COMMON HEMO-PARASITIC INFECTION WITH THEIR PREVALENCE IN GOAT IN CHITTAGONG CITY

A Clinical report submitted by

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LIST OF ABBREVIATIONS AND SYMBOLS

<	= Less than
>	= Grater than
≤	= Less than or equal
≥	= Greater than or equal
CVASU	= Chittagong Veterinary and Animal Sciences University
DLS	= Department of Livestock Services
GDP	= Gross Domestic Products
SAQTVH	= Shahedul Alam Quadery Teaching Veterinary Hospital

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The author

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ABSTRACT

The study was carried out for a period of 50 days from 11th November to 30th December 2012 to measure the proportional prevalence of blood parasitic diseases in goat in Chittagong city and to identify the risk factors associated with blood parasitic diseases. A total of 100 goats were included for epidemiological study, laboratory examination and statistical analysis. The epidemiological survey of this study was carried out using preset questionnaires, for laboratory examination peripheral blood smears from ear vein were prepared from goat in Chittagong city. Result revealed that the proportional prevalence of anaplasmosis is 4%. Host risk factors such as types of animal, age and presence of ectoparasites were investigated for the possible association with frequency of blood parasitic diseases. The proportional prevalence of anplasmosis in male and female animals was 2.6% and 4.9%. At the age of below 6 months of goats were more infected (11.1%) with anaplasma organism than other groups. The prevalence of ectoparasite infestation was 33% in goat.

Keywords: Goat, Hemo-parasitic diseases, Age, Sex, Ectoparasites.

CHAPTER I
INTRODUCTION

Livestock is one of the most potential sub-sector of agriculture in Bangladesh which plays an indispensible role to promote human health and national economy of the country. Livestock not only assist to upgrade the financial condition but also made a substantial contribution to human nutrition.

In recent years, there has been increasing recognition of the importance of livestock to the poor, with estimates indicating that at least 70% of the rural poor depend on livestock for part of their livelihoods (Livestock In Development, 1998). As such, there is an increasing demand for a better understanding of the role of livestock in poverty reduction. In the past, the focus of most livestock development projects has been on raising production levels through better disease control and the introduction of such new technologies as fodder plants, breeds of livestock, equipment or management practices. However, most interventions did not have an explicit focus on the poor (Livestock In Development, 1998) and little information has been generated on the impact of livestock-oriented projects on the rural poor. With regard to animal health, little is known about the impact of specific diseases on poor households or indeed, about the differing needs of the poor as consumers of animal healthcare (Heffernan and Misturelli, 2000).

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 22.9 million cattle, 1.2 million buffalo, 20.8 million goat and 2.7 million sheep (DLS, 2007).

The total contribution of livestock sub-sector to Gross Domestic Product (GDP) in Bangladesh is approximately 7.2%, livestock in agricultural production 17.3%. It also generated 13% of foreign currency and provided 20% fulltime employment and 50% partial employment of rural population (Alam, 1993).

Goat rearing is an integral part of many farming systems in Bangladesh. The goat is probably the only animal which in Bangladesh is managed for multiple end uses: meat, hides, milk and manure. It provides one of the main sources of income for the farmers of Bangladesh. It is a major contributor of protein and fat and often the goat enterprise can help farmers to overcome an unforeseen crisis, which demands immediate finance. Black Bengal goat is a very useful small livestock in Bangladesh. It is a great source of income for the poor people of Bangladesh. (Agricultural Revolution, 2013). The skin of the Black Bengal goat in particular is unique throughout the world (Banerjee, 1980).

Bangladesh is a moderately hot and humid country with short winter and prolonged rainy season. The geo-climatic condition of Bangladesh is suitable for the development and survival of various parasites. Among the parasites, tick (ectoparasites) and endoparasites are very common. Tick is notorious ectoparasites which have wide host range and attacks various animals, birds and also man. They are voracious blood suckers regardless sex and developmental stage. They continuously suck blood for long time, usually for 3-5 (Kettle, 1995) days resulting anaemia, malnutrition, and eventually reduce productivity of the host (Soulsby, 1982).

Ticks and tick borne diseases (TTBDs) are widely distributed throughout the world particularly in tropical and subtropical countries. Endemic diseases such as tick-borne diseases particularly theileriosis, babesiosis and anaplasmosis which have considerable economic importance locally and regionally but are non–threatening internationally (McCosker, 1979).

Piroplasmosis, a tick-borne hemoprotozoal disease is a major constraint on livestock health and production. Theileriosis and babesiosis are common in tropical and subtropical countries and lead to meat and milk production losses in ruminants (Uilenberg, 1995). Identification of Theileria and Babesia species is based on morphology, host specificity, transmission mode, tick vector competency and epidemiological data. As different species share a similar morphology and tick vector data are not always available, differential diagnosis for a particular species is difficult. Information regarding to the epidemiology of tick-borne hemoprotozoan diseases, such as dynamics of transmission by the tick vector, is important for the development of effective control strategies (Morzaria *et al*., 1992). In addition to information about the prevalence of the

diseases in ruminants, the detection and discrimination of these species in tick vectors are also important for the epidemiology of theileriosis and babesiosis.

