# 1. Introduction

There are many animals in the world, but simply being an animal does not make it a pet. Companionship and a connection with the animal are what distinguish it as a pet. By definition, a pet, sometimes known as a companion animal, is an animal maintained primarily for the companionship or pleasure of its owner, as opposed to as a working animal, livestock, or laboratory animal (2022). According to archaeology, human ownership of dogs as pet dates back at least 12,000 years (Clutton-Brock, 1995). So, human and animal relationships have been going on for so long. A recent study found thatthere are around 470 million dogs maintained as pets worldwide and approximately 370 million pet cats (Sa, 2022). There are more than nine hundred million dogs around the world, and their numbers are growing. There are approximately six hundred million cats on the planet. Morethan 740 million dogs live unrestrained or free ranging. Only 17–24% of dogs live aspets in developed countries. Pets bring both physical and emotional advantages to their owners. Walking a dog may provide exercise, fresh air, and a social connection for both the owner and the dog. Pets can provide companionship to people who live alone or to elderly people who do not have enough social connections (2022).

Owning a few rare species of dogs and cats is also a source of pride. As a result, most renowned individuals or celebrities have more than one pet. Besides that, some people areraising stray dogs and cats as their pets. It is found that in the seventeenth and eighteenthcenturies, having pets was a symbol of elitism in society (Amato, 2015). This scenario isstill common in Bangladesh as well. Elite people try to keep pets to maintain their status or elitism. Dogs are used for security as well. People are attempting to raise pets primarilyin urban areas. The population of dogs in Dhaka city is 18,585 dogs (52 dogs/km2), withan estimated human-to-free-roaming dog ratio of 828:1 (Tenzin, 2015). But there is no specific data found for the cat population in Bangladesh. As pets, dogs and cats are more popular. Most of the people rear dogs or cats. People nowadays treat their pets as membersof their family. So, they take care of it cautiously.

Pet animals are also affected by various diseases. They get affected by both infectious andnon-infectious diseases. Infectious diseases can be viral (Rabies, Canine Parvovirus, Feline

Panleukopenia etc.), bacterial (Brucellosis, Leptospirosis etc.), fungal and parasiticas well. In parasitic diseases, there are ectoparasitic and endoparasitic diseases. Though ectoparasitic (the name of the disease) diseases are not that much deadlier than other infectious diseases, they can be carriers of some harmful diseases. Ectoparasites are common in dogs and cats, and they can cause both pruritic and non-pruritic skin disorders (Beck, 2006). Ectoparasites can deteriorate the appearance or outlook of pet animals. According to numerous studies, dogs and cats are the most popular companion animals globally, as well as the most significant hosts of ectoparasites (Chukwu, 1985). Despite the benefits of companion animals, they also host ectoparasites that are zoonotic to people, particularly youngsters, the elderly, and the immune compromised (Irwin, 2002). They can cause pain, irritation, skin infections, anemia, and tick fever, as well as act as a vector for a number of deadly diseases (Agu, 2020). Ticks, fleas, lice, and mites infest domestic dogs and produce significant pathological diseases such as severe allergic dermatitis and non-pruritic skin illnesses (Bahrami, 2012; González, 2004). Among species of fleas *Pulexirritans, Leptophyllous segnis* (rat fleas), *Ctenocephalides canis* and *Ctenocephalides felis* are the most typically reported species of fleas from dogs and cats (Zygner, 2006). Lice are responsible for skin pruritus that is more intense with chewing lice or Mallophaga, which include *Heterodoxus spiniger* and *Trichodectes canis*, than with bloodsucking liceor Anoplura. Mallophaga feeds on the host's skin debris and moves through the hair; Anoplura sucks blood while attached to the skin (Tadesse, 2019). Ticks may also be liablefor the transmission of infectious diseases like borreliosis, rickettsiosis and babesiosis (Shaw, 2001). *Rhipicephalus sanguineus* infests domestic dogs at all stages of development. Sometimes, ticks that prefer other animals by chance may additionally parasitize home dogs (Tadesse, 2019).

In the entire world, lots of work has been done on the basis of the ectoparasitic prevalenceof pet animal (Babamale O. Abdulkareem, 2018; Chukwu, 1985; Irwin, 2002; Agu, 2020).Despite having immense importance, to my knowledge, Bangladesh has conducted extremely limited research on it, which encourages me to focus solely on it. Though in our country huge works have been done regarding ectoparasitic prevalence of large and small ruminants (Musa, 2018; Rony, 2010; Paul, 2012) etc.

