni* (55%), *E. alijevi* (36%), *E. caprina* (25%), *E. aspheronica* (12%), *E. capriovina* (6%) and *E. jolchijevi* (2%).

**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. The recorded prevalence of *Strongylus, Strongyloides, Trichuris, Skrjabinema, Dicrocoelium* and *Moniezia* were 93%, 83%, 44%, 0.9%, 2.3% and 31%, respectively.

**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 examined animals were infected with at least one helminth species. Three trematodes (*Fasciola gigantica, Schistosoma bovis, and 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.

# CHAPTER-III

## MATERIALS AND METHODS

### 3.1 Materials and Methodology for prevalence study

#### 3.1.1 Study Area and period

The study was conducted in three districts and veterinary hospitals namely, Central veterinary Hospital**(CVH)**, Dhaka, S.A. Quaderi Teaching Veterinary Hospital**(SAQTVH)**, Chittagong Veterinary and Animal Sciences University, Chittagong and Teaching Veterinary Hospital, Bangladesh Agricultural University**(BAU)**, Mymensingh.Takorgaon District Veterinary Hospital and Bera upazilla Livestock office and Pabna District. The investigation was conducted for a period of 12 months staring from July' 2012 to June' 2013.

#### 3.1.2 Selection of animals and Survey Design

a) Goat of different breeds like Black Bengal, Jamunapari, Cross bred goats were selected for this study as target animals.

b)To determine the age and breed susceptibility of different parasites, goats were categorized into two sub groups as one was less than one year(<1 yr) and another was more than one year age (>1 yr).

c)A total of 422 **(four hindred twenty two)** fecal samples were collected from 422 individuals which were brought for treatment during the study period.

d) Random sampling was followed during sample collection.

A prototype questionnaire was used to record the information like owner's name and address, animal Identification (ID), farm size, breed, age, sex, deworming history. In the present study, the minimum age of the goat was 25 days and the maximum was 60 months.

#### 3.1.3 Sample collection and preservation

Only one type of biological samples (faces) were collected during this study where an individual animal was considered as a sampling unit. Approximately 5-10gm of fecal sample from each individual animal was collected directly from rectum. However, freshly voided fecal samples were also considered and subsequently the collected samples were stored in plastic containers. Then, the container was filled with formalin (10%) and refrigerated at $4^0$C temperature. During sample collection, labeling of the samples were strictly maintained to prevent the misinterpretation

## Data and sample collection site in three districts of Bangladesh:

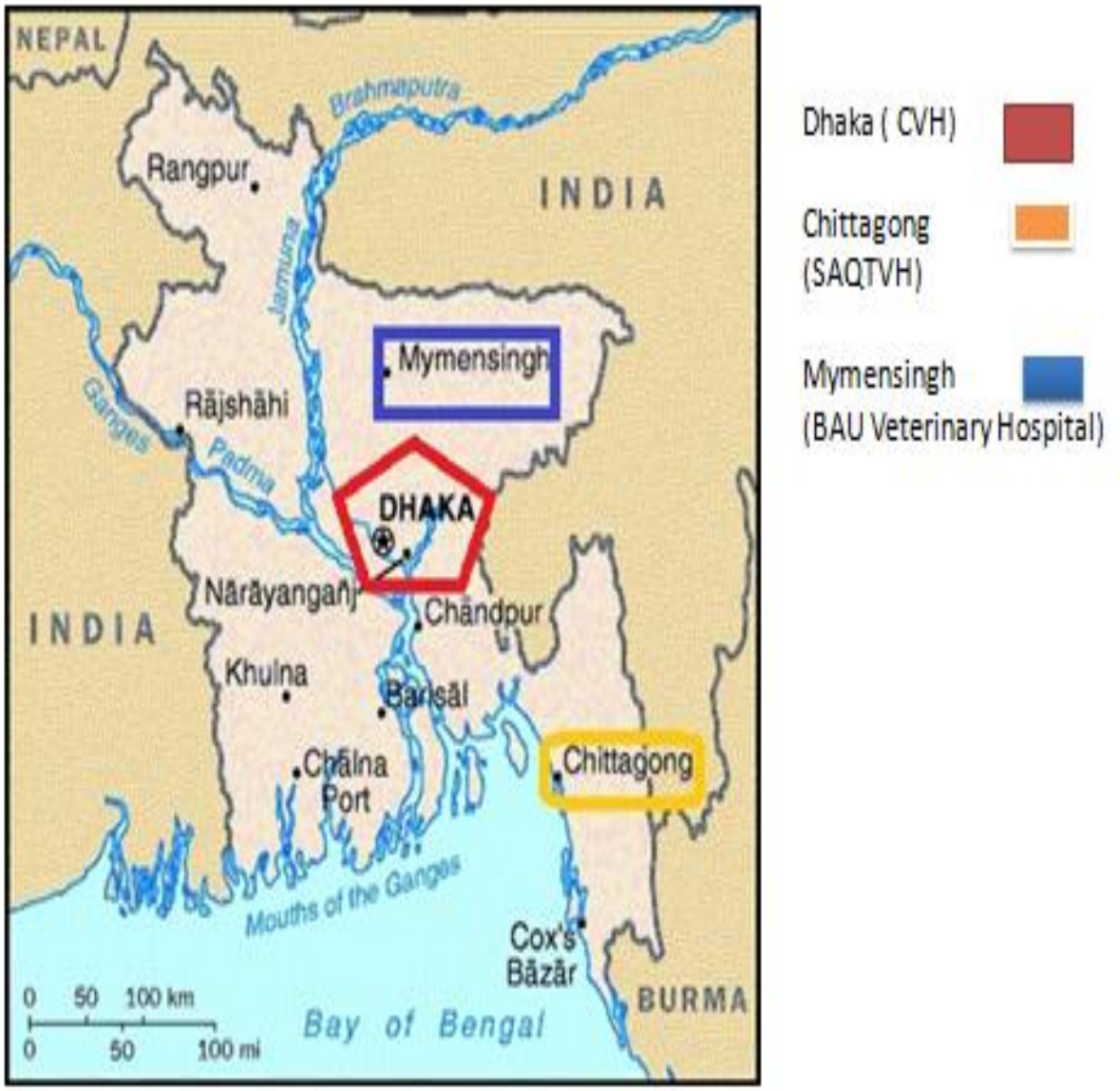
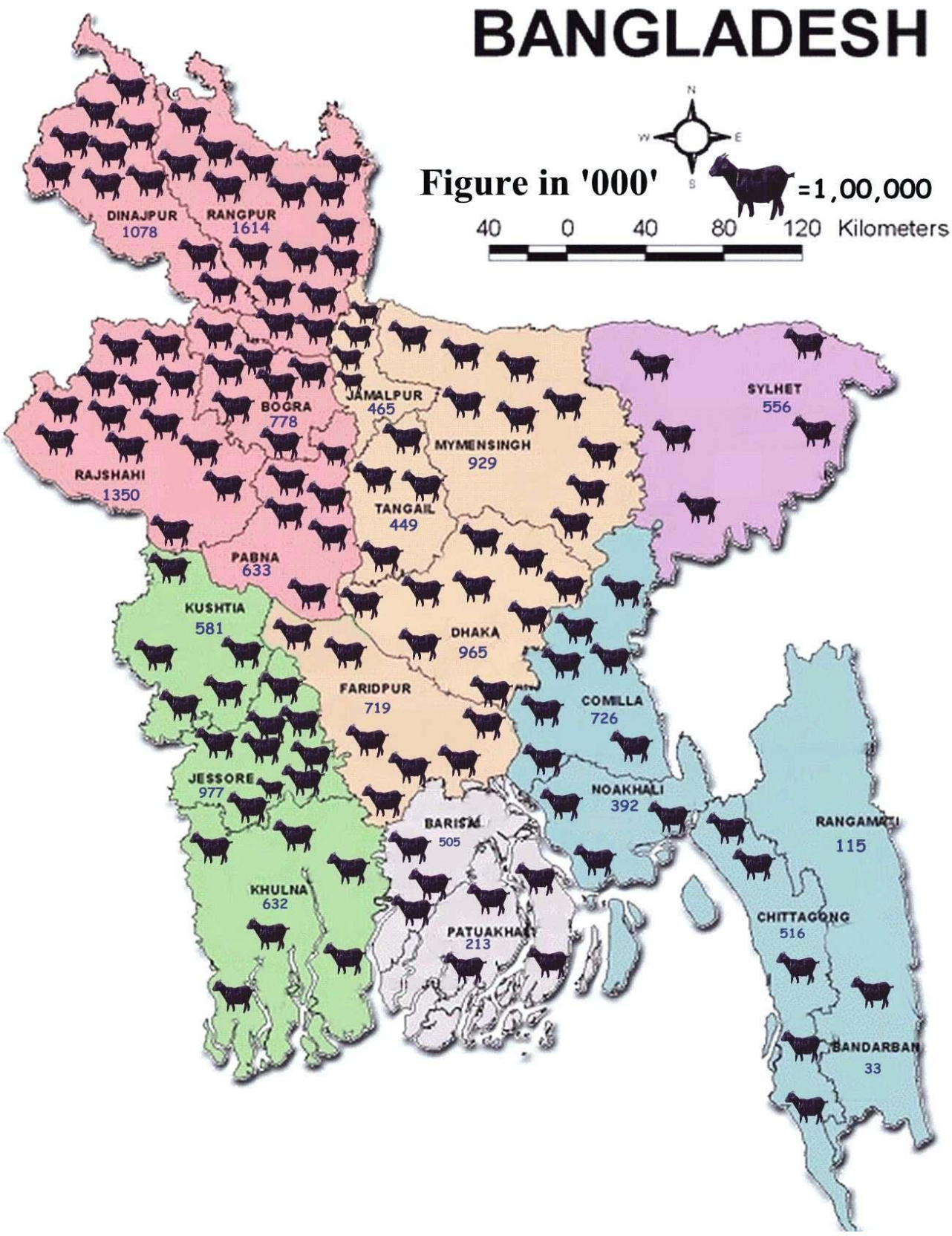