The hot and humid weather of Bangladesh favors the growth and multiplication of arthropods vector like tick, flies, mosquitoes that are responsible for transmission of different causative agents from diseased animal to healthy animal resulting different disease including babesiosis, anaplasmosis, theilleriosis etc. Babesiosis, anaplasmosis, theilleriosis are distributed worldwide, have got a serious economic impact due obvious reason of death , decreased production and lowered working efficiency and acting as serious economic challenge, particularly in developing countries (Uilenberg, 1955) . these diseases not only acts as serious constrains in the productivity of animal but also involve in zoonoses (such as *Babesia divergens, Babesia microti)* (Sparangano, 1999) Prevalence of blood protozoa such as *Babesia bigemina, Babesia divergens , Theileria annulata, Theileria mutans* and blood rickettsia such as *Anaplasma marginale*, *Anaplasma centrale*, has been reported in animals of Bangladesh (Ahmed, 1976; Samad and Gautam, 1984).

Anaplasmosis is an infectious disease of cattle caused by several species of the blood parasite *Anaplasma*. *A. marginale* is the most common pathogen of cattle. Sheep and goats are much less commonly affected. Anaplasmosis is also called "yellow bag" or "yellow fever" as affected animals can develop a jaundiced appearance. Anaplasmosis is seen worldwide (Smith, 2002).

Anaplasmosis is a tick transmitted haemorickettsial infection and babesiosis is tick transmitted haemoprotozoan infection of cattle. Both diseases have got a serious economic impact due to obvious reason of death, decreased production and lowered working efficiency. Both diseases have been reported in Bangladesh. The agro-ecological and geoclimatic conditions of Bangladesh are highly favourable for growth and multiplication of ticks which act as natural vectors of babesiosis and anaplasmosis (Ahmed, 1976; Samad and Gautam, 1984).

There are many research works are done on Hemo-parasitic diseases at different region in Bangladesh but veterinary clinical based works are not available which is very important. The study was undertaken in Chittagong city, Bangladesh with the following objectives-

Objectives of the study:

1) To know the prevalence of hemo-parasitic diseases in goat in Chittagong city.
2) To know the relationship between ectoparasites and hemo-parasitic diseases.
3) To know the prevalence of hemo-parasitic diseases based on age and sex of the animal.

CHAPTER II
REVIEW OF LITERATURE

Climatic condition of Bangladesh favours the tick population, which are vectors of various tick borne diseases. Prevalence of tick borne protozoan parasites such as *Babesia bigemina, Theileria mutans, Anaplasma centrale, Anaplasma marginale, Babesia bovis, Babesia gibsoni, Babesia canis and Theileria ovis* has been reported in animals of Bangladesh. Therefore, few important literatures related to these diseases are reviewed here.

2.1: Anaplasmosis

Bram (1983) found that anaplasmosis is characterized by fever, severe anemia, jaundice, brownish urine, loss of appetite, dullness or depression, rapid deterioration of physical condition, muscular tremors, constipation, yellowing of mucous membrane and labored breathing.

Merck Veterinary Manual (1997) published that anaplasmosis, formerly known as Gall sickness, traditionally refers to a disease of ruminants caused by obligate intra-erythrocytic bacteria of the order Rckettsiales, family Anaplasmataceae, genus Anaplasma. Cattle, sheep, goat, buffalo and some wild ruminants can be infected with the erythrocytic anaplasma.

2.2: Etiology of anaplasmosis

Bram (1983) found that there are many anaplasma species parasites but *Anaplasma marginale* and *Anaplasma centrale* are the most important species. Goat anaplasmosis is usually caused by *Anaplasma marginale* .

Ristic and Weinman (1968) mentioned that clinical anaplasmosis is usually caused by *Anaplasma marginale*. Goat is also infected with *Anaplasma centrale*, which generally results in mild disease.

2.3: Epidemiology of Anaplasmosis:

2.3.1: Geographical occurrence:

Smith (2002) showed that anaplasmosis is seen worldwide and has been reported in at least 40 states in the USA.

Gautam *et al*. (1982) that the animals show clinical diseases under stress of certain intercurrent diseases, inclement weather, pregnancy and lactation. The exotic and to lesser extent crossbred animals are fully susceptible. The disease causes direct losses due to prolonged period of convalescence, low productivity and mortality.

Blood *et al.* (1968) found that anaplasmosis is transmitted by a diverse group of biological and mechanical vectors. Infection in goat is endemic in tropical and subtropical areas that support large population of these vectors. Infection occurs sporadically in temperate climate areas.

Lew and Jorgensen (2005) mentioned that anaplasmosis occurs in tropical and subtropical regions worldwide (~40° N to 32° S), including Asia.

2.3.2: Mode of infection

Ristic and Weinman (1968) mentioned that anaplasma is one of the most important parasites transmitted by at least 20 ticks species, including *Argas persicus, Ornithodoros lahorensis, Boophilus annulatus, B. decoloratus, B. microplus, Dermocentor albipictus, D. andersoni, D. accidentalis, D. variabilis, Hyalomma excavatum, Ixodes ricinus, Rhipicephalus bursa, R. sanguineus and R. simus* (Marchette and Stiller, 1982) but mostly *Boophilus microplaus* causing Anaplasmosis (TFRC, 1996). Various other biting arthropods have been implicated as mechanical vectors. Experimental transmission has been demonstrated with a number of species of *Tabanus* (Horse fly) and with mosquitoes of the genus Psorophora.

