PREVALENCE OF GASTRO-INTESTINAL PARASITIC INFECTIONS AND EFFICACY OF ANTIPARASITICS AGAINST THESE INFECTIONS IN DOGS IN MYMENSINGH SADAR

Badrul Huda Mehedi, Azimun Nahar, A K M Anisur Rahman and Md. Amimul Ehsan*

Department of Medicine, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

*Corresponding author: Dr. Md. Amimul Ehsan; E-mail: amimul.med@bau.edu.bd

ARTICLE INFO

Received 05 December, 2020
Revised 23 December, 2020
Accepted 27 December, 2020
Online 12 January, 2021

Gastro-intestinal parasitic infections in dogs represent a major concern in developing countries including Bangladesh. Dogs are important definitive or reservoir hosts for several zoonotic parasites. This study was conducted to determine the prevalence of gastro-intestinal parasites in dogs from different areas of Mymensingh Sadar. The fecal samples were examined by simple sedimentation and stool's ova counting method for detection of eggs/cysts/oocysts of parasites. The overall prevalence of gastrointestinal parasites was 60.00% (51/85) and the mixed parasitic infection was 16.47% (14/85). A total of six species of gastro-intestinal parasites (ova/oocyst) were identified, of them four species were nematode namely, Toxocara canis (24.7%), Acylostoma caninum (7.05%), Acylostoma braziliense (2.35%), Uncinaria stenocephala (2.35%), one species was cestode, Taenia pisiformis (3.52%) and one species was protozoa, Isospora canis (3.52%). The prevalence of infection was significantly (P<0.02) higher in puppies and young dogs than that in adult dogs. The efficacy of fendedazole (Bol. Fenvet®), albendazole (Tab. Alben DS®), fenbendazole (Tab. Paraclear®) was 100% effective against single helminth infection. However, the efficacy of mebendazole (Syrup. Mebantrin®) was 25%-50% against mixed helminth infections. The efficacy of metronidazole (Syrup. Amodis®) was 100% against single protozoal infection. So, anthelmintic including albendazole, fenbendazole, mebendazole and metronidazole may be recommended to treat effectively the single infection of helmint and protozoa, respectively, in dogs. Special emphasis should be given to deworm puppies as they are more vulnerable to parasitic diseases. The T. canis, A. caninum, A. braziliense and U. stenocephala prevalent in dogs are zoonotic and have public health impact.

To cite this article: Mehedi B. H., A. Nahar, A. K. M. A. Rahman, M. A. Ehsan, 2020. Prevalence of gastro-intestinal parasitic infections and efficacy of antiparasitics against these infections in dogs in Mymensingh sadar. Res. Agric. Livest. Fish., 7 (3): 411-419.
INTRODUCTION

Dog is very popular as pets in many countries including Bangladesh. It has also an important role in the transmission of important zoonotic parasites to human beings. Environmental contamination with dog feces harboring various infective stages of parasites such as eggs, larvae or oocysts act as a leading source of infection to livestock and human (Bentonsui et al., 2009). Hydatidosis and toxocariasis, are considered as serious public health concern (Alvarez-Rojas et al., 2014). Being a reservoir host for a large number of parasites dogs share these pathogens between pets and humans (Duscher et al., 2015). Human can be infected through the ingestion of eggs, cysts or oocysts via contaminated food-stuffs or water, hands, inhalation of dust, and/or by penetration of larvae through the skin (Lee et al., 2010a). Dogs are the definitive or reservoir hosts of more than 60 zoonotic parasites, such as Taenia sp., Echinococcus sp., Diphylidium caninum, Toxocara canis, Ancylostoma sp., Giardia sp., and Cryptosporidium sp. (Satyal et al., 2013; Perera et al., 2013). A high prevalence of gastrointestinal disorders with intestinal parasitic infections in dogs are recognized commonly in most developing countries (David et al., 2015). T. canis is one of the most common gastrointestinal parasites of dogs (Lee et al., 2010b; Overgauw and Van Knapen, 2013). Heavy prenatal infection with T. canis may lead to the death of all puppies due to migration of larvae into the lung. Dogs especially puppies are also severely affected with Ancylostoma caninum and suffered with anaemia resulting death of puppies between 10 and 24 days after a single primary infection. The infection with Ancylostoma braziliense and Uncinaria stenocephala are not related with anaemia but prompts severe diarrhea (Miller, 1971). Canine hookworms are responsible for zoonotic gastrointestinal parasitic diseases (Bowman et al., 2010). Hookworms are commonly associated with cutaneous larva migrans in humans. Dogs are also being infected with various types of tapeworm infections such as Taenia spp, D. caninum etc. Dogs are also infected with different types of protozoal diseases. Isospora canis or Isospora wallacei are common protozoal infection in dogs (Katagiri and Oliveira, 2008). Although a number of pet dogs are increasing rapidly in Bangladesh especially in the big cities, there are scant information on prevalence and the risk factors of intestinal parasitism in pet dogs. To control parasitic infections in dogs and the zoonotic transmission of these parasites to human being, knowledge on prevalence and the risk factors of these parasitic infections is essential.