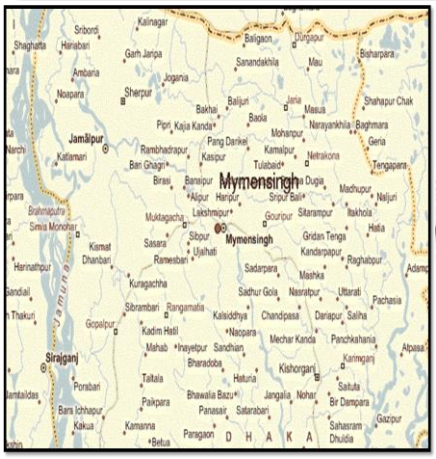

**Plate 1. Data and sample collection site in different districts of Bangladesh**

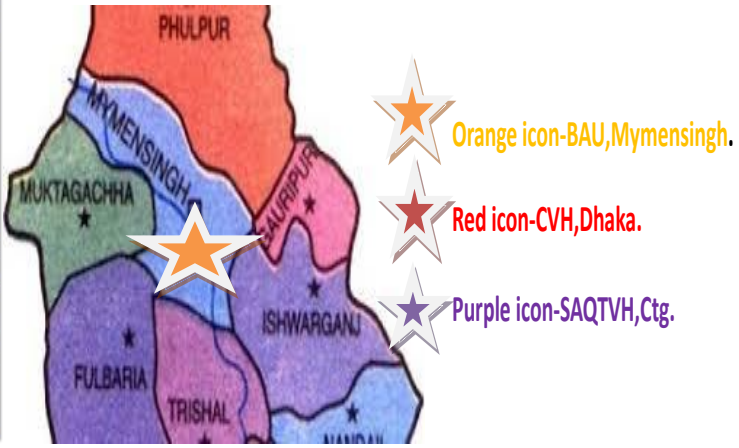



(Source: Bhuiyan, Dr.A.K.Fazlul.Haque,ILRI, Dec 2009.)

**Plate 2 .Overall Goat Distribution of Bangladesh.**

## SITE OF SAMPLE COLLECTION IN MYMENSINGH CITY




## SITE OF SAMPLE COLLECTION IN DHAKA CITY


## SITE OF SAMPLE COLLECTION IN CHITTAGONG CITY

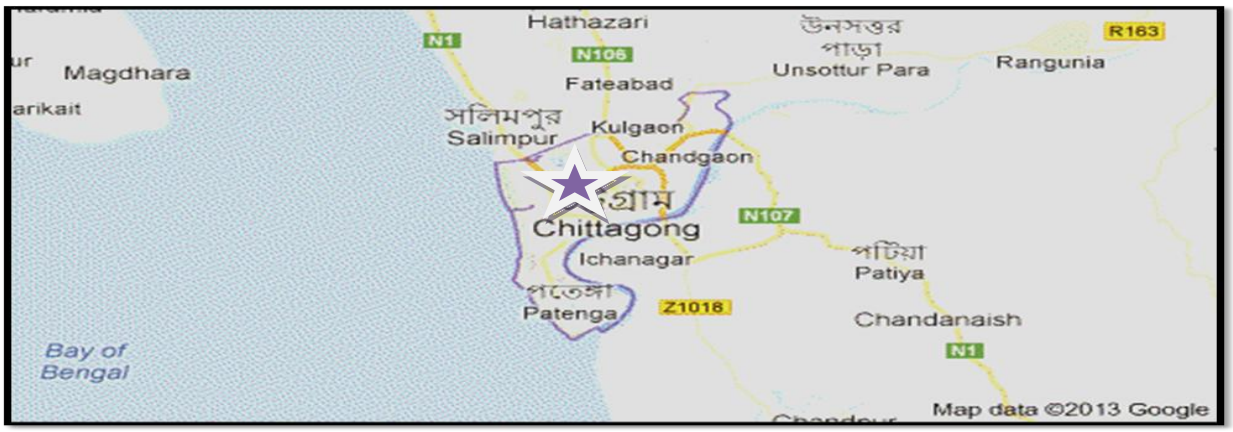



**Plate 3. Site of sample collection at BAU Vet Hospital,CVH and SAQTVH.**

### 3.1.4 Examination of samples

In addition to gross examination of faecal samples (color, consistency, blood or mucus, etc.), three different types of qualitative tests, namely direct smear, flotation and sedimentation techniques were used to examine the fecal samples (Hendrix, 2006). Zinc Sulphate solution was used as floatation fluid. At least, two smears were prepared from each sample for each test to identify the morphological characteristics of eggs, cyst, Oocysts etc. (Hendrix, 2006 and Soulsby, 1982).

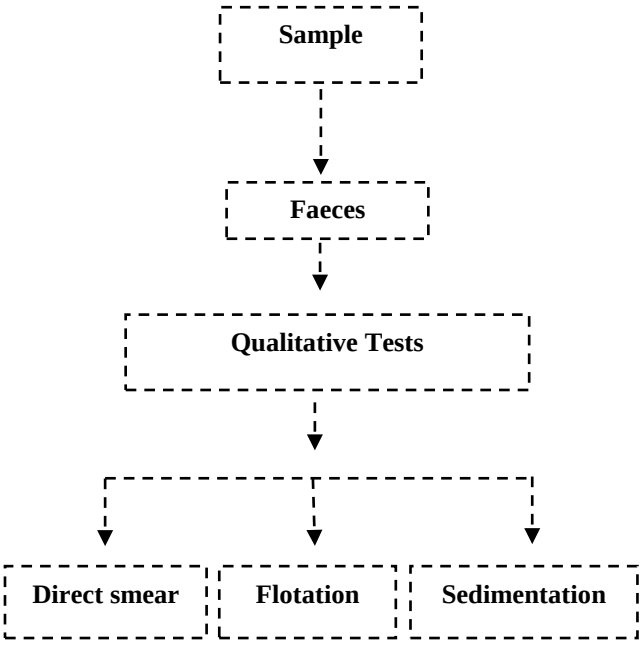



**Fig. 1: Experimental Design (at a glance)**

### 3.1.5 Statistical Analysis

Questionnaire data were entered into the Excel spreadsheet. Descriptive analysis was performed by means of frequency (N, %) of positive and negative sample test results overall and stratified by different explanatory variables. Invariable analysis was conducted using Chi square test and t test for the selected explanatory variables and those having *P*-value ≤0.05 were considered significant. Data management and analysis were performed using Microsoft Excel and STATA version 12 (Stata Corp, College Station, Texas).

# CHAPTER-IV

## RESULTS

**4.1. Results belong to prevalence of gastrointestinal parasitic infections described with following headlines:**

- Descriptive statistics of different variables.
- Overall prevalence of gastrointestinal parasites.
- Prevalence on the basis of type of parasite (Trematodes, Nematodes and Cestodes).
- Prevalence of different genus of gastrointestinal parasites in goat.
- Median, maximum, minimum, $25^{th}$ and $75^{th}$ quartile values of continuous variables (age and body weight) stratified by presence and absence of parasite.
- Relationship of different variables with presence of gastrointestinal parasites in goats.

### 4.1.1 Descriptive statistics of different variables

Samples were collected from different breeds of goat, namely Black Bengal and Jamunapari and some crossbred which constituted 54%, 43% and 3% samples, respectively. Among all study population 66% were female goat and the rest 34% were male. Samples were collected from varying aged animals of which 38% were less than or equal 1 years old and the rest (62%) were more than one year old. 67% animals of the study population was not dewormed ever. We collected samples from three different study areas, namely S. A. Quaderi Teaching Veterinary Hospital, Chittagong, Central Veterinary Hospital, Dhaka and Agricultural University Veterinary Hospital, Mymensingh which provided 49%, 26% and 25% samples in the study, respectively. Descriptive statistics of variables are presented in figure 1.

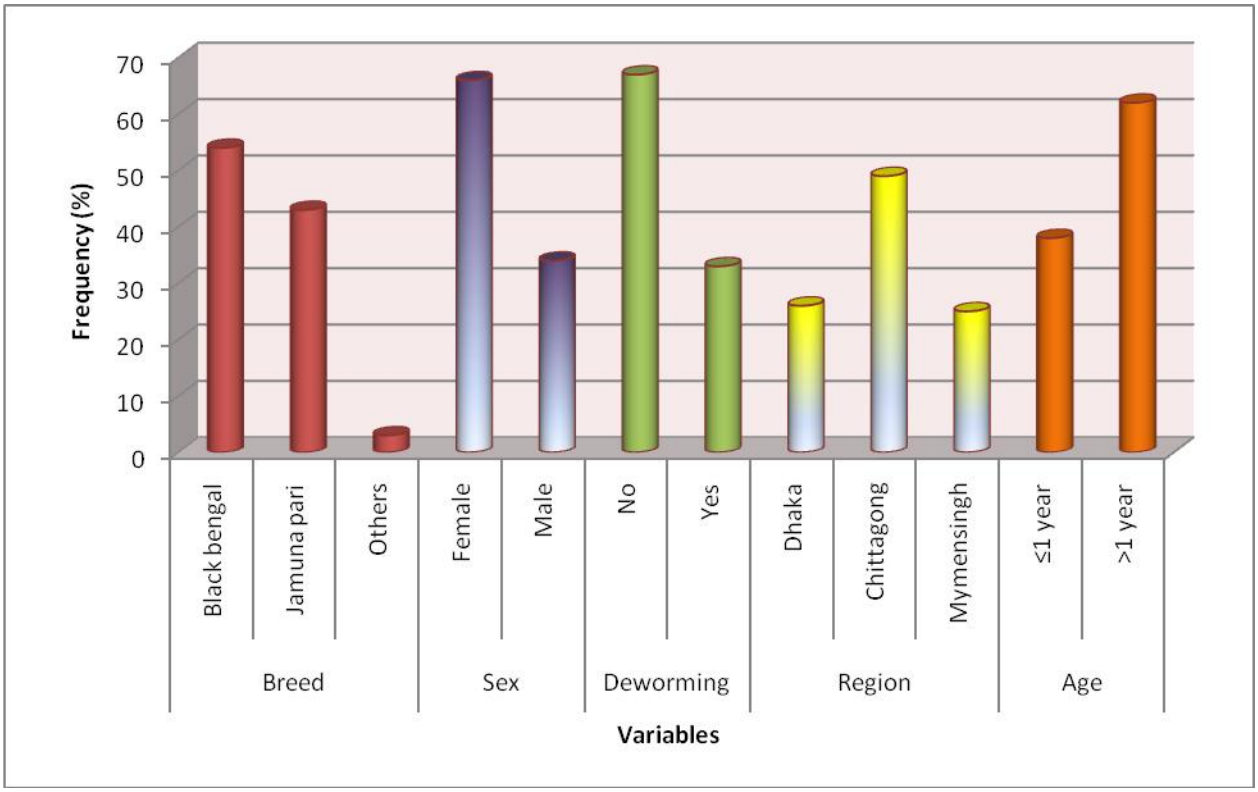



Figure 2: Descriptive statistics of the variables: breed, sex, deworming, region and age