Ristic (1996) found that the experimental and epizootiological evidence incriminates horse flies (*Tabanus* spp.) as the most significant insect vector of Anaplasmosis. Transmission by flies is affected by direct transfer of blood from infected to susceptible cattle and must take place within a few minutes after feeding on an infected animal.

Blood *et al.* (1968) reported that anaplasmosis is spreaded from animal occurs chiefly by insect vectors. A variety of arthropods may act as vectors but significant natural vectors are vectors are ticks in the family Ixodidae and flies in the family Tabanidae. Of ticks, the one –host Boophilus spp. are major importance in tropical and subtropical regions and three- host Dermocentor spp. major importance in the Western USA.

Merck Veterinary Manual (1996) published that numerous species of tick vectors (*Boophilus, Dermocentor, Rhipicephalus, Ixodes, Hyaloma and Ornithodoros*) can transmit Anaplasma spp. after feeding on an infected animal, intrastadial transmission may occurs. Transplacental

transmission has been reported and is usually associated with acute infection of the dam in the second or third trimester of generation. Anaplasmosis may also be spread through the use of contaminated needles or dehorning or other surgical instruments.

Soulsby (1986) found that transmission by blood sucking flies is well recognized and Tabanids deer flies, stable flies and mosquitoes are the insects chiefly concerned. Direct transfer of infected blood must take place for insect transmission and this must occur within a few minutes after feeding on an infected animal. Mechanical transmission of Anaplasmosis is well known and major and minor operation operations in cattle husbandry such as dehorning, castration, vaccination, blood sampling etc. may be responsible for the transmission of Anaplasmosis both in and out of season.

2.4: Risk factors:

2.4.1: Susceptible host

Blood *et al*. (1968) mentioned that breeds with black or red coat color have a higher risk of infection than those with white coats in regions where biting flies are the insect vectors. Dairy breeds be at greater risk for iatrogenic transmission.

Shompole *et al*. (1989) found that *Anaplasma ovis* and *A.marginale*, infect in goats. *Anaplasma* species are obligate intraerythrocytic parasites in the order *Rickettsiales* which infect domestic and wild ruminants transmitted biologically by certain tick species and mechanically by other blood sucking arthropods and fomites.

Maas and Buening (1981) found that *Anaplasma marginale* (the type species for cattle) also causes latent anaplasmosis in sheep and goats.

Bazargani *et al*. (1985) showed that goat can also be a susceptible host for *Anaplasma ovis*.

2.4.2: Nutritional status

Blood *et al.* (1968) mentioned that clinical disease is less severe in animal on a low plane of nutrition. Exposure of infected, clinically normal animals to devitalizing environmental influences, particularly shortage of feed and the presence of other diseases may result in the development of acute introduced into outbreaks among them are not uncommon 2-3 weeks after entry.

2.4.3: Season

Blood *et al.* (1968) mentioned that in temperate climates, a seasonal occurrence of disease occurs in association with seasonal occurrence of the insect vectors. Winter outbreaks are likely associated with iatrogenic transmission or possibly the winter tick.

2.5:Clinical signs of Anaplasmosis:

Barry and van Niekerk (1990) reported that anaplasmosis is suspected of causing abortions in Boer goats that are subjected to physical stress, such as walking long distances during the dry seasons. Therefore this parasite may be of economic importance under certain conditions. Tick paralysis caused by a toxin produced by some species of ticks, such as the Karoo paralysis tick *Ixodes rubicundus*, is the most economically important tick problem in South Africa. It affects sheep, goats and cattle.

Fourie *et al.* (1989) reported that in southwestern Orange Free State, most cases occurred in the first week in May, but the timing of outbreaks varied with latitude; it is possible that rainfall and low temperature have an influence on when outbreaks occur.

Bram (1983) mentioned that anaplasmosis is characterized by fever, severe anemia, jaundice, brownish urine, loss of appetite, dullness or depression, rapid deterioration of physical condition, muscular tremors, constipation, yellowing of mucous membrane and labored breathing.

Urquhart *et al.* (1996) reported that the clinical features include pyrexia, anorexia, labored breathing and severe drop in milk yield or abortion. Occasionally per acute cases occur, which usually die within a day of the onset of clinical signs.

Splitter *et al.* (1956) found that experimental inoculation of goats with *A. ovis* induces an acute disease characterized by depression, anorexia, fever, and progressive anemia.

2.6:Post-mortem findings of Anaplasmosis:

Blood *et al.* (1968) reported that the most obvious findings are emaciation, pallor of the tissues and thin watery blood. There is mild jaundice and the liver is enlarged and deep orange in color. The kidneys are congested and there may be myocardial hemorrhages. The spleen is enlarged with soft pulp. The bone marrow cavity may be redden by increased hematopoietic tissue in acute case but there may be serious atrophy of marrow fat in chronic case.