In developed countries the principles of control of gastro-intestinal parasites are mainly based on proper practices of hygiene, management, biosecurity and protective treatment (Radostits et al., 2000). In Bangladesh, these are not always possible and mostly dependent on the anthelmintics to control the parasitic infection of dogs (Rahman, 1997). A good number of anthelmintics and antiprotozoal drugs against a wide range of helminths and protozoa are available in local market of Bangladesh. The commonly available drugs in Bangladesh market are levamisole, albendazole, fenbendazole, mebendazole, triclabendazole, ivermectin, piperazine citrate, pyrantel pamoate, nitrooxylin sodium etc. Fenbendazole with praziquantel was reported to be 100% effective for the removal of Ancylostoma sp., Toxocara sp. and Taenia spp (Conwin et al., 1984). The efficacy of albendazole 98.8% to 100% against Ancylostoma spp (Ramalingam et al., 1983). The efficacy of metronidazole was 90-100% against protozoal infections in both dogs and cats (Garanayak et al., 2017). The comparative efficacy of some anthelmintics against common helminths had been investigated mostly in indigenous cattle, sheep, goat etc with varied level of efficacy (Hossain and Ali, 1998; Hanif et al., 2003; Hossain et al., 2004; Khalid et al., 2004; Hossain et al., 2005). However, there is a scant report on the efficacy of antiparasitics (anthelmintic, antiprotozoal drugs) against gastro-intestinal parasitic infections in dogs. Therefore, the objectives of this study were to determine the overall prevalence of parasitic infections, identify the risk factors for parasitic infections and evaluate the efficacy of anthelmintic, antiprotozoal drugs against these parasitic infections.

MATERIALS AND METHODS

Study period and study area

This study was carried out in household dogs in different areas of Mymensingh Sadar from December 2018 to May 2019. A total of 85 fecal samples of dogs were collected purposively irrespective of their age and sex. The selected dogs were categorized into three age groups: puppies of ≤6 months (n = 47), the young dog of > 6 months to 1 year (n = 25) and the adult dog of > 1 year (n = 13). About 10 grams of faeces from each dog was collected from the top of the freshly voided faecal mass with necessary precaution to avoid cross contamination. The age and sex of the dogs were recorded during sample collection.
Faecal examination
The fecal samples were examined by simple sedimentation technique and Stoll's ova counting method for detection of the eggs of the gastrointestinal helminthes and cysts/oocysts of the protozoa. The eggs of the helminth parasites and the cysts/oocysts of the protozoa were identified by their characteristic morphological features (Soulsby, 1982; Thienpont et al., 1986).

Trial of anthelmintic and antiprotozoal drug
Two groups of dogs infected with single and mixed infections of helminth and protozoa were treated by commercially available anthelmintics (Bol. Fenvet® Tab. Alben DS®, Tab. Paraclear® and Syrup. Mebantrin) and antiprotozoal drug (Syrup. Amodis®) in Bangladesh.

Data analysis
The data analysis for the determination of prevalence and risk factors analysis of parasitic infection of dogs was done by Epi info software version 7.2.2.16. Odds ratio was calculated according to the formula given by Schlesselman (1982).