Age and body weight of the subjects were collected. Before categorization, mean age of the animals were calculated. Mean age of the animals were nearly similar in Chittagong and Mymensingh (21.73±1.12 and 25.88±1.19, respectively). Mean age of the animals from Dhaka region was 13.28 (SE 0.89). Mean body weight of the animals from Chittagong and Dhaka region was nearly similar (Table 1) but lower mean weight was estimated for animals from Mymensingh (10.87±0.41). Narrower confidence intervals for all estimates were observed which might indicate an adequate sample size for the study.

Table 1: descriptive statistics of continuous variables

| **Continuous variables** | **Mean** | | | **SE** | | | **95% CI** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Ctg** | **Dhk** | **Msingh** | **Ctg** | **Dhk** | **Msingh** | **Ctg** | **Dhk** | **Msingh** |
| Age (month) | 21.73 | 13.28 | 25.88 | 1.12 | 0.89 | 1.19 | 19-23 | 11-15 | 23-28 |
| Body weight (kg) | 18.77 | 17.15 | 10.87 | 0.66 | 0.78 | 0.41 | 17-20 | 15-18 | 10-11 |

Ctg = Chittagong; Dhk = Dhaka; Msingh = Mymensingh; SE = Standard error; CI = Confidence interval

### 4.1.2 Overall prevalence of gastrointestinal parasites

Nearly similar prevalence of gastrointestinal parasites in selected study areas was recorded (figure 2). Highest prevalence of overall gastrointestinal parasitic infection in goats was recorded in samples from Central Veterinary Hospital, Dhaka (63.88%). A slightly lower prevalence was estimated in samples of Bangladesh Agricultural University Veterinary Hospital (Mymensingh) (62.13%). In S. A. Quaderi Teaching Veterinary Hospital overall prevalence was estimated as 59.43%. Around 40% goats were free from parasites in the study areas.

### 4.1.3 Prevalence on the basis of type of parasite (Trematodes, Nematodes and Cestodes):

Both nematodes **(38%) and trematodes (40%)** were highly prevalent in samples from Bangladesh Agricultural University Veterinary Hospital (Mymensingh). Samples from the other two study areas (Central Veterinary Hospital, Dhaka and S. A. Quaderi Teaching Veterinary Hospital) were more positive for nematodes (**66% and 49%,** respectively) but the prevalence of trematodes was not remarkable (6% and **& 2**%, respectively) in the mentioned areas. Prevalence of cestode was nearly similar in all three study areas (**lowest 3% and highest 8%)** (Figure 4).

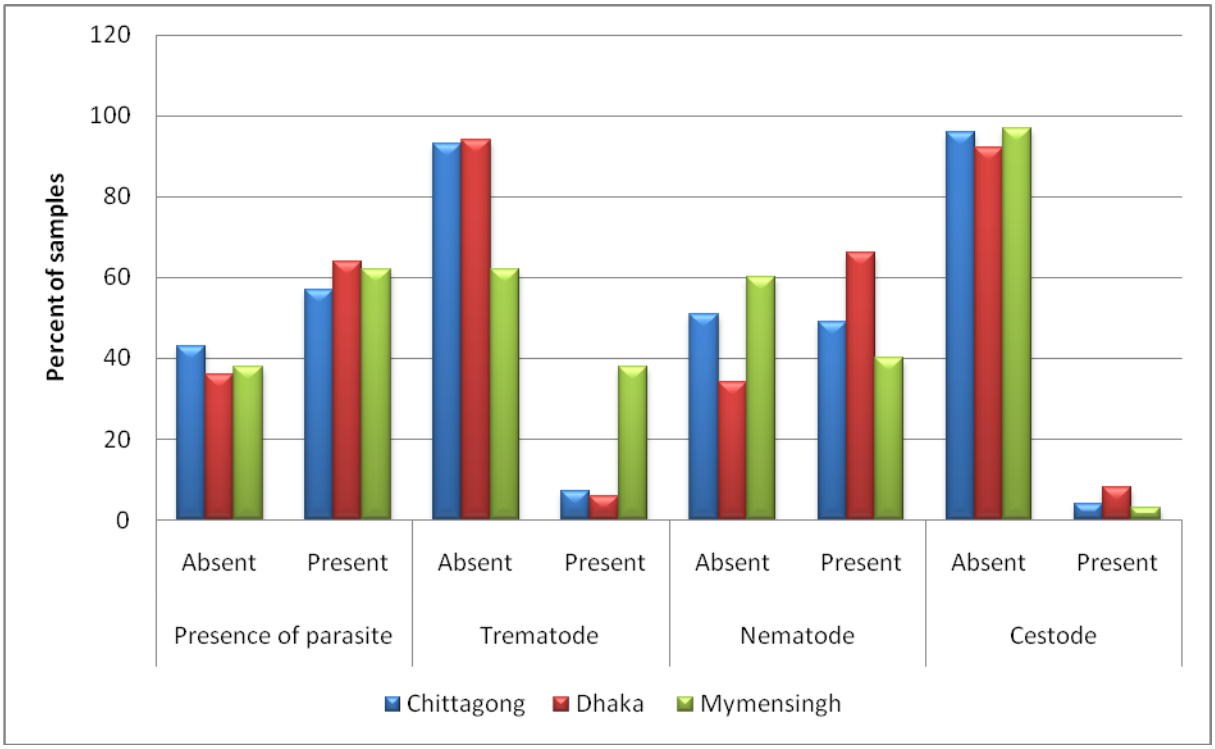



**Figure 3: Prevalence on the basis of type of parasite (Trematodes, Nematodes and Cestodes) stratified by study areas.**

### 4.1.4 Prevalence of different genus of gastrointestinal parasites in goat

Current study revealed highest prevalence for Haemonchus (**20.28%)** and lowest prevalence for Toxocara (0.9%) in S .A. Quaderi Teaching Veterinary Hospital of Chittagong. In Central Veterinary Hospital, Dhaka highest prevalence was recorded for **Haemonchus (39.81%)** and lowest for Trichuris (0.01%). On the other hand, in Bangladesh Agricultural University Veterinary Hospital (Mymensingh) the most prevalent parasite was Paramphistomum (24%) and lowest prevalence was estimated for Strongyloides and Cooperia (01%) (Figure 3).

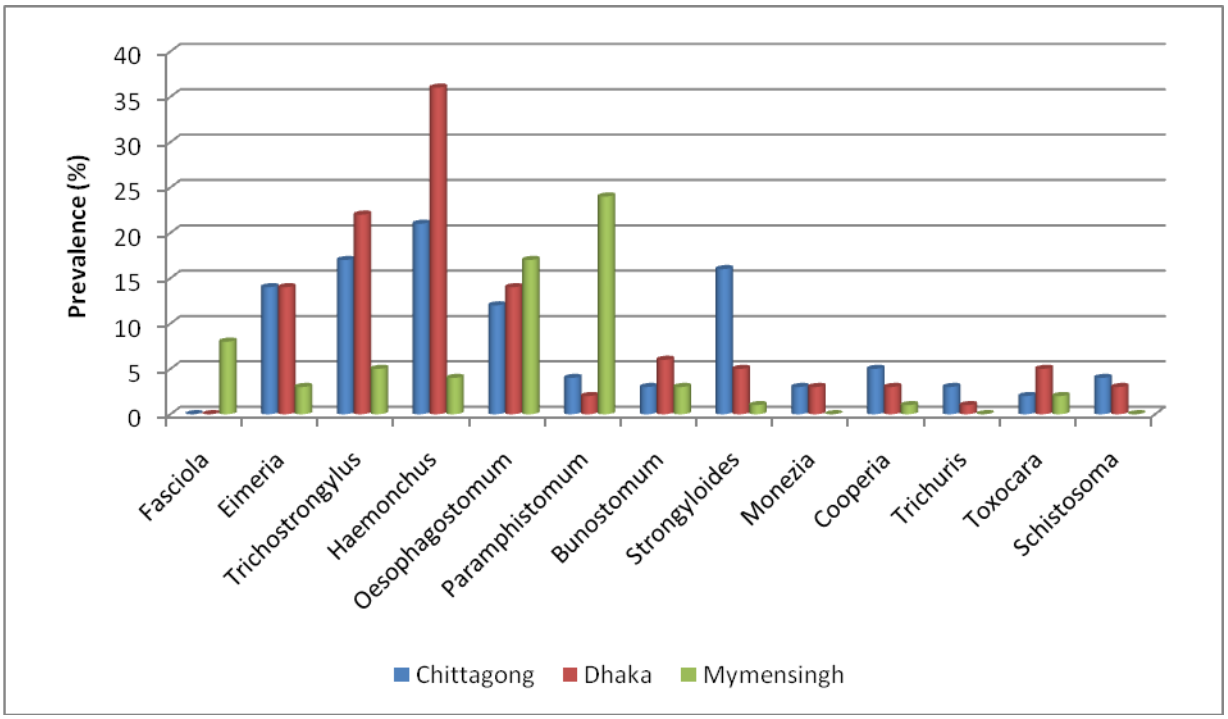



**Figure 4: Prevalence of different genus of gastrointestinal parasites in goat**

Considerably higher prevalence was recorded for Strongyloides (15.56%), Trichostrongylus (15.09%), Oesophagostomum (9.90%) and Eimeria (6.60%) than Paraphistomum, Bunostomum, Schistosoma and Moniezia infection in the population of S. A. Quaderi teaching Veterinary Hospital. Besides Haemonchus, higher prevalence was estimated for Trichostrongylus (24.07%), Eimeria (13.80%), Oesophagostomum (13.80%) and Strongyloides (6.48%) than Paramphistomum, Bunostomum, Schistosoma, Moniezia and Toxocara infection in samples from Central Veterinary Hospital, Dhaka. On the other hand, Oesophagostomum (17%), Fasciola (8%) and Trichostrongylus (5%) were more prevalent in samples from Bangladesh Agricultural University Veterinary Hospital (Mymensingh) in comparison with the prevalence of Bunostomum, Haemonchus, Eimeria and Toxocara (Figure 6).