Therefore, this study offers baseline information on the prevalence of ectoparasitic infestations of dogs and cats in Dhaka, Bangladesh, as well as their related risk factors.

Considering the above circumstances, the present study was conducted to fulfill the following objectives:

- To investigate the prevalence of ectoparasite in pet animals i.e., dogs and cats.
- To analyze the associated risk factors in the occurrence of ectoparasitic diseases.

# 2. Materials and method

## 2.1. Study population

The population for this study was dogs and cats with any type of skin lesion. A retrospective study was carried out in the Dhaka Metropolitan Area. A total of 174 data were collected from the registered case sheets of sick pet animals (dogs and cats) in the hospital.

## 2.2. Study area


**Fig.-1**: Geographical location of data collection site

This study area is Dhaka, which is divided into two major areas. Theyare semi-urban and urban, respectively. Semi-urban areas include Vulta, Gazipur, Narayanganj, Kuril, Khilkhet, Kawla, Gawsia, Rupganj, Dumni and Purbacahal, while rural areas include Bashundhara, Gulshan, Mirpur, Badda, Baridhara, Uttara, Khilgaon, Ramna, Shantinagar, Dhanmondi, Banani

### 2.3. Study period

The study period was from January 2022 to August 2022.

### 2.4. Study design

A cross-sectional study was carried out at the Teaching and Training Pet Hospital and Research Center (TTPHRC), Purbachal, Dhaka. A pre-structured questionnaire was used for data collection.

### 2.5. Data collection

A set of questionnaires was used for each case. All the relevant information based on age,sex, breed, vaccination, deworming, usual places for defecation, coat color, BCS, roaming and exposure to other animals during this time were recorded.

### 2.6. Statistical analysis

To demonstrate the frequency and prevalence of ectoparasites, all collected data were imported into Microsoft Excel 2013 and transferred to STATA 13.0 for statistical analysis.

# 3. Result

### 3.1. Overall Prevalence of Ectoparasites:

Ninety-four dogs and eighty cats examined for ectoparasites, 56 (59.57%) dogs and 47 (61.25%) cats were found to be infested with ectoparasites.

**Table 1:** Overall Prevalence of Ectoparasites in dogs and cats (n=174).

| **Species** | **Total number** | **Positive Number** | **Percentage (%)** | **P value** |
|---|---|---|---|---|
| Cat | 80 | 47 | 61.25% | 0.822 |
| Dog | 94 | 56 | 59.57% | |