RESULTS AND DISCUSSION

Overall prevalence of gastro-intestinal parasites
A total of 85 dogs were examined through fecal sample examination, of which 60.0% (51) were found to be infected with one or more species of gastro-intestinal parasites (Table 1). A total of six species of gastro-intestinal parasites were identified on the basis of the characteristic morphological features of eggs or oocysts. In this study, four species of nematode such as *T. canis*, *A. caninum*, *U. stenocephala* and *A. braziliense*; one species of cestode such as *T. pisiformis* and one species of protozoa namely *I. canis* were identified (Table 1 and Figure 1). The highest prevalence was observed for *T. canis* (24.7%) followed by *A. caninum* (7.05%), *A. braziliense* (2.35%), *U. stenocephala* (2.35%), *T. pisiformis* (2.35%) and *I. canis* (3.52%). Mixed infections with two or more gastrointestinal parasites were detected in 20.00% (14) dogs (Tables 1 and 2).

| Name of the parasites | Prevalence (n = 85) |
|-----------------------|---------------------|
|                       | No. of positive     | Prevalence (%) |
| *T. canis*            | 21                  | 24.7           |
| *A. caninum*          | 6                   | 7.05           |
| *A. braziliense*      | 2                   | 2.35           |
| *U. stenocephala*    | 2                   | 2.35           |
| *T. pisiformis*       | 3                   | 3.52           |
| *I. canis*            | 3                   | 3.52           |
| Mixed infection       | 14                  | 16.47          |
| Total                 | 51                  | 60             |

This study describes the prevalence and risk factors of gastrointestinal parasitic diseases in dogs in Mymensingh Sadar. In the present study, 60.00% dogs were found to be infected with one or more species of gastro-intestinal parasites. Lower prevalence than this result were reported bu other authors such as 41.46%, 44.3% and 46.7% from India, Cuba and Kathmandu district in Nepal, respectively (Panigrahi et al., 2014; Puebla et al., 2015; Satyal et al., 2013). However, higher prevalence (78.5%) than our result has also been reported from domestic dogs of Chittagong, Bangladesh (Basu et al., 2010). It was revealed in this study that 24.7% of the dogs were infected with *T. canis*. Sarder et al., (2012) reported higher prevalence (33.30%) of...
Toxocara sp in Bangladesh. Some authors reported variable prevalence of Toxocara canis which ranged from 2.2% to 16.62% (Hoskins et al., 1982; Savilla, 2009; Katagiri and Oliveira, 2008; Ilic et al., 2017; Little et al., 2009). Higher prevalence of toxocariasis in this study might be due to selection of young dogs; as these ascarids mostly infect younger dogs below one year of age (Soulsby, 1982; Martinez-Moreno et al., 2006; Taylor et al., 2016). The prevalence of Acylostoma sp was 9.41%. Sarder et al., (2012) observed an overall prevalence of 31% for Acylostoma sp in dogs in Dhaka city corporation. The prevalence of A. caninum was 7.05% in this study which was inconsistent with the findings of Muhamed and Al-barwary (2016) who reported 2.2% A. caninum infection in dogs from Iraq. Other authors reported 44.8 to 52% prevalence of A. caninum infection in dogs from Hawassa and Bahir Dar town of Ethiopia and in Nepal respectively (Paulos et al., 2012; Getahun et al., 2012; Satyal et al., 2013). The variation in findings of the present result and earlier reports might be due to differences in the geographical location, breeds of animals, sample size and sampling technique, methods of faecal examination and endemicity of the area. The prevalence of I. canis (3.52%) observed in this study was lower than the findings of Mahmud et al., (2014) who reported 14.75% infection in dogs from Sirajganj, Bangladesh. The prevalence of I. canis was reported to be 5.1% in Kerman city, Iran (Mirzaei, 2010). In this study, prevalence of Taenia pisiformis was found to be 3.52% which was consistent with other report (5%) in Bangladesh (Das et al., 2012). The variations among the findings might be due to the difference in the selection of animal, techniques of sample collection, period and place of study, environmental factors and breed of the animals etc.