### 4.1.5 Median, maximum, minimum, 25th and 75th quartile values of continuous variables (age and body weight) stratified by presence and absence of parasite

Box plot was created to show the difference in age and body weight in animals with and without parasitic infection. In the present study minimum age was 4 month and maximum age was 42 month for goats without parasitic infection, whereas, minimum and maximum age for the goats with parasitic infection were 3 months and 55 months, respectively. Minimum and maximum body weights in both groups of goats (with and without parasitic infection) were nearly similar (4 kg and 38 kg in without infection and 4 kg and 39kg in with GI parasitic infection) (Figure 4). However, there were some outliers who had extreme age and body weight (shown as dots).

Parasite infected 25% goats were of 10 months old with 10 kg body weight and 75% goats were of 30 months old with 20 kg body weight. Median age and median body weight for both groups of goats were nearly similar (Figure 4).

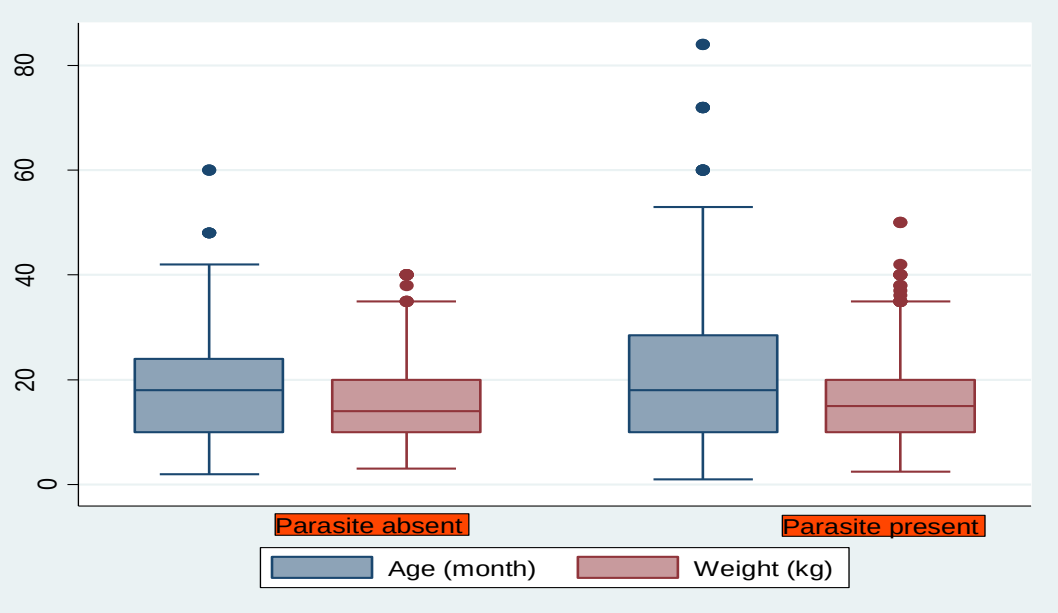



Figure 5: box plot of continuous variables (age and body weight), showing the median, maximum, minimum, 25th and 75th quartile values stratified by presence and absence of parasite.

Table 2: comparison of means of continuous variables (age and weight) between the groups of animals with and without gastrointestinal parasitic infection using t-test

| Variables | Parasitic infection | Mean | SE | 95% CI | P-value |
|---|---|---|---|---|---|
| Age | Present | 21.39 | 0.99 | 19-23 | 0.18 |
| | Absent | 19.43 | 0.99 | 17-21 | |
| Weight | Present | 16.70 | 0.57 | 15-17 | 0.28 |
| | Absent | 15.73 | 0.68 | 14-17 | |

We conducted a t-test analysis to identify if mean age and mean body weight was significantly different in groups of goats with and without gastrointestinal parasitic infection (Table 2). Mean age and body weight were slightly different in two groups of goats and the p-value of the t-test was not significant, indicates a less remarkable influence of age and body weight on the occurrence of parasitic infection in goat.

### 4.1.6 Relationship of different variables with presence of gastrointestinal parasites in goats

Chi square test was performed to identify the association of different variables with the presence of gastrointestinal parasites in goats. Prevalence was higher in females (63%) in comparison with males (56%), however variables were not significantly associated (p-value = 0.16) (Table 3). It can be concluded that the prevalence was similar in different breeds as the slight difference among the breeds were not statistically significant (p-value = 0.42). Higher prevalence (63%) was observed in group of animals who were not dewormed in comparison with the dewormed animals. Highest prevalence was observed in Dhaka region (68%) followed by Mymensingh (62%) and Chittagong (56%), association was not statistically significant though. After categorization, age was not significantly associated with the parasitic infection status of the animal, concordant with the previous analysis shown in Table 2.

Table 3: Relationship of different variables with the presence of gastrointestinal parasites

| Variables | Level | Number of observation (N) | Parasite present (%) | Parasite absent (%) | p-value |
|---|---|---|---|---|---|
| **Sex** | Female | 268 | 170 (63) | 98 (37) | 0.16 |
| | Male | 140 | 79 (56) | 61 (44) | |
| **Breed** | Black Bengal | 225 | 131(58) | 94 (42) | 0.42 |
| | Jamunapari | 171 | 110 (64) | 61 (36) | |
| | Others | 10 | 6 (60) | 4 (40) | |
| **Deworming** | Yes | 137 | 78 (57) | 59 (43) | 0.24 |
| | No | 272 | 171 (63) | 101 (37) | |
| **Region** | Chittagong | 204 | 115 (56) | 89 (44) | 0.12 |
| | Dhaka | 101 | 69 (68) | 32 (32) | |
| | Mymensingh | 103 | 64 (62) | 39 (38) | |
| **Age** | ≤ 1 year | 149 | 90 (60) | 59 (40) | 0.96 |
| | >1 year | 155 | 94 (61) | 61 (39) | |

We conducted Chi square tests to assess the association of different variables with the presence of commonly isolated parasitic genus. The analysis revealed that, there is a statistically significant varying prevalence of Haemonchus, Oesophagostomum, Paramphistomum and Trichostrongylus according to different regions (Table 4). Very low prevalence of Haemonchus was recorded in Mymensingh (4%) in comparison with other two regions (21% in Chittagong and 36% in Dhaka). On the other hand a very high prevalence of Paramphistomum was recorded in Mymensingh region (35%) in comparison to other regions (Table 4).

Prevalence of Haemonchus and Paramphistomum was significantly varied with breeds. High prevalence of Haemonchus was observed in Jamunapari (28%) but the prevalence of Paramphistomum was lowest in this breed (10%) in comparison with black Bengal and other non-descriptive breeds (Table 4).

Except Trichostrongylus, infection with other parasites showed no significant relationship with sex (Table 4). More female (18%) were infected with Trichostrongylus in comparison with male (11%).

Young animals were found more susceptible to Haemonchus (26%) in comparison with animals with more than one year of age (17%). The reverse was observed for Paramphistomum (2% in young and 18% in adults) (Table 4).

Table 4: Relationship of different variables with presence of Haemonchus, Oesophagostomum, Paramphistomum and Trichostrongylus

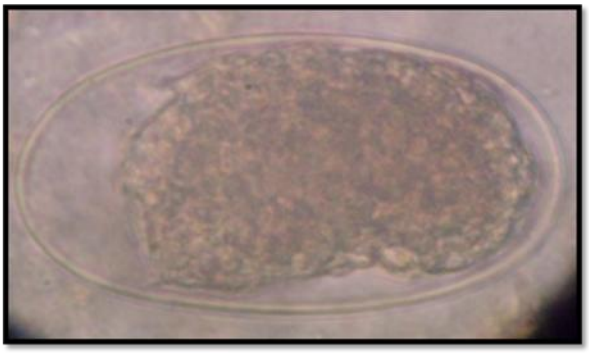
| Variables | Level | Haemonchus n (%) positive | Oesophagostomum n (%) positive | Paramphistomum n (%) positive | Trichostrongylus n (%) positive |
|---|---|---|---|---|---|
| Region | Chittagong | **44 (21)** | **25 (12)** | **9 (4)** | **33 (17)** |
| | Dhaka | **38 (36)** | **15 (14)** | **3 (3)** | **24 (22)** |
| | Mymensingh | **4 (4)** | **25 (24)** | **36 (35)** | **7 (7)** |
| Breed | Black Bengal | **36 (16)** | 38 (17) | **35 (15)** | 33 (15) |
| | Jamunapari | **49 (28)** | 26 (15) | **10 (6)** | 28 (16) |
| | Others | **1 (10)** | 1 (10) | **3 (25)** | 3 (25) |
| Sex | Female | 60 (22) | 47 (17) | 31 (11) | **49 (18)** |
| | Male | 26 (18) | 18 (13) | 17 (12) | **15 (11)** |
| Age | ≤ 1 year | **42 (26)** | 24 (15) | **3 (2)** | 28 (18) |
| | >1 year | **43 (17)** | 41 (16) | **45 (18)** | 35 (14) |

- Bold and Italic numbers within shaded boxes = significant relationship (p-value <0.05)

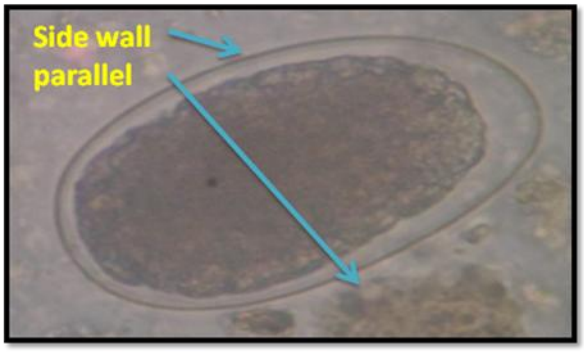
# Plate IV

Image01: Labelling of vials for collection of goat feces and Microscopic exam of goat feces.