Ristic (1996) reported that the gross pathological changes are typical of anemia in which erythrocytes are removed by the reticuloendothelial system. The prominent changes are icterus mucous membrane, enlarged spleen and obstructed gall bladder. Petechial hemorrhage may be observed on the epicardiam and pericardiam and the heart is usually pale and flabby. The liver may be mottled yellow or brown, hepatic and mediastinal lymphnodes are brown, moderately and moist on section.

2.7: Diagnosis of Anaplasmosis:

Splitter *et al*. (1956) and Shompole *et al*. (1989) reported that based on the intraerythrocytic location of inclusion bodies, as a conventional diagnostic method, *A. ovis* is differentiated from *A. marginale*.

Lew and Jorgensen (2005) and Lew *et al.* (2002) reported that the PCR, as a more sensitive and specific technique than other conventional methods, has been increasingly applied to diagnose anaplasmosis in blood and tick vectors.

Ristic (1996) reported that during the acute stage of anaplasmosis, the diagnosis is made on the basis of clinical symptoms, hematological changes and microscopic examination of stained peripheral blood films for intraertthrocytic inclusion bodies. Giemsa staining is the oldest and nost frequently used method. Other staining methods include toluidine blue and acridine orange. The latter method, an ultraviolet microscope for visualization of the marginal anaplasma bodies. In contrast to the ease with which acute form of anaplasmosis are recognized.

Blood et al. (1968) reported that anaplasma organism can be diagnosed by the blood smear prepared from the peripheral blood. Diff-Quick staining of blood smears is as accurate as Giemsa in the detection of Anaplasma spp. and can be completed in 15 seconds as prepared to mearly an hour for Giemsa.

Ristic (1996) reported that various soluble and corpuscular antigens extracted from the blood of infected animals has been used for serologic diagnosis of Anaplasmosis. Currently used tests are Complement Fixation (CF), Capillary Tube Agglutination (CTA) and Card Agglutination (CD).

Blood *et al.* (1968) reported that the complement fixation test is the standard test for the detection of carrier animals. It is satisfacrory for use in cattle, goat and sheep but antibody titer is highest during the active phase of the disease. A rapid card agglutination test, which tests serum or plasma for antibodies against *Anaplasma marginale*, is cheap and quick and sufficiently

accurate to be used as a hard test. Other serological tests like a capillary tube agglutination test, indirect fluorescent antibody test, a dot ELISA are also used for the detection of *Anaplasma* spp. Nucleic probe analysis can be used to detect low level of parasitemia.

2.8: Treatment of Anaplasmosis:

Blood *et al.* (2000) reported that treatment is with tetracyclines. Treatment of clinical disease can be with oxytetracycline, 6-10 mg/kg BW daily for three days, or a single injection of long-acting oxytetracycline at a dose of 20 mg/kg intramusclularly. The convalescent period is long. Concurrent administration of estradiol cyionate (14.3 mg/kg intramusclularly) appears to improve the rate of recovery by promoting parasitemia during treatment. Tetracycline will not eliminate infection and immunity will persist. Blood transfusions are indicated in animals with a PCV less than 50%. Imidocarb (3mg/kg BW) is also an effective treatment for clinical cases and does not interfere with the development of acquired immunity to *A. marginale*.

Kamaruddin *et al.* (2007) mentioned that anaplasmosis is treated with the tetracycline or oxytetracycline injection (6-10 mg/kg BW daily for 3 days) and imidocarb (3 mg/kg Bw) is also used.Oral administration of chlortetracycline (11 mg/kg Bw) for 30-60 days is also effective in eliminating the carrier-state.

2.9: Prevention and Control of Anaplasmosis:

Blood *et al.* (2000) reported that the eradication of anaplasmosis is not a practicable procedure in most countries at the present time because of the wide range of insects which are capable of carrying the disease, the long infectivity of carrier animals, and in some areas, the presence of carriers in the wild animal population. In enzootic areas some benefits is derived from the control of ticks and others vectors weekly dipping in an acaricide is used in tropical areas to control this and other tick-borne diseases. The introduction of the disease into herds by carrier animals should be prevented by prior serological testing. Attention should be also given to prevent iatrogenic transmission with instrument used for injection or surgical operations by disinfection after use on each animal. Exposure negative animals that are to be introduced into an enzootic area should be vaccinated. Serological tests should be done and culling of reactors or treating them as outlined above to eliminate carrier state. If an outbreak does occur, affected animals should be treated vigorously and in-contact animals vaccinated and placed on a regimen of

prolonged tetracycline perotection. Most control programs in enzootic areas are based on increasing the resistance of the population by immunization. In any vaccination programs particularly attention should be paid to the animals at high risk, particularly animals brought in from non-enzootic areas, those in surrounding similar areas to which infection may be spread by expansion of the vector population under the influence of suitable climatic conditions, and animals within the are which are likely to be exposed to climatic or nutritional stress.

Urquhart *et al.* (1996) mentioned that vaccination of susceptible stock with small quantities of blood containing the mildly pathogenic *A. centrale* or a relatively avirulent strain of A. marginale is practiced in several countries, any clinical sings in adult being controlled by drugs.