### Table 2. Prevalence of mixed infections of different parasites in dogs

| Name of the parasites                  | Mixed infection (n=14) | No. of positive case | Prevalence (%) |
|----------------------------------------|------------------------|----------------------|----------------|
| T. canis, A. caninum, A. braziliense    |                        | 4                    | 28.57          |
| T. canis, T. taeniaeformis, U. stenocephala |                      | 2                    | 14.28          |
| A. caninum, A. braziliense, U. stenocephala |                      | 2                    | 14.28          |
| A. braziliense, T. taeniaeformis, T. canis |                      | 3                    | 21.42          |
| T. canis, A. caninum                   |                        | 2                    | 14.28          |

### Age related prevalence of gastro-intestinal parasites

In this study prevalence of intestinal parasites was found to be higher in puppies (68.08%) compared with young (64.00%) and adult (23.04%) (Table 3). Puppies (≤6 month), were found to be infected with T. canis (29.78%), A. caninum (8.51%), A. braziliense (2.12%), U. stenocephala (2.12%), T. pisiformis (2.12%) and I. canis (4.25%). The mixed infections in puppies were recorded as 19.14%. In young animals (>6 month to 1 year) the most prevalent gastro-intestinal parasite was T. canis (20.00%) followed by A. caninum (8.00%), A. braziliense (4.00%), U. stenocephala (4.00%), T. pisiformis (4.00%) and I. canis (4.00%). In addition, 20% young dogs were infected with mixed parasites. Adult dogs (>1 year) were found mostly to be infected with T. canis (15.38%) and T. pisiformis (7.69%). It was revealed that, age of the dogs had a significant effect on gastro-intestinal parasitic infection. Puppies were found to be more infected with gastro-intestinal parasitic infection than young animals and adults in the current study. This result is in agreement with several other studies (Endrias et al., 2010; Swai et al., 2010; Andresiuki et al., 2007). Oliveira-Sequeira et al., (2002) and Muradian et al., (2005) also demonstrated higher prevalence ancylostomiasis and toxocariasis in dogs below one year of age. T. canis was detected more frequently in dogs less than 1 year of age which is consistent with the findings of other authors (Little et al., 2009; Katagiri and Oliveira, 2008; Hoskins et al., 1982). Higher prevalence of A. caninum and T. canis in younger dogs might be due to the transplacental and transmammary passage of larvae to the puppies (Bowman, 2009; Soulsby, 1982). Young dogs were found to be more susceptible to I. canis infection than the adults. Similar result had been recorded by Mirzaei (2010) in Iran. This might be due to lower immunity where older dogs are comparatively resistant to such infection as they have higher adaptive immunity (Soulsby, 1982).
Figure 1. Morphological features of eggs/oocyst of parasites identified in feces from dog under microscope (40x objective)

Table 3. Age related prevalence of gastro-intestinal parasitic infections in dogs

| Parameter            | Name of parasites | No. of positives | Prevalence (%) |
|----------------------|-------------------|------------------|----------------|
| Puppy (≤6 month)     | T. canis          | 14               | 29.78          |
|                      | A. caninum        | 4                | 8.51           |
|                      | A. braziliense     | 1                | 2.12           |
|                      | U. stenocephala   | 1                | 2.12           |
|                      | T. pisiformis     | 1                | 2.12           |
|                      | I. canis          | 2                | 4.25           |
|                      | Mixed infection   | 9                | 19.14          |
| Total                |                   | 32               | 68.08          |
| Young (<6 month to 1 Year) | T. canis       | 5                | 20             |
|                      | A. caninum        | 2                | 8              |
|                      | A. braziliense     | 1                | 4              |
|                      | U. stenocephala   | 1                | 4              |
|                      | T. pisiformis     | 1                | 4              |
|                      | I. canis          | 1                | 4              |
|                      | Mixed infection   | 5                | 20             |
| Total                |                   | 16               | 64             |
| Adult (>1 year) n=13 | T. canis          | 2                | 15.38          |
|                      | T. pisiformis     | 1                | 7.69           |
| Total                |                   | 3                | 23.07          |
Sex related prevalence of gastro-intestinal parasites in dogs