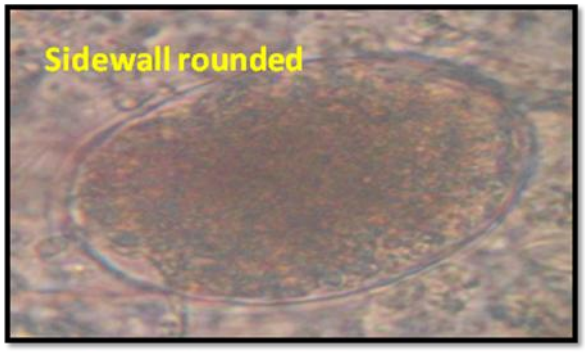
Egg of *Tricostrongulus spp*.



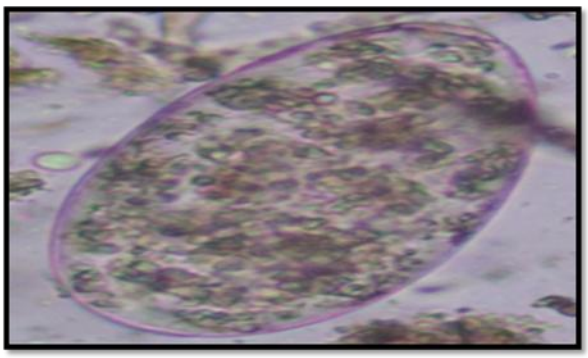
Egg of *Ostertagia spp*.



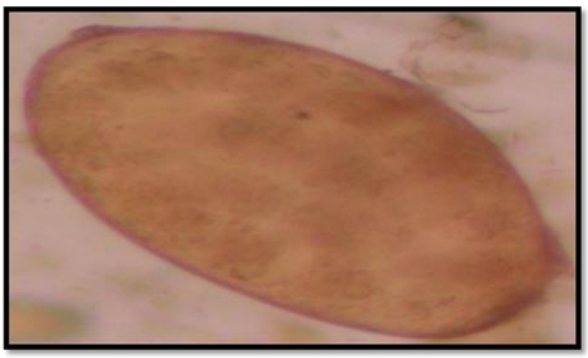

Egg of *Bunostomum spp*



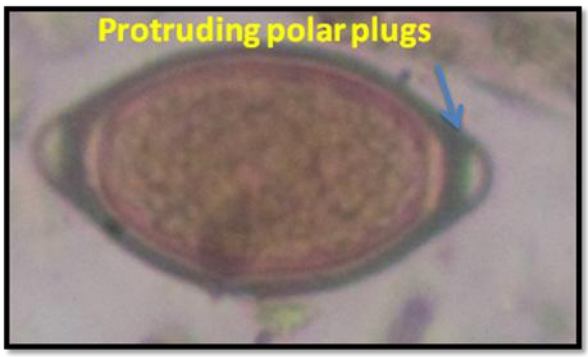

Egg of *Chabertia spp*.



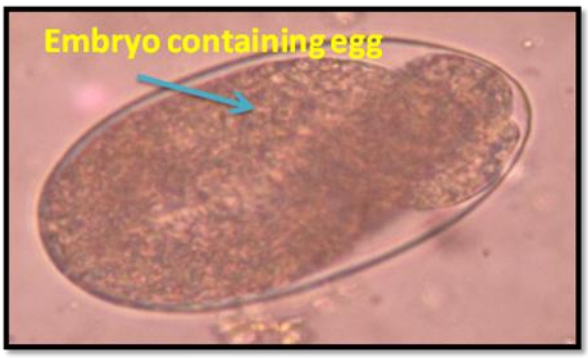
Egg of *Paramphistomum spp*



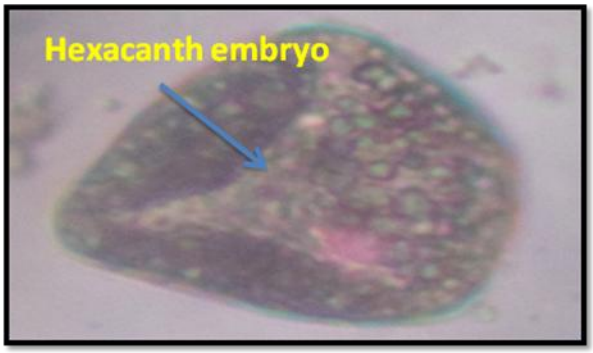
Egg of *Fasciola spp*



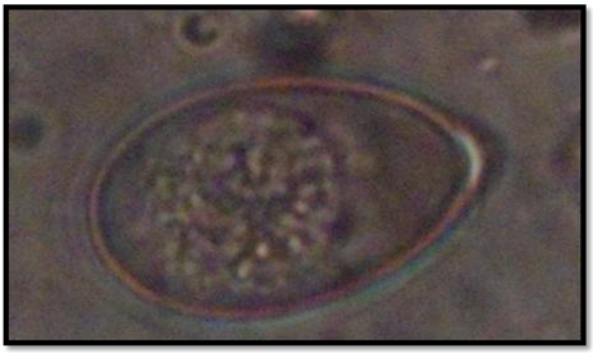

Egg of *Trichuris spp*




Egg of *Strongyloid spp*




Egg of *Moniezia spp*



Unsporulated oocyst of *Eimeria spp*

**Plate-IV: Microscopic pictures of eggs of some helminthes during this study.**

# CHAPTER-V

# DISCUSSION

**5. Prevalence study**

**5.1 Overall prevalence of gastrointestinal parasitic infections**

The overall prevalence of gastrointestinal parasitic infections in goats of this study showed consistency with the observation of Zeryehun *et al.* (2012), Hassan *et al.* (2011) ,Gadahi *et al.* (2008) who recorded 61.4% in small ruminant in Ethiopia, 63.41% in Black Bengal goat in Chittagong district, Bangladesh and 63.50% in sheep and goat in and around Rawalpindi and Islamabad, Pakistan, respectively. The earlier observation was partially consistent with the reports of Khajuria *et al*. (2012), Dagnachew *et al.* (2011), Biu *et al.* (2009) and Asif *et al.* (2008), who reported 67.24 % in Jammu province, Kashmir, 47.67% in Ethiopia, 58.0% in the University of Maiduguri research farm in Nigeria and 65.7% in Pakistan, respectively. Lower prevalence of gastrointestinal parasitic infections were recorded by Rehman *et al.* (2006), Muraleedharan (2005) who recorded 41.16% in Pakistan and 46.12% in India, respectively. On the other hand, observation of this study was greatly varied from Islam *et al.,* (2008) and Lima *et al.* (2003) who recorded 74.55% in different regions of Bangladesh and 82.00% in Brazil, respectively. Variation in the occurrence of gastrointestinal parasites infection might be due to geo-climatic conditions, sample size, breed, age, sex, plane of nutrition, stress, availability of intermediate host, vegetation, grazing pattern, rearing and husbandry measures, deworming, genetic resistance etc. (Hansen and Perry, 1990).

**5.2 Prevalence on the basis of type of parasite (Trematodes, Nematodes and Cestodes).**

Prevalence of trematodes in goats of veterinary hospital of BAU was partially in accordance with the observation of Opara *et al.* (2005) who recorded 13% in southeast Nigeria. Nematodes infection of this study in CVH was partially in agreement with the result of Opara *et al.* (2005) who observed 78.4% in Nigeria. Moreover, Prevalence of nematodes in goats of S. A. Quaderi Teaching Veterinary Hospital was partially consistent with the results of Ijaz *et al.* (2008) who recorded 42.67% in goats in Lahore, Pakistan. Variation in the occurrence of nematodes and trematodes might be due to geo-climatic conditions including sample size, availability of intermediate hosts and rearing pattern of the goats in the study areas (Alim *et al.,* 2012). On the other hand, infection rate of cestodes in goats of this current study showed harmony with the results of Opara *et al.* (2005) who recorded 8.7% in Nigeria. Lower prevalence of cestodes of this study might be due to less dissemination of eggs in the faces

from the gravid segments (Radostits *et al.,* 1994).

**5.3 Prevalence of different genus of gastrointestinal parasites in goats**

The highest prevalence of *Haemonchus* spp in goats was in accordance with the results of Uddin *et al.,* (2006) and Tehrani *et al.,* (2012) who recorded 39.79% in goats of Bandarban district of Bangladesh and 33.08% in sheep at Urmia respectively. The earlier result of this study greatly varied from Coelho *et al.,* (2012), Shahiduzzaman *et al.* (2003), Gadahi *et al*. (2008), Rajapakse *et al.* (2008), Lima *et al.* (2003), and Woldemariam (2003) who recorded 61. 65.63% in different regions in Bangladesh**,** 64.19% in Iran, 81% in Srilanka, 75.13% in Brazil and 95-100% in Ethiopia, respectively. Slightly lower prevalence of gastrointestinal parasites was recorded by Pathak *et al.* (2008) and Almalaik *et al*. (2008) in different regions of the world. Comparatively higher prevalence of *Haemonchus* spp in CVH and TVH of CVASU in compare to other. Favorable climatic conditions for the development of the free-living stages of the GI nematodes (Kantzoura *et al*., 2012).