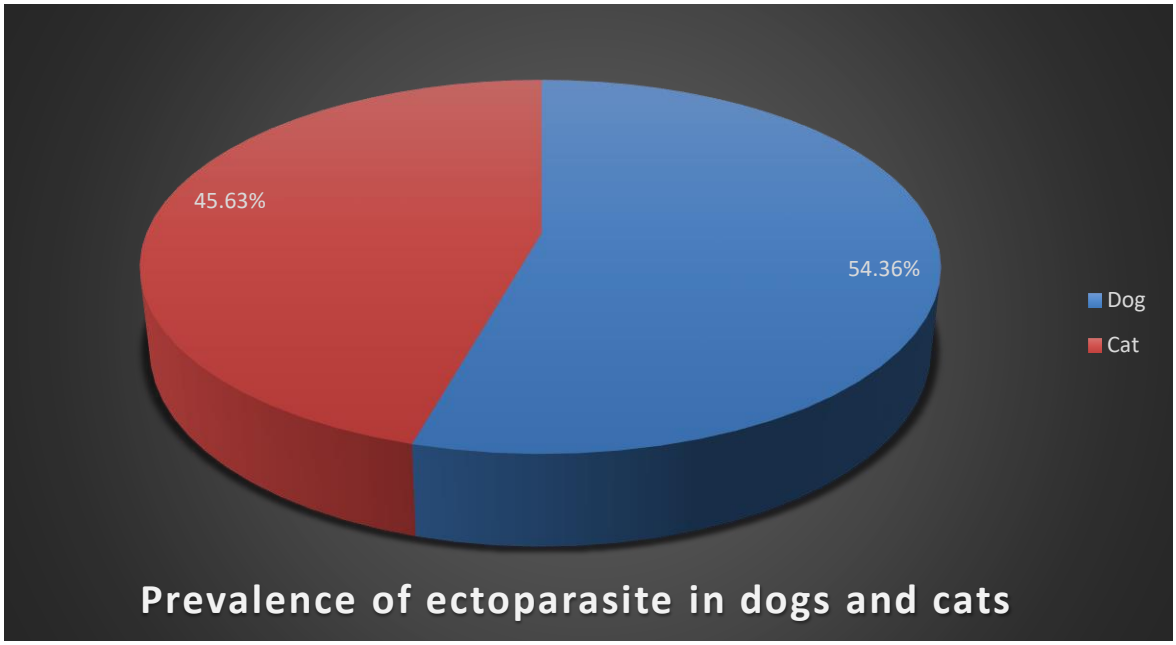


**Fig. 2:** Prevalence of ectoparasite in dogs and cats

### 3.2. Prevalence of ectoparasitic diseases in cats based on their associated risk factors:

In this study, the ectoparasite found in semi-urban areas are 76.92% where the total cat population in these areas is thirteen. Most of the population is from urban areas (n = 67). In urban areas, ectoparasites were found in 58.21% of cats which is 18.71% less than in semi-urban areas. Here exotic breeds (68.63%) are more susceptible than local breeds (48.28%). In terms of sex, females (76.92%) are more susceptible than male cats (53.70%). Here age is an important risk factor (P value-0.002) where most susceptible cats were between 1 month to 1 year(Frequency- 31, Percentage- 70.45%). In this study, it is found that cachectic animals (100%) and poor body condition (63.77%) condition are more susceptible. Here most of the susceptible coat color is ash (77.27%). Here cats that roam outside (67.16%) are more susceptible than cats that do not roam or do not come to the exposure to other animals (30.77%). Vaccination and deworming have a very profound impact on this study (P value-<0.001). Vaccinated cats (44.90%) are less susceptible than non-vaccinated cats (87.10%). Here the cats that are dewormed (56.75%) have less ectoparasitic infestation than those that are not dewormed (87.50%).

**Table 2:** Frequency and percentage of different variables related to prevalence of ectoparasite of pet cats (n=80).

| **Parameters** | | **Total number** | **PositiveNumber** | **Percentage (%)** | **P value** |
|---|---|---|---|---|---|
| City | SemiUrban | 13 | 10 | 76.92 | 0.205 |
| | Urban | 67 | 39 | 58.21 | |
| Breed | Local | 29 | 14 | 48.28 | 0.072 |
| | Exotic | 51 | 35 | 68.63 | |
| Sex | Female | 26 | 20 | 76.92 | 0.046 |
| | Male | 54 | 29 | 53.70 | |

| Parameters | | Total number | PositiveNumber | Percentage (%) | P value |
|---|---|---|---|---|---|
| Age(m) | 0-1Y | 44 | 31 | 70.45 | 0.002* |
| | 2-5Y | 32 | 17 | 53.13 | |
| | 6-10Y | 3 | 1 | 33.33 | |
| | 11-15Y | 1 | 0 | 0 | |
| BCS | Cachectic-1 | 2 | 2 | 100 | 0.195 |
| | Poor-2 | 69 | 44 | 63.77 | |
| | Fair-3 | 7 | 2 | 28.57 | |
| | Good-4 | 2 | 1 | 50 | |
| Coat color | Black | 6 | 1 | 16.67 | 0.057 |
| | Brown | 14 | 8 | 57.14 | |
| | Ash | 22 | 17 | 77.27 | |
| | White | 38 | 23 | 60.53 | |
| Roaming & exposed to other animals | Yes | 67 | 45 | 67.16 | 0.014 |
| | No | 13 | 4 | 30.77 | |
| Vaccination | Yes | 49 | 22 | 44.90 | <0.001* |
| | No | 31 | 27 | 87.10 | |
| Deworming | Yes | 48 | 21 | 56.75 | <0.001* |
| | No | 32 | 28 | 87.50 | |