Female dogs (70.58%) were found to be more infected with parasitic diseases than male (52.94%) dogs (Table 4). The prevalence of T. canis (25.49%) was highest in male dogs followed by A. caninum (7.84%), I. canis (3.92%) A. braziliense, U. stenocephala and T. pisiformis (1.9%). The mixed infections in male were recorded as (9.8%). Similar to males, the highest level of T. canis (23.52%) was noted in the females which was followed by A. caninum (5.88%), T. pisiformis (5.88%), U. stenocephala (2.94%), A. braziliense (2.94%) and Isospora canis (2.94%) (Table 3). This result is in accordance to other reports (Getahun et al., 2012; Paulos et al., 2012; Endrias et al., 2010; Katagiri and Oliveira, 2008; Razmi et al., 2006). Higher frequency of enteric helminthiasis in male dog has been reported by other authors in Tanzania, Nigeria and in Brazil also (Swai et al., 2010; Umar, 2009; Oliveira- Sequeira et al., 2002).

Risk factors analysis of gastro-intestinal parasitic infections according to age and sex in dogs

The risk of parasitic infections was 4.8 times higher (P<0.02) in puppies than that in adult (Table 5).

Efficacy of anthelmintics and antiprotozoal drugs against parasitic infections in dogs

The efficacy of anthelmintics was 100% against single parasitic infection but the efficacy was 25%, 25%, 50% against mixed parasitic infection (Table 6). The efficacy of antiprotozoal drugs was 100% against single protozoal infection (Table 6). The efficacy of Bol. Fenvet®, Tab. Alben DS®, Tab. Paraclear® against single infection was 100% against roundworm, hookworm, tapeworm, respectively which was similar to the other reports (Corwin et al., 1984; Ramalingam et al., 1983). The efficacy of Syrup Mebantrin® varied from 25% to 50% against mixed helminth infections which was lower than the previous report (Guerrero et al., 1981). The efficacy of antiprotozoal drugs Syrup Amodis® was 100% against single infection of infected dogs which was similar to other report (Garanayak et al., 2017). A lot of factors may be responsible for the difference of drugs efficacy against single and mixed parasitic infection. For example, the efficacy trail was conducted in field conditions and owners were requested to treat their pet dogs with prescribed anthelmintics and antiprotozoal drugs. Again the dose rate was same for the all cases of parasitic infection and for that reason in case of heavy infection it was not recovery properly. During post-treatment fecal sample collection it was also tried to know whether as such the treatment was given or not. But if there are some gap in choice of drugs, dose and timings of the treatment, the efficacy will not reveal the true status of the drugs.

| Parameter | Parasitic infection | Odds ratio | P-value |
|-----------|---------------------|------------|---------|
| ≤6 month  | Yes 32, No 15 | 1.42 | 0.49 |
| >6 month to 1 year | Yes 15, No 10 | - | - |
| ≤6 month  | Yes 32, No 15 | 4.8 | 0.015 |
| >1 year   | Yes 4, No 9 | - | - |
| >6 month to 1 year | Yes 15, No 10 | 3.37 | 0.087 |
| >1 year   | Yes 4, No 9 | - | - |
| Female    | Yes 21, No 13 | 0.88 | 0.786 |
| Male      | Yes 30, No 21 | - | - |
Table 6. Efficacy of anthelmintics and antiprotozoal drug against parasitic infections in dogs

| Type of infection     | Anthelmintics/anti-protozoal drug | Name of parasite | No. of dog treated | No. of dog recovery (%) | No. of dog unrecovery (%) | EPG before treatment (Mean) | EPG two weeks after treatment (Mean) |
|-----------------------|----------------------------------|------------------|-------------------|------------------------|--------------------------|-----------------------------|----------------------------------|
| Single infection      | Bol. Fenvet®                    | a                | 3                 | 3 (100%)               | 0 (0%)                   | 233.3                       | 0                                |
| (Helminth)            | Tab. Alben DS®                  | b                | 3                 | 3 (100%)               | 0 (0%)                   | 111                         | 0                                |
| Tab. Paraclear®       | c                                | 3                | 3                 | 3 (100%)               | 0 (0%)                   | 300                         | 0                                |
| Mixed infection       | Syrup. Mebantrin®               | a+b              | 4                 | 1 (25%)                | 3 (75%)                  | 650                         | 25                               |
| (Helminth)            | Syrup. Mebantrin®               | a+b+c            | 4                 | 1 (25%)                | 3 (75%)                  | 800                         | 50                               |
| Mixed b              | Mixed b                         | 4                | 2 (50%)           | 2 (50%)                | 650                      | 33.3                        | 0                                |
| Single infection      | Syrup. Amodis®                  | d                | 3                 | 3 (100%)               | 0 (0%)                   | 300                         | 0                                |
| (Protozoa)            |                                  |                  |                   |                        |                          |                             |                                  |