Prevalence of *Paramphistomum* spp infection of this study was varied with the observation of Uddin *et al.* (2006) *and* Uddin *et al.* (1998) who recorded 65.28%, 56.66% in different regions in Bangladesh. The earlier observation also varied from the report of Pathak *et al.* (2008) who recorded 80.68% of Paramphistomiasis in India. Lower prevalence of *Paramphistomum* spp infection of this study might be due to geo-climatic conditions (Gupta *et al.,* 1987) or improved husbandry practices (Alim *et al.*, 2012).

Prevalence of *Trichostrongylus* spp in goats of CVH was consistent with the record of Coelho *et al.* (2012), Almalaik *et al.* (2008), Lima *et al.* (2006) and Waruiru *et al.*, (2005) who reported 20.79%, 24.4% in turkey, 24.32% in Brazil and 29% in Kenya, respectively. Khajuria *et al.* (2012), Nuruzzaman *et al.* (2012), recorded 13.67 % in Jammu province and 16.00% in Thakurgaon district, Bangladesh, 13.25% respectively which supported the prevalence observed in TVH, CVASU. Occurrence of *Trichostrongylus* spp infection in veterinary hospital of BAU was partially consistent with the findings of Howlader *et al.* (2012) and Gadahi *et al.* (2008) reported 6.67% in Sylhet district of Bangladesh and 4.51% in Pakistan. However, observation of this study varied from the report of Rajapakse *et al.*, (2008), Mulugeta et al., (2008), Kumsa *et al., (*2004), Woldemariam (2003) and Umur *et al.*, (2003) who recorded 59%, 48.8%, 40.2%, 83-100% and 40%, respectively in corners of the world. Comparatively higher prevalence of *Trichostrongyltus spp* of current investigation might be due to high susceptibility and survivality of pre-parasitic phages (Soulsby, 1982) as

well as poor husbandry practices (Alim *et al.*, 2012).

Prevalence of *Strongyloides* spp infection in CVH and Veterinary hospital of BAU of this study was found consistent with the report of Gadahi *et al*. (2008), Nwosu *et al.* (2007), Yadav *et al.* (2006), Jithendran *et al.* (2001) who recorded 3.22% , 4.1%, 1.15% ,4.8% in Iran, Nigeria, jammu district in Pakistan, India respectively. However, the observation of this study showed a discrepancy with reports of Hassan *et al.* (2011), Lima *et al.* (2003), Waruiru *et al.* (2005), Nwosu *et al.* (1996) who recorded 51.74% in Chittagong district, Bangladesh, 72.8%, 51.6%, 83% in Brazil, Kenya and Nigeria, respectively. Variation in occurrence of such infection in goat might be due to free living nature of the parasite and different bionomics of the parasites (Urquhart *et al.*, 1996 and Soulsby, 1982).

Prevalence of *Fasciola* spp infection of this study in the veterinary hospital of BAU was consistent with the observation of Khajuria *et al.* (2012) and Jithendran *et al.* (2001), who reported 8.2 % in middle Jammu province and 9.6% in India. Observation of this study showed a discrepancy with the report of Uddin *et al.* (2006) and Waruiru *et al.* (2005) who recorded 15.42**%** and 31.5% Kenya. Lower prevalence for *Fasciola* spp was recorded by Kantzoura *et al.* (2012), Gadahi *et al.* (2008), Mungube *et al.* (2006), Koinari *et al.* (2012) and Yadav *et al.* (2006) which partially supported the observed results of *Fasciola* spp in TVH, CVASU and CVH, Dhaka. Comparatively lower prevalence of *Fasciola* spp infection of this study might be due to geo-climatic condition or poor same size or less availability of specific snail host in the study area (Kakar MN and JK Kakarsulemankhel, 2008. and Bachal, 2002).

Prevalence of *Oesphagostomum* spp in three study areas was relatively consistent with result of Waruiru *et al.* (2005) who reported 13%. The earlier observation greatly varied with the observation of Mohanta *et al.* (2007), Uddin *et al.* (1998) who recorded 92%, 24.17% in different regions in Bangladesh. The observation also varied from the report of Rajapakse *et al.* (2008), Waruiru *et al.* (2005), and Woldemariam (2003) who recorded 88%, 13%, 33-83% in different corners of the world. In the present study, *Oesophagostomum* spp infection was observed low which might be due to the relatively long life cycle and low resistance to desiccation of the pre-infective stages of this genus (Pfukeny *et al*., 2007 and Rivera *et al*., 1983).

The prevalence of trichuris spp infection in goats of this study was partially consistent with the observation of Kantzoura *et al.* (2012), Koinari *et al.*, (2012), and Nwosu *et al.* (2007) who recorded 2.9% and 3.6% respectively in Greeche, Papua New Guinea and Thailand. The earlier observation was inconsistent with the reports of Radfar *et al.* (2011), Gadahi *et al.* (2008), Rajapakse *et al.* (2008), Asif *et al.* (2008) who reported 44.75% (Iran), 35.48 (Pakistan), 59% (Srilanka), 62.5% (Pakistan), respectively. Variation in the occurrence of Trichuris spp infection in this study might be due to geo-climatic conditions of the study areas as well as husbandry practices (Alim *et al.*, 2011).

Prevalence of *Moniezia* spp revealed by current study was consistent with the observation of Jithendran *et al.* (2001), Waruiru *et al.* (2005), Yadav *et al.* (2006), Mohanta *et al.* (2007) and Arkom *et al.* (2010), who recorded 2.7% sheep and goats of Himachal Pradesh of India, 2.5% in sheep and goats of Kenya, 0.96% in R.S. Pura, Bishnah and Samba tehsils of Jammu district, 2.66% in Mymensingh district of Bangladesh and 2.23% in Thailand. However, results of current study was not consistent with the reports of Nwosu *et al.* 1996, Uddin *et al.* 1998, Pathak *et al.* (2008), Lima *et al.* (2003) and Koinari *et al.* (2012) who observed 31% in Nigeria, 11.25% in Bandarban district of Bangladesh, 17.04% in the Veterinary College of Durg district, Chhattisgarh, 8.4% in Brazil and 9.1% in sheep and goats in Papua New Guinea. The Variation on the prevalence for *Moniezia* might be due to geo-climatic location, stocking density, deworming and less dissemination of eggs from the gravid segments (Radostits *et al.*, 1994).

Prevalence of *Eimeria* spp of this current study was in harmony with the reports of Koinari *et al.* (2012) Yadav *et al.* (2006) who observed 17.3% in sheep and goats in Papua New Guinea and 6.73 % in of Jammu district. The earlier result showed a discrepancy with the result of Regassa *et al.* (2004) and Koudela B *et.al.* (1998), Coelho *et al.* (2012) and Terefe *et al.* (2012) who recorded higher prevalence of such infection in different corners of the world. Adult showed lower susceptibility of *Eimeria* spp infection which might be the cause of lower prevalence of such infections in the study animals.

## 5.4 Relationship of different variables with presence of gastrointestinal parasites in goats

### 5.4.1 Age wise prevalence of parasitic infection:

In current study, influences of age on the occurrence of gastrointestinal parasitic diseases were observed. Prevalence of parasitic infection in goats more than 12 months of age of three study areas was consistent with the report of Hassan *et al.* (2011) and Uddin *et al.*, (2006) who noticed that older animals or goats are more infected by GI parasites than younger animals. However, the result of this study based on age category showed discrepancy with the result of Raza *et al*. (2010) who reported that younger animals (<12 months) are more susceptible to parasitic infection than older ones. In this study, higher prevalence of parasitic infection in adult goat might be due to keeping them for a longer period of time in breeding purposes or supply inadequate feed against their high demand. Besides this, maximum adult female animals were in pregnancy during this investigation which might be accounted for higher prevalence in adult. (Alim *et al.,* 2011 and Raza *et al.*, 2010).

### 5.4.2 Sex wise prevalence of gastrointestinal parasites:

Observed prevalence of gastrointestinal parasitic infection in female goats was consistent with the records of Uddin *et al.* (2006), Shahiduzzaman *et al.* (2003) and Tehrani *et al.* (2012) who observed that females showed more susceptibility to GI parasites infection than the males. Higher prevalence of GI parasitic infections in female animals of this study might be due to the variation in sample size, lowered resistance of female animals, temporary loss of acquired immunity near parturition stress, genetic resistance of host. (Bachal *et al.*, 2002).

### 5.4.3 Region wise prevalence of gastrointestinal parasites in goats

Prevalence of the gastrointestinal parasites infection varied in the three different regions of current study. Comparatively higher prevalence of parasitic infection was found in CVH of Dhaka than other two hospitals which might be due to sampling method, deworming history, rearing pattern of the goats .The overall prevalence GI parasitic infection was more in S.A. Quaderi Teaching Veterinary hospital was consistent with the result of Hassan *et al.* (2011) who reported 63.41% prevalence in Chittagong regions. Variation in the occurrence of GI parasitic infection in 3 different hospitals might be due to geo-climatic conditions, sample size, rearing pattern and husbandry practices.

### 5.4.4 Limitation of the study:

This study was carried out to determine the prevalence of helminth parasites seasonally butthe 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 leftuntouched due to time and cost factors so that future researchers can elaborate this study by approaching the untouched portion.

# CHAPTER-VI

## CONCLUSION

The study was performed aiming to determine the prevalence of gastrointestinal parasitic infections of goat .The study revealed comparatively higher prevalence of *Haemonchus* spp, *Oesophagostomum* spp, *Trichostrongylus* spp in TVH of CVASU and CVH of Dhaka and also revealed comparatively higher prevalence of *Paramphistomum* spp and *Oesophagostomum* spp in goats. The result of this current study will give epidemiological forecasting in the occurrence of such diseases in goat which will help the clinician in diagnosis of such infections. However, this study will make the way to take further study related to these diseases which will help to take necessary preventive and control measures against them. A well planed widespread investigation should be taken in future giving special emphasis on diversified tophography and seasons of this country.