Pegram *et al*. (1993) mentioned that control of Tick-borne diseases has traditionally been based on dipping of animals using acaricides. Initiated during colonial times, government-sponsored programmes were introduced to protect exotic and crossbred animals. In many countries, dipping services were provided by the State and were backed up by laws making dipping compulsory. In areas of high infestation, treatment could be provided as often as twice a week.

Taylor *et al.* (2007) reported that the control of the disease depends on effective quarantine to prevent the introduction of the vector tick. The control of ticks by dipping or spraying animals at risk with recommended acaricides. In routine surgery, Care should be taken to prevent accidental transfer of blood from one animal to another. Widespread use of tick vaccines may also have a significant influence on the incidence of infection in cattle. Radostits *et al*.(2008) and Zaugg (2009) also reported it.

2.10: Babesiosis

Merck Veterinary Manual (1997) published that babesiosis is caused by intra-erythrocytic protozoan parasites of the genus *Babesia.* The disease, which is transmitted by ticks, affects a wide range of domestic and wild animals and occasionally humans.

2.11: Etiology of Babesiosis in Goat:

Radostits *et al*. (2008) found that babesiosis is a hemoparasitic disease caused by protozoa of the genus *Babesia* (Phylum:Apicomplexa), which infects mainly ruminants (Melendez, 2000). Infection of a vertebrate host is initiated by inoculation of sporozoite form of parasites into the blood stream during the taking of a blood meal.

Taylor *et al.* (2007) reported that in sheep and goats, babesiosis is associated with *B. ovis* and *B. motası*. *Babesia ovis* occur in Southern Europe, former Soviet State, Middle East and Asia. Rhipicephalus bursa has been shown to be a vector for B. ovis. Babesia motasi occur in Southern Europe, the Middle East, the former Soviet State, southeast Asia and Africa. The parasite transmitted by ticks of the genus Haemaphysalis.

Hungerford (1962) reported that there has been much confusion in referring to the various tick fever diseases. Thus, in the literature of the world there is a tendency to the organisms as *Babesia argentiana* and *Babesia bigemina*.

Sulaiman *et al*. (2010) reported that four species of Babesia have been reported from sheep and goats mainly consisting of one large form (*B. motasi*) and three small forms (*B. ovis*, *B. foliata* and *B. tyalori*), while Friedhoff referred that the Babesiosis in domestic small ruminants is due to at least three species, namely : *B. ovis*, *B. motasi* and *B. crassa*. *B. ovis* is less pathogenic than *B. motasi* for sheep infection and cause relatively moderate haemolytic anemia, whereas Friedhoff considered the *B. ovis* is the most important causative agent which transmitted by *Rhipicephalus bursa*, *R. turanicus*, *Hyalomma anatolicum excavatum* and probably by *R. evertsi evertsi*, whereas the known vector of *B. motasi* are *Haemophysalis punctata* and *R. bursa* and the *B. motasi* is more pathogenic than *B. ovis* in India and northern Africa.

2.12: Epidemiology:

It is very important to recognize some characteristics of the ticks in order to better understand the biology of babesiosis.

Globally, the geographic distribution of the tick and consequently of babesiosis, can be classified into three zones:

Free zones: Locations where the ticks does not occur because of weather conditions, so babesiosis is not present.

Areas of enzootic instability: Locations where there is a well-defined cold season, leaving goat for long periods without tick contact. This allows the antibody levels to drop to a point where during the warmer months they are very susceptible to outbreaks of babesiosis.

Endemic areas: Location where the prevalence of ticks is high enough to occur all year long, essentially reinoculating and therefore boosting the animals' immunity continuously. In this region, therefore boosting cases og babesiosis.

Soulsby (1986) reported that *Babesia motasi* infection in goat is found in Southern Europe, Middle East, Soviet Union, South East Asia, also Africa and others parts of the tropics. *Babesia ovis* is distributed throughout tropical and subtropical areas, also in Southern Europe, Soviet Union. *Babesia taylori* infection in goat is found in India.

Taylor *et al.* (2007) mentioned that in sheep and goats, babesiosis is associated with *B. ovis* and *B. motası*. *Babesia ovis* occur in Southern Europe, former Soviet State, Middle East and Asia. *Rhipicephalus bursa* has been shown to be a vector for *B. ovis*. *Babesia motasi* occur in Southern Europe, the Middle East, the former Soviet State, southeast Asia and Africa. The parasite transmitted by ticks of the genus *Haemaphysalis* (H. Punctata, H. Otophila), *Dermacentor* .

2.13: Risk factors:

2.13.1: Host factors

Soulsby (1986) mentioned that four species of *Babesia* have been from sheep and goats, consisting of one large form and one small forms. These are *Babesia motasi, Babesia ovis, Babesia foliate, Babesia talori*.

Urquhart *et al.* (1996) reported that in endemic areas, particularly in adult animals, is often associated with some forms of stress, such as parturition or prevalence of another disease, such as tick-borne fever.

2.13.2:Age

Urquhart *et al.* (1996) reported that in endemic areas, the young first acquires immunity passively, in the colostrums of the dam and as a result. Often suffers only transient infections with mild clinical sings. It is frequently stated that there is an inverse age resistance to babesia infection in that young animals are less susceptible to babesiosis than other animals.