a. Round worm, b. Hook worm, c. Tape worm, d. Isospora sp

CONCLUSION

Gastro-intestinal parasitic infection is highly prevalent in dogs. Albendazole, fenbendazole, and mebendazole containing anthelmintics are highly effective against single helminth infection in dogs. Similarly, metronidazole, pyrimethamine+ sulfadoxine are recommended to treat single protozoal infection in dog. Special emphasis should be given to deworm puppies as they are more vulnerable to parasitic diseases. The *T. canis*, *A. caninum*, *A. braziliense* and *U. stenocephala* prevalent in dogs are zoonotic and have public health impact. Regular deworming and awareness building among dog owners are required to control the disease burden in dogs and also the risk of transmission to humans.

REFERENCES

1. Alvarez-Rojas CA, Romig T and Lightowlers MW, 2014. *Echinococcus granulosus* sensu lato genotypes infecting humans- review of current knowledge. International Journal for Parasitology, 44(1): 9-18.
2. Basu J, Islam MM, Rahman MW, Alam MR, Parvez MM, 2010. Study on identification and prevalence of common gastrointestinal parasitic infection in domestic dog in Chittagong district. International Journal of Animal and Fisheries Science, 3: 354-356.
3. Bentouisni B, Meradi S, Ayachi A and Cabaret J, 2009. Cestodes of untreated large stray dog populations in Algeria: a reservoir for herbivore and human parasitic diseases. Open Veterinary Science Journal, 3(1): 64-67.
4. Bowman DD, Montgomery SP, Zajac AM, Eberhard ML, Kazacos KR (2010). Hookworms of dogs and cats as agents of cutaneous larva migrans. Trends Parasitology, 26 (4): 162-167.
5. Corwin SE Pratt HD and McCurdyyet, 1984. Anthelmintic effect of febantel/praziquantel paste in dogs and cats. American journal of veterinary research, 45 (1): 154-5.
6. Das S, Alim MA, Sikder S, Gupta AD and Masuduzzaman M, 2012. Prevalence and Worm Load of Enteric Helminthiasis in Stray Dogs of Chittagong Metropolitan, Bangladesh. YYU Veteriner Fakultesi Dergisi, 23(3): 141-145.
7. David EB, Guimaraes S, de Oliveira AP, Goulart de Oliveira-Sequeira TC, Nogueira and Bittencourt G 2015. Molecular characterization of intestinal protozoa in two poor communities in the State of Sao Paulo, Brazil. Parasites & Vectors, 8: 103.
8. Duscher GG, Leschnik M, Fuehrer HP and Joachim A 2015. Wildlife reservoirs for vector-borne canine, feline and zoonotic infections in Austria. International Journal for Parasitology. Parasites and Wildlife, 4(1): 88-96.

9. Endrias Z, Semahneg Y and Mekibib B, 2015. Prevalence of helminth parasites of dogs and owners awareness about zoonotic parasites in Ambo town, central Ethiopia. Ethiopian Veterinarian Journal, 14 (2): 17-30.

10. Garannayak N, Gupta AR and Patra RC, 2017. Successful Therapeutic management of canine isosporosis in puppies. Journal of Parasitic Disease, 41(1): 48-50.

11. Getahun Z and Addis M, 2012. Prevalence of gastrointestinal helminthes among dogs in Bahir Dar Town, Ethiopia. World Applied Sciences journal, 19 (5): 595-601.

12. Guerrero J, Pancari G, and Michael B, 1981. Comparative anthelmintic efficacy of two schedules of mebendazole treatment in dogs. American Journal of Veterinary Research, 42(3): 425-427.