# CHAPTER-VII

## REFERENCES


Alam, J. 1993. Livestock sector for more investment in Bangladesh. *Asian Livestock,* 18: 77-78.

Alim, M.A., Das, S., Roy, K., Sikder, S., Mohiuddin , Masuduzzaman, M., and Hossain, M.A. 2012. Prevalence of Gastrointestinal Parasites in cattle of Chittagong Division, Bangladesh, *Wayamba J. Anim. Sci.,4: 1-8.* ISSN: 2012-578X.

Almalaik, A.H.A., Bashar, A.E., and Abakar, A.D. 2008. Prevalence and Dynamics of Some Gastrointestinal Parasites of Sheep and Goats in Tulus Area Based on Post-Mortem Examination. *Asian J. Anim. Vet. Adv.,* 3: 390-399.

Anonymous. 2007. Bangladesh Economic Review. Economic Adviser's Wing, Finance Division, Ministry of Finance, Government of the People's Republic of Bangladesh. 21-22.

Asif, M., Azeem, S., Asif, S., and Nazir, S. 2008. Prevalence of Gastrointestinal Parasites of Sheep and Goats in and around Rawalpindi and Islamabad. *Pak. J. Vet. Anim. Sci*., 1: 14-17.

Bachal, B., Phullan, M.S., Rind, R., and Soomro, A.H. 2002. Prevalence of Gastrointestinal Helminths in Buffalo Calves. *Online J. Bio. Sci.*, 2(1): 43-45.

Bhuiyan, Dr.A.K.Fazlul.Haque., National Consultant Bangladesh. Dec. 2009. Study on the Status, Trends, Utilization and Performance of FAnGR and Their Wild Relatives, I.L.R.I, 50-51.

Biu, A.A., Maimunatu, A.F., Salamatu and Agbadu, E.T. 2009. A faecal survey of Gastro-intestinal parasites of ruminants on the University of Maiduguri Research Farm. *Int. J. Biomed. And Hth. Sci.,* 5(4): 112-115.

Chavhan, P.B., Khan,L.A., Raut, P.A., Maske, D.K., Rahman, S., Podchalwar, K.S., and Siddiqui, M.F.M.F. 2008. Prevalence of Nematode parasites of Ruminants at Nagpur. *Vet. World.,* 1(5): 140.

Coelho, W.M.D., Amarante, A.F.T.D., and Bresciani, K.D.S. 2012. Occurrence of gastrointestinal parasites in goat kids. *Rev. Bras. Parasitol. Vet., Jaboticabal*, 21(1): 65-67.

Dagnachew, S., Amamute and Temesgen, W. 2011. Epidemiology of gastrointestinal helminthiasis of small ruminants in selected sites of North Gondar zone, Northwest Ethiopia. *Ethiop. Vet. J.*, 15 (2): 57-68.

Dewan, M.L., Hossain, M.I., and Baki,M.A. 1979. Pathological investigation on the mortality of buffalo calves of Bangladesh. *Bang. Vet. J*., 13: 1-7.

DLS. 2010-11. FMD control initiatives in Bangladesh, by Dr. Md Mohsin Ali and Dr. Md Ainul Hoque**,** Annual report on livestock, Division of Livestock Statistics, Ministry of Fisheries and Livestock,Farmgate, Dhaka,Bangladesh. 4-21.

Eysker, M., and Kooman, F.N.J. 1993. Notes on necessary necropsy and herbage processing techniques for gastrointestinal nematodes of ruminants. *Vet. Parasitol*., 46: 205-213.

Gadahi, J.A., Arshed, M.J., Ali, Q., Javaid, S.B., and Shah, S.I. 2008. Prevalence of Gastrointestinal Parasites of Sheep and Goat in and around Rawalpindi and Islamabad, Pakistan. *Vet. World*., 2(2): 51-53.

Githigia, S.M., Thamsborg, S.M., Munyua, W.K., and Maingi, N. 2001. Impact of Gastro-intestinal helminths on production in goats in Kenia. *Small Rum. Res*, 42(1): 21-29.

Gupta, P.P., Singh, B., Mandal, P.C., Gill, B.S., and Grewal, G.S. 1978. A postmortem study of mortality pattern in adult buffaloes in Punjab. *Ind. J. Anim. Sci*., 48: 669.

Hansen J. and Perry B. 1990. *A Handbook.:The Epidemiology, Diagnosis and Control of Gastro-lntestinal Parasites of Ruminants in Africa.* I.L.R.A.D (International Laboratory for Research on Animal Diseases), Nairobi, Kenya., 121.

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

Hendrix & Sirois. 2006. Laboratory Procedures for Veterinary Technicians, 5th Ed., 812-814.

Hossain, M.J., Amin, M., Mostofa, M., Sharif, M., and Khalid, S.M.A. 1994. Efficacy of Levanid against natural gastrointestinal nematodiasis and paramphistomiasis in sheep. *The Bang. Vet*., 21 (2): 70-73.

Howlader, M.M.R., Akanda, M.R., Hossain, F.M.A., Uddin, M.N., Belal, S.A., and Ashad, F.A. 2012. Prevalence of gastro-intestinal nematodiasis in Black Bengal goat of Sylhet Govt. Goat Development Farm, Bangladesh. Journal of research in Biology, 3: 246-250.

Ijaz, M., Khan, M.S., Avais, M., Ashraf, K., Ali, M.M. and Saima. 2008. Infection Rate and Chemotherapy of Various Helminths in Goats in and around Lahore. *Pak. Vet. J.*, 28(4): 167-170.

Iqbal, Z., Akhtar, M., Khan, M.N., and Riaz, M. 1993. Prevalence and economic significance of haemonchosis in sheep and goats slaughtered at Faisalabad abattoir. *Pakistan J. Agric. Sci*., 30: 51-3.

Irfan, M. 1984. Key note address on effect of parasitism in lowering livestock population. *Pak. Vet. J.*, 4: 25-27.

Islam, K.B.M.S., and Taimur, M.J.F.A. 2008. Helminthic and protozoan internal parasitic infections in free ranging small ruminants of Bangladesh. *Slovenian Vet. Res.*, 45: 67-72.

Jithendran, K.P., and Bhat, T.K. 2001. Epidemiology and control of parasitism in nomadic situations in Hemachal Pradesh. *E.N.V.I.S Bulletin: Himalayan ecology and development*, 9(1): 5-13.

Kakar, M.N., and Kakarsulemankhel, J.K. 2008. Prevalence of endo (trematodes) and ecto-parasites in cows and buffaloes of Quetta, Pakistan. *Pak. Vet. J.*, 28(1): 34, 34-36.

Kamal, A.H.M., Uddin, K.H., and Rahman, M.L. 1991. Prevalence of gastro-intestinal nematodes in goat at Chittagong hill areas of Bangladesh. *A.J.A.S.*, 6(3): 343-345.

Kantzoura, V., Kouam, M.K., Theodoropoulou,H., Feidas, H., and Theodoropoulos, G. 2012. Prevalence and Risk Factors of Gastrointestinal Parasitic Infections in Small Ruminants in the Greek Temperate Mediterranean Environment .*Open Journal of Veterinary Medicine*, 2: 25-33.

Khajuria, J.K., Katoch,R., Yadav, A., Godara, R., Gupta, S.K., Singh, A. 2012. Seasonal prevalence of gastrointestinal helminths in sheep and goats of middle agro-climatic zone of Jammu province. *J. Parasite. Dis.*, 37(1): 21-25.

Khan, M.N., Sajid, M.S., Khan, M.K, Iqbal, Z. and Hussain, A. 2010. Gastrointestinal helminthiasis: prevalence and associated determinants in domestic ruminants of district Toba Tek Singh, Punjab, *Pak. Parasitol.Res.*, 107(4): 787-794.

Koinari, M., Karl, S., Ryan, U., and Lymbery, A.J. 2012. Infection levels of gastrointestinal parasites in sheep and goats in Papua NewGuinea. *Journal of Helminthology*, 1-7.

Koudel, B., and Boková, A. 1998. Coccidiosis in goats in the Czech Republic. *Vet Parasitol.*, 76(4): 261-7.

Krecek, R.C., Groeneveld, H.T., and Maritz, J.I. 1992. A preliminary study of the effect of microclimate on the third-stage larvae of *Haemonchus contortus* and *Haemonchus placei* on irrigated pasture. *International Journal for Parasitology* , 22: 747-752.

Kumsa, B., and Wossene, A. 2006. Abomasal nematodes of small ruminants of Ogaden region, eastern Ethiopia: prevalence, worm burden and species composition. *Revue Med. Vet.*, 157(12): 27.

Lima, M.M., Faustino, M.A.G., Santana, V.L.A., Santos, N.V.M. and Alves, L.C. 2003. Evaluation of gastrointestinal helminth infection in goats from the metropolitan area of Recife ,Pernambuco State, Brazil, through faecal egg count and larval culture. *Revista Brasileira de Ciencia Veterinaria,* 10(3): 140-144**.**

Miller, H.R. 1987. Gastrointestinal mucus, a medium for survival and for elimination of parasitic nematodes and protozoa. *Parasitol.,* 94: S77-S100.

Mohanta, U.K., Anisuzzaman, Farjana, T., Das, P.M., Majumder, S., and Mondal, M.M.H. 2007. Prevalence, population dynamics and pathological effects of intestinal helminthes in Black Bengal goats. *Bangl. J. Vet. Med.,* 5(1&2): 63–69.

Mondal, M.M.H., and Islam, MK. 1997. Prevalence and pathological effects of *Trichuris* infection in Black Bengal goats. *Bangl. Vet. J.,* 28: 15-20.