### 3.3. Dog Prevalence of ectoparasitic diseases in dogs based on their associated risk factors:

In this study, semi-urban dogs are more susceptible to ectoparasite than urban dogs. Here the percentage of ectoparasite positive semi-urban dogs is 65.42% and the urban dogs are 56.92%. Local breeds (60.47%) have higher ectoparasite infestation than exotic breeds (58.82%). In terms of sex, females (71.43%) are more susceptible than male dogs (54.55%). Here most of the ectoparasite positive dogs' age range is between 2 and 5 years (Frequency-41). But the 0 to 1 year age range percentage is the highest (82.86%) and this means that they are more susceptible than the other age ranges. In this study, it is found that cachectic animals are more susceptible (100%). Here this study said that whitecoated dogs (84.62%) are more susceptible than black (47.62%) and brown (58.82%). Here the dogs that roam outside the house are more susceptible (55.56%) than the dogs that do not go outside (62.07%). In case of dogs, vaccination is statistically significant (<0.001%). Non-vaccinated dogs (81.08%) are more susceptible than vaccinated dogs (45.61%). In this case, dogs who have been dewormed are less susceptible than dogs who have not been dewormed. 65.12% non-dewormed dogs are ectoparasite positive where 54.90% dewormed dogs are ectoparasite positive.

**Table 3:** Dog Prevalence of ectoparasitic diseases in dogs based on their associated risk factors (n=94).

| **Parameters** | | **Total Number** | **Positive Number** | **Percentage (%)** | **P value** |
|---|---|---|---|---|---|
| City | Semi Urban | 29 | 19 | 65.42 | 0.433 |
| | Urban | 65 | 37 | 56.92 | |
| Breed | Local | 43 | 26 | 60.47 | 0.872 |
| | Exotic | 51 | 30 | 58.82 | |
| Sex | Female | 28 | 20 | 71.43 | 0.046 |
| | Male | 66 | 36 | 54.55 | |

| Parameters | | Total Number | Positive Number | Percentage (%) | P value |
|---|---|---|---|---|---|
| Age(m) | 0-1Y | 35 | 29 | 82.86 | 0.002* |
| | 2-5Y | 41 | 18 | 43.90 | |
| | 6-10Y | 16 | 7 | 43.75 | |
| | 11-15Y | 2 | 2 | 100 | |
| BCS | Cachectic-1 | 1 | 1 | 100 | 0.388 |
| | Poor-2 | 8 | 3 | 37.50 | |
| | Fair-3 | 84 | 51 | 60.71 | |
| | Good-4 | 1 | 1 | 100 | |
| Coat color | Black | 42 | 20 | 47.62 | 0.026 |
| | Brown | 34 | 20 | 58.82 | |
| | White | 13 | 11 | 84.62 | |
| Roaming and exposure to other animals | Yes | 36 | 20 | 55.56 | 0.532 |
| | No | 58 | 36 | 62.07 | |
| Vaccination | Yes | 57 | 26 | 45.61 | 0.001* |
| | No | 37 | 30 | 81.08 | |
| Deworming | Yes | 51 | 28 | 54.90 | 0.315 |
| | No | 4 | 28 | 65.12 | |

# 4. Discussion

Dogs and cats are frequent household pets, contributing to the physical, social and emotional development of children as well as the well-being of their owners in both developed and developing countries (Alvarado-Esquivel, 2015; Robertson, 2000). Despite the benefits, domestic dogs contain a surprising amount of ectoparasites which pose a significant hazard to them. Ectoparasites are a widespread and significant source of skin problems in dogs and cats. They have a global spread and can transmit illness. Ectoparasites can cause life-threatening anemia and occasionally hypersensitivity issues in young and elderly animals (Araujo, 1998).

The current study is the first to look at the incidence of parasite infestations in companion dogs in Dhaka. It was discovered that ectoparasites affected 59.57% of dogs and 61.25%of cats. These findings suggest that ectoparasites are more widespread in cats than in companion dogs in this region.

This conducted study revealed that mites infected 62.5% of the dogs and cats studied, fleas infected 8.92%, and ticks infected 3.57%. But in Nigeria, Abdulkareem et al. found that 71.2% of the ectoparasites were ticks while 17.3% and 11.5% were fleas and lice, respectively. But this study did not find any lice at all. It could have happened because of the regional variation.