13. Hanif MA, Talukdar MRI, Lucky NS and Haque AKM, 2003. Gastrointestinal helminthes infection in diarrhoeic calves and evaluation of some anthelmintics against them. The Bangladesh Veterinarian, 1: 13-18.

14. Hoskins JD, Malone JB and Smith PH, 1982. Prevalence of parasitism diagnosed by fecal examination in Louisiana dogs. American Journal of Veterinary Research, 43(6): 1106-9.

15. Hussain KA, Samad MA, Islam MA and Bhuiyan AA, 2005. Clinical observations with therapeutic management of parasitic bottle jaw syndrome in calves. Bangladesh Journal of Veterinary Medicine, 3(2): 124-128.

16. Hossain MA and Ali KM, 1998. Effects of anthelmintics on the body weight of goats naturally infected with fascioliasis and gastrointestinal nematodiasis. Bangladesh Veterinary Journal, 32(1): 41-46.

17. Hossain MJ, Amin M, Mostofa, Sharif M and Khalid SMA, 2004. Efficacy of LevanidR against natural gastrointestinal nematodiasis and paramphistomiasis in sheep. The Bangladesh Veterinarian, 21: 70-73.

18. Ilic T, Kuliscic Z, Antic N, Radisavijevic K and Dimitrijevic S, 2017. Prevalence of zoonotic intestinal helminths in pet dogs and cats in the Belgrade area, Serbia. Journal of Applied Animal Research, 45 (1): 204-208.

19. Katagiri S and Oliveira-Sequeira TCG, 2008. Prevalence of dog intestinal parasites and risk perception of zoonotic infection by dog owners in Sao Paulo State, Brazil. Zoonoses and Public Health, 55(8-10): 406-413.

20. Khalid SMA, Amin MR, Mostofa M, Hossain MJ and Azad MAK, 2004. Effect of vermic against gastrointestinal nematodiasis in sheep. Journal of Biological Science, 4(6) : 720-724.

21. Lee AC, Montgomery SP, Theis JH, Blagburn BL and Eberhard ML, 2010a. Public health issues concerning the widespread distribution of canine heartworm disease. Trends in Parasitology, 26 (4): 168-173.

22. Lee AC, Schantz PM, Kazacos KR, Montgomery SP and Bowman DD, 2010b. Epidemiologic and zoonotic aspects of ascarid infections in dogs and cats. Trends in Vector Research and Parasitology, 26(4): 155-161.

23. Little SE, Johnson EM, Lewis D, Jaklitsch RP, Payton ME, Blagburn BL, Bowman DD, Moroff S, Tams T, Rich L and Aucoin D, 2009. Prevalence of intestinal parasites in pet dogs in the United States. Veterinary Parasitology, 166(1-2): 144-52.

24. Macpherson CN, 2013. The epidemiology and public health importance of toxocariasis: a zoonosis of global importance. International Journal for Parasitology, 43(12-13): 999-1008.

25. Mahmud MAA, Belal SMSH and Uddin FMJ, 2014. Prevalence of Protozoan Diseases in pet dogs at district veterinary hospital, Sirajganj, Bangladesh. Bangladesh Journal of Veterinary Medicine, 12(2): 191-196.

26. Martinez-Moreno FJ, Hernandez S, Lopez-Cobos E, Becerra C and Acosta I, 2006. Estimation of canine intestinal parasites in Cordoba Spain and their risk to public health. Veterinary Parasitology, 143 (1): 7-13.

27. Miller TA, 1971. Vaccination against the canine hookworm diseases. Advances in Parasitology, 9: 153-183.
28. Mirzaei M, 2010. Prevalence of stray dogs with intestinal protozoa parasites. American Journal of Animal and Veterinary Parasitology, 5(2): 86-90.

29. Muhamed TA and Al-Barwary LTO, 2016. Prevalence of Intestinal Parasites in the Intestine of Dogs (Sheep-Keeper, Owned, Pet and Stray) in Duhok Province, Kurdistan Region. Journal of Veterinary Science and Technology, 7(6): 379.