Soulsby (1986) mentioned that an inverse age susceptibility occurs in Babesia infections, young animals being naturally resistant while older animals are fully susceptible. Youngs in an enzootic area are free of clinical sings and have a very low parasite density. The passive transfer of maternal antibodies via the colostrums is probable responsible in part of this resistance.

2.13.3: Environmental factors:

Blood *et al.* (1968) reported that there is a seasonal variation in the prevalence of clinical babesiosis. The greatest incidence occurring soon after the peck of the tick population. Of the climatic factors, air and temperature is the most important because of its effect on tick activity, higher temperature increases it, humidity and rainfall has little effect and even with temperature the effect is limited once a threshold of 7-10ºC minimum temperature is exceed.

Urquhart *et al.* (1996) reported that in endemic areas, where there are many infected ticks, the immunity of the host is maintained at a high level through repeated challenge and overt disease is rare. In contrast, where there are few ticks or when they are confined to limited areas, the immune status of the population is low, and the young animals receive low little, if any, colostral protection.

2.13.4: Other factors

Urquhart *et al.* (1996) reported that if in endemic area, the number of ticks suddenly increase due to favourable climatic conditions of clinical cases may rise sharply. This situation is known as enzootic instability.

Blood *et al.* (1968) reported that in housed animal, the level of antibodies in the patient are at their lowest when the animal comes out of the barn in the spring and gradually increases as they are exposed to vectors ticks. In enzootic areas, the animals most commonly affected by clinical diseases are susceptible animal introduced for breeding purposes, for slaughter, or in transit, other stress like parturition, starvation or concurrent disease. Break down of immunity are likely to occur if there is a superimposed infection with different parasites especially *Anaplasma marginale* Endemic (enzootic) stability is achieved in area where all young animals are frequently exposed to the parasite while they are still protected by colostral and innate immunity and endemic instability occurs if some animal fail to become infected for prolong period after birth. Various factors such as changes in climatic condition and frequency of acaricidal treatment can influence the tick population .

2.13.5:Mode of transmission

Zaugg (2009) reported that *Babesia spp*. are a various group of tickborne, obligate, intra-erythrocytic Apicomplexan parasites infecting a wide variety of animals. Ticks are most often

infected transovarially. The female tick becomes infected by the ingestion of parasites during engorgement. After it drops off the host, the babesial agents reproduce within the tick's tissues. Some of the reproducing organisms are incorporated within developing tick embryos, and the disease agents are transmitted to new hosts by the feding of ensuing tick larvae, nymphs, or adults.

2.14: Clinical signs of babesiosis:

Radostits *et al.* (2000) reported that incubation period of babesiosis is 2-3 weeks. *B. bigemina* and *B. bovis* produce acute syndromes which are clinically indistinguishable, and are characterized by high fever (41˚C), anorexia, depression, weakness, cessation of rumination, and a fall in milk yield. Hemoglobinuria can be seen, the color of urine is dark-red to brown. Respiratory and heart rates are increased, and the red conjunctivate and mucous membranes change to the extreme pallor of severe anemia. Abortion ocur in pregnant animals. Subacute syndrome also occurs in young animals, but fever is mild and hemoglobinuria is absent.

Rahbari *et al.* (2008) mentioned that in case of Babesiosis develop fever and parasitemia within 2 to 4 days; the clinical signs of the disease include anorexia, listlessness, anemia, moderate jaundice and hemoglobinuria. In intact animals, hyperthermia returned to normal on the fourth day after the peak pyrexia, and parasitemia is eliminated within the course of the disease.

2.15: Necropsy findings of babesiosis:

Radostits *et al.* (2000) found that in acute cases of babesiosis in all species , in which patient die after a brief illness and during an anemic crisis, typical lesions are jaundice, thin watery blood, pale tissues, enlargement of the spleen which has a soft pulpy consistency and gross enlargement and dark brown discoloration of the liver. The gallbladder is distended with thick, granular bile, the kidynes are enlarged and dark, and the bladder contains red brown urine. Echymotic hemorrhages are present under the epicardium and endocardium, the pericardial sac contains an increased quantity of blood stained fluid. In subacute or chronic cases of fairly long duration, the carcass is emaciated but haemoglobinuria is absent; the other cases are present but less pronounced.

2.16: Pathology of babesiosis:

Burtis and Ashwood (1999) reported that histopathologic examination revealed focal necrosis, lymphohistiocytic, ericholangitis and cholangiohepatitis and canalicular cholestasis in the liver. Severe oedema, mild lymphocytolysis and haemorrhagic lymphadenitis were also present. Pathologic examinations of the tissues indicated that the kidneys and lungs were the organs most severely affected by experimental infection with *B. ovis*. Acute alveolar oedema and infiltration of neutrophils and macrophages in interstitial were present. Acute diffuse proliferative glomerulitis, congestion and stasis in glomerular capillaries and acute tubular necrosis were also present. Biochemical parameters were determined.

Meyer and Harvey (2004) reported that the values of glucose (glucose oxidase), creatinine (Jaffe), BUN (urease), AST (Carman), ALT (Ritman and Frankel), total bilirubin (Vandenberg), total protein (Biuret), fibrinogen (refractometry) and urinalysis were measured in this study. Haematologic parameters were estimated.