**Table 4:** Prevalence of different ectoparasites.

| **Parameters** | **Positive number** | **Percentage (%)** |
|---|---|---|
| Mite | 35 | 62.5% |
| Flea | 5 | 8.92% |
| Tick | 2 | 3.57% |

In this study, semi-urban dogs are more susceptible to ectoparasites than urban dogs. Here the percentage of ectoparasite-infested semi-urban dogs are 65.42% and the urban dogs are 56.92%; cat infestation with ectoparasites is 76.92% in semi-urban areas and 58.21% in urban areas. Here most of the semi urban pets are affected by ectoparasites. Here Vulta, Gazipur,

Narayanganj, Kuril, Khilkhet, Kawla, Gawsia, Rupganj, Dumni and Purbacahal are denoted as semi-urban. Semi-urban means partly urban (between urban and rural) somewhat but not wholly characteristic of urban areas (Edu) and Bashundhara, Gulshan, Mirpur, Badda, Baridhara, Uttara, Khilgaon, Ramna, Shantinagar, Dhanmondi, Banani, Shyamoli, Shahbag, Bashabo, Malibagh, Rampura, Mohakhali, Cantonment, Lalmatia, Lalbag, Kotbari and Agargaon these areas are denoted as Urban area. Here the variation happens because of the environmental difference and awareness of the owners is also a crucial factor here. Urban people have more pet awareness than semi-urban dwellers. Because development and urbanization processes result in a complex web of human-animal interactions (Palmer, 2003). For this relationship urban people care more for their pets. Sometimes they treat their pets as family members too. It is found in dogs that local breeds (60.47%) have more ectoparasitic infestation than exotic breeds (58.82%) which is similar to the study conducted in Nigeria. But cats' statistics differ from dogs'. In cats, exotic breeds (68.63%) are more susceptible than local breeds (48.28%). In terms of sex, female cats (76.92%) and dogs (71.43%) are more susceptible than male cats (53.70%) and dogs (54.55%). This conducted study, multiple infestation is described commonly among the female dogs and cats. This may have been influenced by the pets' living conditions and the number of other associated pets in the household. This finding, however, completely agreed with the earlier reports from Nigeria (Agbolade, 2008; Ugbomoiko, 2008) and other endemic communities in tropical countries (Bahrami, 2012; Mosallanejad, 2012; Nuchjangreed, 2007). This is owing to hormonal changes during reproduction and the sedentary behaviors that females frequently engage in when nursing, which favor re-infestation as previously reported by Dantas-Torres et al.in 2010. In Malaysia, Kamaruddin et al. did not find any significant difference between the sexes (Kamaruddin, 2020). In this study, age is an important risk factor (P value-0.002) most susceptible cats were between 0 to 1 year (Frequency- 31, Percentage- 70.45%) and in dogs 0 to 1 year age range percentage is the highest (82.86%) and this means that they are more susceptible than the other age ranges. In Abdulkareem's study, it also revealed that,the intensity of infestation was higher in 0–6 months old pets which may be due to the gradual acquisition of immunity and the close proximity of the young dogs to the ground. Mosallanejad et al. and Abdulkareem's study substantiate my findings too. (Abdulkareem, 2019; Mosallanejad, 2012).

In this study, it is found that cachectic animals are more susceptible (100%) in both dogs and cats. Then the next susceptible body condition is poor (63.77%) in cats but in dogs the second most susceptible is fair (60.71%). This is due to the considerable number of sampled hosts with a fair (BCS-3) body condition score. Massei et al. found in their study that 80% of the dogs sampled appeared in fair body condition (BCS = 3) (Massei, 2017) which is similar to my study findings. In contrast, a study in Nepal found that 69% of free-roamingdogs in Kathmandu were in good health, owing to the effectiveness of public education and dog sterilization programs, and that only 9% of these dogs had skin problems (Kakati, 2012). Most of the susceptible coat color is ash (77.27%) and white color (60.53%) is the second highest susceptible in cats and white coated dogs (84.62%) are more susceptible than black (47.62%) and brown (58.82%) coat-colored dogs. But Abdulkareemet al found that ectoparasite occurrence varied with the coat color of the host and in his study. Brown coated were more susceptible (Abdulkareem, 2019). Here cats that roam outside (67.16%) are more susceptible than that do not roam or do not come to the exposure of animals (30.77%) but the dogs that roam outside the house are less susceptible (55.56%) than dogs that do not go outside (62.07%). Abdulkareem found that most of the pets seen in the research region were free-roaming, and this management style exposes pets to the greatest number of parasitic illnesses (Abdulkareem, 2019) which is similar to the findings in cats but different from the dogs' findings of this study. Vaccination has a significant impact on this study (P value- <0.001) in both dogs and cats and both vaccination and deworming are significant only for cats. Vaccinated cats (44.90%) are less susceptible than non-vaccinated cats (87.10%). Similarly, non-vaccinated dogs (81.08%) are more susceptible than vaccinated dogs (45.61%). Dewormed cats (56.75%) and dogs (54.90%) have less ectoparasitic infestation than non-dewormed cats (87.50%) and dogs (65.12%). In 2018, Alho et al. found similar studies which substantiate my findings (Alho, 2018).