30. Muradian V, Gennari SM, Glickman LT and Pinheiro SR, 2005. Epidemiological aspects of Visceral Larva Migrans in children living at Sao Remo Community, Sao Paulo SP, Brazil. Veterinary Parasitology, 134(1-2) : 93-97

31. Oliveira-Sequeira TC, Amarante AF, Ferrari TB and Nunes LC, 2002. Prevalence of intestinal parasites in dogs from Sao Paulo State, Brazil. Veterinary Parasitology, 103(1-2): 19-27.

32. Overgaauw PA and Van Knapen F, 2013. Veterinary and public health aspects of Toxocara spp. Veterinary Parasitology, 193 (4): 398-403.

33. Panigrahi PN, Gupta AR, Behera SK, Panda BSK, Patra RC, Mohanty BN and Sahoo GR, 2014. Evaluation of gastrointestinal helminths in canine population of Bhubaneswar, Odisha, India: a public health appraisal. Veterinary world, 7 (5): 295-298.

34. Paulos D, Addis M, Fromsa A and Mekibib B, 2012. Prevalence of gastrointestinal helminthes among dogs and owners perception about zoonotic dog parasites in Hawassa Town, Ethiopia. Journal of Public Health and Epidemiology, 4 (8): 205-209.

35. Perera PK, Rajapakse RP, and Rajakaruna RS, 2013. Gastrointestinal parasites of dogs in Hantana area in the Kandy District. Journal of the National Science Foundation of Sri Lanka, 41 (2): 81-91.

36. Puebla LEJ, Nunez FA, Rivero LR, Hernandez YR, Garcia IS and Millan IA, 2015. Prevalence of Intestinal Parasites in Dogs from Municipality La Lisa, Havana, Cuba. Journal of Veterinary Science and Technology, 6 (5): 25-30.

37. Radosits OM, Gay CC, Blood DC and Hincliff KW, 2000. A textbook of the Diseases of Cattle, Sheep, Pigs, Goats and Horses. 9th edn. W.B. Saunders Co. p.1319.

38. Rahman MH, 1997. Incidence of some helminth parasites of zoonotic significance in street dogs in some districts of Bangladesh. Bangladesh Journal of Veterinary Medicine, 7 (1): 14-16.

39. Ramalingam Shivaji, B Sinniah and Uma Krishnan, 1983. Albendazole, an effective single dose, broad spectrum anthelmintic drug. The American Journal of Tropical Medicine and Hygiene, 32 (5): 984-989.

40. Razmi GR, Sardari K and Kamrani AR, 2006. Prevalence of Echinococcus granulosus and other intestinal helminths of stray dogs in Mashhad area. Iranian Archives of Razi Institute, 61 (3): 143-148.

41. Sarder SA, Islam A, Anisuzzaman, Hannan MA, Rabbi AKMA and Islam MA, 2012. Pet dogs in Mymensingh campus. 9. P. 17.

42. Satyal RC, Manandhar S and Dhakal S, 2013. Prevalence of gastrointestinal zoonotic helminths in dogs of Kathmandu, Nepal. International Journal of Infection and Microbiology, 2 (3): 91-94.

43. Savilla TM, 2009. Prevalence of intestinal parasite infection in symptomatic and asymptomatic dogs in southwestern West Virginia: the potential impact on human health. Theses, Dissertations and Capstones. p.842.

44. Schlesselman JJ (1982). Case-Control Studies. 1st edition, Oxford University Press, New York, pp. 174-177.

45. Soulsby EJL, 1982. Helminths, Arthropods and Protozoa of Domesticated Animals. (7th edition). Bailliere Tindall: London.

46. Swai ES, Kaaya EJ, Mshanga, DA and Mbise EW, 2010. A survey on gastro- intestinal parasites of non-descript dogs in and around Arusha Municipality, Tanzania. International Journal of Animal and Veterinary Advances, 2 (3): 63-67.

47. Taylor MA, Coop RL and Wall RL, 2016. Veterinary parasitology. 4 edition. Wiley Blackwell publishing, Oxford.

48. Thienpont D, Rochette F, and Vanparijs OFJ, 1986. Diagnosing Helminthiasis by Coprological Examination. Janseen Research Foundation. Beerse, Belgium.

49. Umar YA, 2009. Intestinal helminthoses in dogs in Kaduna Metropolis, Kaduna State, Nigeria. Iranian Journal of Parasitology, 4 (1): 34-39.