Rahbari *et al*. (2008) reported that data were compared between the control and the infected animals according to leukocyte count in both infected groups was significantly ($P<0.05$) decreased. Nevertheless, lymphocyte count in both groups was higher than those of normal, reached the peak on days 8 and 10 postinoculation ; neutrophil count was decreased.

2.17: Diagnosis of Babesiosis:

Nagore *et al.* (2004) and Inci *et al.* (2010) reported that blood smears and clinical findings are useful in acute cases of piroplasmosis, but are not sufficient in subclinical cases. The complement fixation test is used serological test for bovine babesiosis. The most commonly used tests are ELISA, PCR and a DNA probe, which can detect specific parasitemias at very low levels of infection (Radostits, 2008). Recently, the ‘reverse line blot (RLB) is a versatile technique for simultaneous detection and identification of small ruminant piroplasm species, based on the recognition of specific gene regions by oligonucleotide probes.

CHAPTER III
MATERIALS AND METHOD

3.1: Study area:

The study was carried to measure the proportional prevalence of blood parasitic diseases in goat at Shahedul Alam Quadery Teaching Veterinary Hospital (SAQTVH), Chittagong Veterinary and Animal Sciences University(CVASU).

3.2: Study period:

The study was undertaken for a period of 50 days from 11th November to 30th December, 2012.

3.3: Source of animal and data:

The data used for the study were collected from the following sources:

1) Data of animals were collected from the blood examination record sheet of SAQTVH, CVASU.

2) Blood sample with other necessary information were collected from animals (N=100).

3.4: Survey design:

A preset sheet was used to record information like age, sex, size of the farms, presence of tick or other arthropods . The goats were grouped primarily into two categories as age and sex. Then age group were subdivided into 3 categories (< 6 months, 6-12 months, > 12 months) and the sex group were subdivided as male and female. The minimum age of the animal was 4 months and the maximum was 2.2 years.

3.5: Examination of animals and sample collection:

The animal was examined especially on the basis some parameters like rectal temperature, visible mucous membrane, body conformation score, lymphnode palpation, presence of ticks, urine color. Single blood smear from each animal were collected from ear vein by puncturing with sterile needle. The slides were touched to the coming out blood and then spread by another slide. The slides were air dried and fixed by 100% methyl alcohol for 5 min.

3.6: Staining and examination of blood samples:

The prepared blood smears were stained with the Giemsa stain (working solution) for 25 to 30 minutes. After rinsing with water they were air dried and examined under microscope (10X100x) with immersion oil for the identification of blood parasites as described by Soulsby (1982).

3.7: Measuring the prevalence:

The proportional prevalence of hemo-parasitic infections in goat was estimated by the following formula:

The proportional prevalence of hemo-parasitic infections

$$= \frac{\boldsymbol{No.of\ individual\ having\ a\ disease\ in\ a\ particular\ point\ of\ time} \times \mathbf{100}}{\boldsymbol{No.of\ individual\ in\ the\ population\ at\ risk\ at\ the\ point\ of\ time}}$$

(Thrusfield, 1995).

3.8: Analysis of the data:

The procured data through and record of blood smears examination were stored, sorted and coded by using Office 2007 service pack and data were analyzed by STATA version 11 (STATA Corporation, Collage Station, Texas, USA). Chi-square test was performed to get the p-value (significance was considered $p < 0.05$).

CHAPTER IV

RESULTS AND DISCUSSION

4.1: Result:

4.1.1: Prevalence study

The study revealed that the proportional prevalence of anaplasmosis (*Anaplasma marginale)* in goats in Chittagong city was 4% (Table 1). Other hemo-parasitic diseases were not found.

Table 1: Summary estimates of blood parasites and ectoparasites among age group (N= 100)

Category	Variable	Positive (Percentage)	p
Anaplasma marginale	< 6 month age (n= 18)	2 (11.1%)	0.11
	6-12 months age (n = 44)	0 (0%)	
	> 12 months age (n= 38)	2 (5.3%)	
Anaplasma centrale	< 6 month age (n= 18)	0 (0%)	-
	6-12 months age (n = 44)	0 (0%)	
	> 12 months age (n= 38)	0 (0%)	
Babesia spp.	< 6 month age (n= 18)	0 (0%)	-
	6-12 months age (n = 44)	0 (0%)	
	> 12 months age (n= 38)	0 (0%)	
Ectoparasites	< 6 month age (n= 18)	7 (38.9%)	0.05
	6-12 months age (n = 44)	14 (31.8%)	
	> 12 months age (n= 38)	22 (57.9%)	

Table 2: Summary estimates of blood parasites and ectoparasites between sex group N= 100)

Category	Variable	Positive (Percentage)	p
Anaplasma marginale	Male (n= 39)	1 (2.6%)	
	Female (n= 61)	3 (4.9%)	0.56
Anaplasma centrale	Male (n= 39)	0 (0%)	
	Female (n= 61)	0 (0%)	
Babesia spp.	Male (n= 39)	0 (0%)	
	Female (n= 61)	0 (0%)	
Ectoparasites	Male (n= 39)	15 (38.5%)	
	Female (n= 61)	28 (45.9%)	0.46

4.1.2: Factors affecting the occurrence of diseases

4.1.2.1: Types of animals

The measures of association between test positive animals with other explanatory variables have been represented in Table 2. The percentage of occurrence of positive animals was recorded higher (4.9%) in female compared to male (2.6%) with the p value is 0.56 although the animal variation was not statistically significant.