# 5. Limitations

In this study, there are some limitations too. The study only covered the ectoparasitic prevalence of pet dogs and cats in Dhaka only, small numbers of sample sizes were recorded whereas a larger population would provide a more specified result for a better conclusion and the time was limited too which were barriers for showing the entire situation in our country.

# 6. Conclusion

With Bangladesh's fast urbanization, the rearing of pet dogs and cats is an essential social stress-reduction strategy. Nowadays, most of the people in Bangladesh are rearing pet dogs and cats. As dogs and cats are the most popular companion animals globally, as well as the most significant hosts of ectoparasites. Nowadays, most of the people are rearing pet dogs and cats in Bangladesh. This study substantiates that semi-urban pet dogs and cats are more ectoparasitic infested than urban areas. Age between 0 to 1 year pets are more susceptible for both dogs and cats. Male pets are less susceptible than females. So female pets should take more care. In cats, exotic animals are less susceptible than local breeds. But in dog's exotic animals are more susceptible than local breeds. 0 to 1 year animals are more susceptible in both dogs and cats. Animals who roam around are more susceptible to cats. Vaccination and deworming are especially important and effective factors here. So, vaccination and deworming should be done routinely. To reduce the prevalence, we should take control measures and ensure proper diagnosis and treatment of these diseases.

Finally, as stated above, pets could be one kind of social stress reliever for human. We should provide them with a habitat where they can stay in a proper way andwithout any kind of diseases. The completed study will provide an overview of the risk factors associated with the ectoparasitic prevalence of pet dogs and cats.

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# 8. Appendix

| | |
|---|---|
| City | |
| Nature of cases (Fresh/repeat) | |
| Species of animal | |
| Types of pets(single/mixed) | |
| Breed | |
| Body weight | |
| Sex | |
| Age | |
| Source of pet(domestic/rescued/buying) | |
| Number of pets | |
| Housing system of pet (intensive/semi-intensive/other) | |
| Posture (Normal/defective) | |
| BCS (1-cachectic/2-poor/3-fair/4-good/5-overweight, fat) | |
| Coat color | |
| Physiological status (Estrus/metaestrus/diestrus/recently kidding/pregnant/other | |
| Temperature | |
| Hair coat (shiny/rough & stray/other) | |
| Skin (normal/ring worm/dermatitis/ectoparasite/alopecia/abscess) | |
| Feces (Visible worm/bloody/blackish/greenish/milky white/mucus/foul odoured) | |
| Usual place of defecation | |
| Foot lesion(yes/no) | |
| Ectoparasite found in (Back/tail/ | |
| Feeding type(single/mixed) | |
| Where pet easily roam | |
| Mix with another animal(yes/no) | |
| Vaccination(yes/no) &when, frequency | |
| Deworming (Yes/no)&when, frequency | |

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Finally, a special thanks to Dr. Abdul Mannan, Deputy Chief Veterinary Officer, and Director (In-charge).

# Biography

This is Asma Sadia Authoy, the first child of A. B. M. Showkat Iqbal Shaheen and Nusrat Shamim Mithil, who is doing her graduation in Doctor of Veterinary Medicine (DVM) at Chattogram Veterinary and Animal Sciences University under the Faculty of Veterinary Medicine. She passed the Secondary School Certificate Examination (SSC) in 2013 from Feni Government Girls High School and the Higher Secondary Certificate Examination (HSC) in 2015 from Bhola Fazilatunnesa Government Women College. Currently, she is doing her yearlong internship. She has a great interest in wildlife and pets. She is extremely interested in further research in this area. She had already worked on a project based on antimicrobial resistance. She has a great interest in research.