Mondal, M.M.H., Islam, M.K., Hur, J., LEE, J.H. and Baek, B.K. 2000. Examination of gastrointestinal helminth in livestock grazing in grassland of Bangladesh. *Kor. J. Parasitol.,* 38(3): 187-190.

Mulugeta, Y. 2008. 'A study on ectoparasites of small ruminants in selected sites of Tigray regional state and their impact on the tanning industry', MSc thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.Onderstepoort Journal of Veterinary Research,79(1): 442.

Mungube, E.O., Bauni, S.M., Tenhagen, B.A., Wamae, L.W., Nginyi, J.M., and Mugambi, J.M. 2006. The prevalence and economic significance of *Fasciola gigantica* and *Stilesia hepatica* in slaughtered animals in the semi-arid coastal Kenya. *Trop. Anim. Health. Prod*., 38(6): 475-483.

Muraleedharan, K. 2005. Prevalence of gastrointestinal parasites of livestock in a central dry zone of Karnataka. *J. Vet. Parasitol.,* 19(1): 31-33.

Ndao, M., Belot, J., Zinsstag, J., and Pfister, K. 1991. Epidemiology of gastro-intestinal helminthiasis in small ruminants in the tree-cropping pasture zone in Senegal. *Vet Res.,* 26: 132-139.

Nuruzzaman, M., Haque, M.H., Sarker, S., and Begum, N. 2012: Abomasal Nematodes in Goats Slaughtered at Different Abattoir of Thakurgaon District, Bangladesh. *J. Sci. Res*. 4(2): 491-497.

Nwosu, C.O., Ogunrinade, A.F., Fagbemi, B.O. 1996. Prevalence and seasonal changes in the gastrointestinal helminthes of Nigerian goats. *J. Helminthol*., 70: 329-333.

Nwosu, C.O., Madu, P.P., and Richards, W.S. 2007. Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi-arid zone of North- Eastern Nigeria. *Vet. Parasitol*, 144: 118–124.

Opara, M.N., Nwaobasi and Okoli,I.C. 2005. Occurrence of parasitic helminthes among small ruminants reared under traditional husbandry system in Owerri, South east Nigeria, *Bulletin of animal health and production in Africa*, 53: 226-233.

Pathak, A.K., and Pal, S. 2008. Seasonal Prevalence of Gastrointestinal Parasites in Goats from Durg District of Chhattisgarh, India.*Veterinary world*, 1(5): 136-137.

Pfukenyi, D.M. and Mukaratirwa, S., Monrad, J. 2007. Epidemiological studies of parasiticastrointestinal nematodes, cestodes and coccidia infections in cattle in the highveld and lowveld communal grazing areas of Zimbabwe. *Onderstepoort J. Vet. Res.*, 74: 129-142.

Radfar, M.H., Sakhaee, E.S., Bafti, M., and Mohammadi, H.H. 2011. Study on gastrointestinal parasitic infections of Raeini goats Shiraz University. *I.J.V.R.,* 12(1): 2011.

Radostits, O.M., Blood, D.C., and Gay, C.C. 1994. Diseases caused by helminth parasites. *Veterinary Medicine: A textbook of diseases of cattle, sheep, pigs, goats and horses, 8$^{th}$ edn.* Balliere Tindall Publication, London. 1223-1230.

Rahman, A., Ahmed, M.U., and Mia, A.S. 1975. Studies on the diseases of goats in Bangladesh: mortality of goat~ under farm and rural conditions. *Trop. Anim. Health. Prod.,* 8: 90.

Rahman, W.A., and Hamid, S.A. 2007. Morphological characterization of *Haemonchus contortus* in goats (*Capra hircus*) and sheep (*Ovis aries*) in Penang, Malaysia. Tropical Biomedicine, 24(1): 23-27.

Rajapakse, R.P.V.J., Faizal, A.C.M., Horadagoda, N.U., Dharmawrdana, I.V.P., and Paranagama, W.D. 2008. An abattoir study on the prevalence of gastrointestinal nematodes of goats in the dry zone of Sri Lanka. *J. Natn. Sci. Foundation,* 28(4): 265-275.

Raza, MA., Murtaza, S., Bachaya, H.A., Dastager, G., and Hussain, A. 2010. Point prevalence of haemonchosis in sheep and goats slaughtered at multan abattoir. *J. Ani. & Plant Sci*., 19(3): 158-159.

Regassa,F., Sori, T., Dhuguma, R., and Kiros, Y. 2004. Epidemiology of Gastrointestinal Parasites of Ruminants in Western Oromia, Ethiopia. *Intern. J. Appl. Res. Vet. Med., 4*(1): 57-64.

Rehman, N.U. and Ali, A. 2006. Month wise prevalence of gastro-intestinal trematodes, cestodes and nematodes infecting Damani Sheep and goats in District D.I .Khan, Pakistan. *Pakistan Veterinary Journal*, 21(2): 111-113.

Rivera, B., Parra, D., Garcia, O., and Aycardi, E. 1983. Gastrointestinal parasites in calves in Colombia. *Trop. Anim. Health Prod.*, 15: 107-114.

Sardar, S.A., M, A. Ehsan., Anower, A.K.M.M., M, M.Rahman., and M, A.Islam. 2006. Incidence of liver flukes and gastro-intestinal parasites in cattle. *Bangl. J. Vet. Med*., 4(1): 39-42.

Shahiduzzaman, M.A., M, A.Alim., M, Rahman., and M, H.Mondal. 2003. Seasonal influence on the occurrence of *Haemonchus contort* infections in slaughtered Black Bengal goats in Bangladesh. *Bangl. J. Vet. Med*., 1 (1): 45–48.

Sharkhuu, T. 2001. Helminths of goats in Mongolia. Veterinary Parasitology, 101(2, 5): 161-169.

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

Sissay, M.M., A, Asefa., A, Uggla., P, J.Waller. 2006. Anthelmintic resistance of nematode parasites of small ruminants in eastern Ethiopia: exploitation of refugia to restore anthelmintics efficacy. *Vet. Parasitol.*, 135, 337-346.

Solismaa, M., S, Laaksonen., M, Nylund., E, Pitkänen., R, Airakorpi., and A, Oksanen. 2008.Filarioid nematodes in cattle, sheep and horses in Finland. *Acta. Vet. Scand.*, 50: 20.

Soulsby, E.J.L. 1982. Helminths, Arthropods and Protozoa of Domesticated Animals, 7th edn. Baillere Tindall, London, 707-717, 729-735.

Speedy, A.W. 1992. Progress in sheep and goat research, C.A.B. International, Wallingford, Oxon., U.K., 179-188.

STATA Corp, version 12. Stata Statistical Software. Release. Stata Corp LP, College Station, Texas.

Tehrani, A., J, Javanbakht., M, Jani., F, Sasani., A, Solat., M, Rajabian., F, Khadivar., H, Akbari., and M, Mohammadian. 2012. Histological study of Haemonchus contortus in Herrick sheep abomasums. *J. Bacteriol. Parasitol.*, 3: 144.

Terefe, D., D, Demissie., D, Beyene., and S, Haile. 2012. A prevalence study of internal parasites infecting Boer goats at Adami Tulu Agricultural Research Center, Ethiopia. *J.V.M.A.H.*, 4(2): 12-16.

Uddin, M.Z., T, Farjana., N, Begum., and M, M.H.Mondal. 2006. Prevalence of amphistomes in Black Bengal goats in Mymensingh district. *Bangl. J. Vet. Med*., 4 (2): 103–106.

Umur, S., and B, A.Yukuri. 2006. Seasonal Activity of Gastro-Intestinal Nematodes in Goats in Burdur Region. *Turk. J. Vet. Anim. Sci*, 29: 441-448.

Urquhart, G.M., Armour, J., J, Duncan, L., Dunn, A.M., Jennings, F.W. 2000. Tricostrongyloidae. Veterinary Parasitology, 2nd edn; Blackwell Science Ltd. London, 1(1): 19-22.

Urquhart, G.M., Armour, J., J, Duncan, L., Dunn, A.M., Jennings, F.W. 1996. Rhabditoidea. Veterinary Parasitology, 2nd Edition. Blackwell Science Ltd. London, 1(4): 66.

Vatta, A.F., and R, C.Krecek. 2000. Trematode infection of goats farmed under resource-poor conditions in South Africa. *Veterinary Parasitology*, 69(4): 103, 119-131.

Waller, P.J. 2004. Management and control of nematode parasites of small ruminants in the face of total anthelmintic failure. *Trop. Biomed*., 21: 7-13.

Wanjala, K., J, Chemuliti., F, D.Wesonga., L, Munga., P, Ngare., G, A.Murilla., and J, O. Wesongah. 2002. Prevalence of parasitic infection in small ruminants in a pastoral community in Narok district, Kenya. *Bulletin of Animal Health Production*, 53: 218-225.

Waruiru, R.M.,R, O.Otieno., and M, N.Mutune. 2005. Gastro-intestinal parasitic infections of sheep and goats in semi-arid areas of Machakos district, Kenya. Bulletin of animal health and production in Africa, 53: 25-34.

Woldemariam, D.L. 2003. Nematodes prevalence, helminth management practices and anthelmintic resistance in small ruminants in Mid-rift valley of Ethiopia. *University of Pritoria Thesis and Desertation,U.Pe.T.D.,* 4(4): 43- 44.

Yadav, A., J, K.Khajuria., A, K.Raina. 2006. Seasonal prevalence of gastrointestinal parasites in sheep and goats of Jammu. *Indian.Vet. J.*, 20: 65–68.

Yadav, C.L., P,S.Banerjee., Y, Garg and S, Vatsya. 2005. All India network program on gastrointestinal parasitism establishment of epidemiology of important parasitic diseases *J.Vet.Parasitol.*89(9): 1518-1523.
Retrieved from http:// www. helminthparasitespectruminnorth-eastindia.com.

Zeryehun, T. 2012.Helminthosis of sheep and goats in and around Haramaya, Southeastern Ethiopia. J. Vet. Med. & Anim. Helth., 4(3): 48–55.