4.1.2.2: Age

Animals of age between below six months were highly (11.1%) susceptible to blood parasitic disease (anaplasmosis) than others (p = 0.11).

4.1.2.3: Season

The study revealed that the occurrence of blood-parasite (anaplasmosis) infection in goats in autumn was 4%. In this season the occurrence of ectoparasites infestation was 33% in chittagong city.

4.1.2.4: Ectoparasites

Animals having ectoparasites mostly ticks in their body positive (33%). The blood parasitic infection is always related with ectoparasites infestation.

4.2: Discussion:

Mohanta *et al. (*2011) reported that the proportional prevalence of *Anaplasma marginale* infection in goats was 14.94% in hilly area of Bangladesh which is more than the present study result. Ahmadi-Hamedani *et al.* (2009) reported that 63.73% goats were infected with anaplasma sp in Iran which more than the study result in Bangladesh. This variation might be due to season, area, management, duration of study and resistance of the animal and tick activity.

In case of age Mohanta *et al. (*2011) reported that older animals were more susceptible than young animal but the study revealed that young animal (4-6 months) were more susceptible than older animal.

The study revealed that the occurrence of blood-parasite (anaplasmosis) infection in goats in autumn was 4%. In this season the occurrence of ectoparasites infestation was 33%. Mohanta *et al. (*2011) reported that the seasonal prevalence of blood protozoa was highest.
Mohanta *et al. (*2011) reported that the seasonal prevalence of ectoparasites (ticks) in hilly area in bangladesh was more than the study.

4.3: Limitations of the study

The study period was too short to perform properly. The data and samples were collected at only one season. Farmers were not cooperative and friendly. In many cases, they were noncooperative to allow for collecting of the blood samples of their goats. In some cases, interview was not taken from the animal owner.

CHAPTER V
CONCLUSION

Anaplasmosis is an infectious disease of livestock caused by several species of the blood parasite *Anaplasma*. *A. marginale* is the most common pathogen of cattle. Sheep and goats are much less commonly affected. The proportional prevalence of anaplasmosis was 4% in goat in Chittagong city. Among the host risk factors, the male goats were more susceptible to blood parasitic diseases. Animals of four to six months of age were prone to blood parasitic diseases than others groups. Animals having ectoparasites especially ticks in their body tested positive with blood parasitic diseases more than the animals having no ticks in their body.

CHAPTER VI
RECOMMENDATION

From the study, it may be recommended that the result of the study would be more authentic if:

- It was conducted for a long period of time.
- Population size would be more.
- At least two sets of data would be taken at two different seasons of the year.
- Previous authentic record of the prevalence of the blood parasitic diseases would be helpful.

CHAPTER VII

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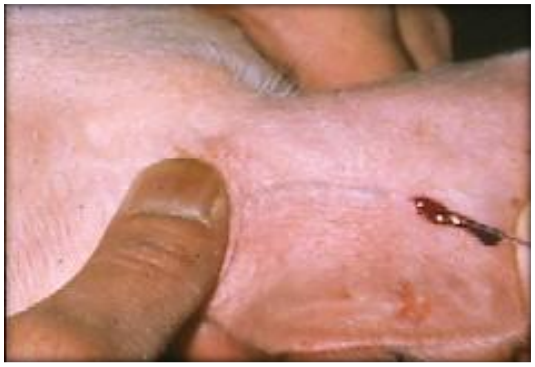
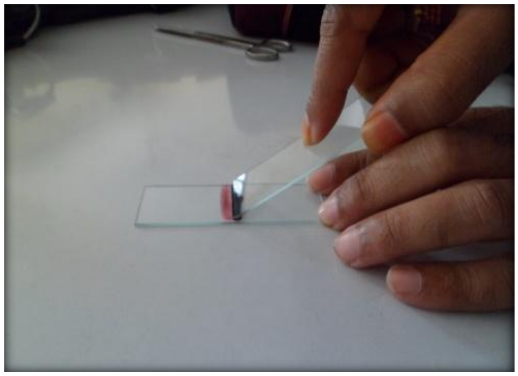
ANNEX



Collection of blood from Ear vein

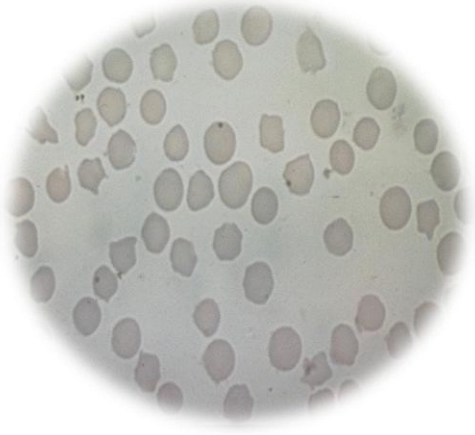


Preparation of blood smear

Preparation of working solution

Staining

Microscopic Examination



Anaplasma marginale within RBC