Research Article

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Prevalence of Zoonotic Gastrointestional Helminth Parasites in Pet and Stray Dogs of Rupandehi District, Nepal

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ABSTRACT

Dogs are associated with zoonotic disease transmission including the helminth parasites. Soil contamination with dog faeces facilitates the transmission of zoonotic parasites.

Cross-sectional study: *Out of 400 dogs fecal sample examined, 235 (58.75%) were positive for presence of at least one of the zoonotic helminth. The prevalence of helminth parasites was significantly higher in stray dogs (78.5%) than in pet dogs (39%) ($p<0.05$). The common parasites observed in present study were Ancylostoma spp. (46.81%), Toxocara canis (37.87%), Taenia spp. (9.36%), Dipylidium caninum (22.98%), Trichuris vulpis (5.73%) and Diphyllobothrium (2.98%).*

The overall prevalence was significantly higher in the pet dogs of age up to 1 year (52.44%) than the pet dogs of age above 1 year (29.66%). Single helminth parasitic infection was more common (78.72%) than concurrent mixed infection (21.28%) among positive samples. The prevalence of zoonotic helminth parasites was significantly greater in male pet dogs (46.97%) than in female pet dogs (23.53%) and in stray dogs prevalence was 83.48% in male dogs and 71.76% in female dogs. The prevalence was high in crossbred pet dogs (44.16%) than in purebred pet dogs (35.77%) which is not statistically significant ($p>0.05$). Significantly higher prevalence of gastrointestinal zoonotic helminthes was found in non-dewormed dogs (61.41%) than in dewormed dogs (36.81%).

Application of the One Health concept, in which the collaborative work of multiple disciplines aims to help attain optimal health for people, animals and our environment, has to be advocated to improve the management of intestinal parasitic helminth infections and to minimize the risk of exposure for humans and dogs both.

Introduction

The domestic dog (*Canis familiaris*) is the first domesticated mammal co-existed with man in all eras and culture since the days of the cave dwellers [1]. Higher level of self-esteem in children is seen with keeping pets [2]. From the estimated 500 million dogs worldwide, 400 million are believed to be stray dogs [3] and higher numbers of stray dogs are observed in developing countries, roaming freely increasing the risk of infection [4]. Thus, it increases potential health risks for the human population associated with owning a pet [5].

Zoonotic parasitosis are a worldwide health problem [6], due to their high prevalence rates leading to high economic and physical loss to human health [7]. Dogs play an important role in public health acting as reservoirs and transmitters of parasites [8]. Many canine gastrointestinal parasites eliminate their dispersion elements (eggs, larvae, and oocyst) by the fecal route [9]. This is considered as a major factor for the transmission of zoonotic parasitoses [10], and is potentiated by the high prevalence of helminth infections in dogs worldwide, which ranges from 67.4 to 100% [11]. In addition, the low level of hygienic conditions, lack of sufficient veterinary attention and zoonotic disease awareness compounds the risk of transmission of these diseases to human [6,12].

Both stray and pet dogs are involved in parasitic transmission, even if the particular implication of each population is not clearly

established [13]. Dalimi et al. [14] reported that human infection with helminth parasites is an emerging health issue due to sharing of human environment with animals, either pets or wild life. The most common zoonotic diseases of the developing countries are cutaneous and visceral larva migrans, hydatidosis, and taeniasis [15] and giardiosis, cryptosporidiosis and echinococcosis [16].

Rupandehi is one of the most populated district of Nepal and there is high number of pet and stray dogs. However, no research has been done on canine gastrointestinal (GI) zoonotic parasites in this area yet (Personnel Communication, DLSO, 2017). Gastrointestinal (GI) parasites are common pathogens in pet and stray dogs and some of them are zoonotically important [10,15]. This study tends to provide base line data regarding the prevalence of zoonotic gastrointestinal parasites. The hypothesis is that there is certain amount of gastrointestinal parasites present more in stray dogs in comparison to pet dogs and to assess potential risk factors that lead it to be zoonotic threat at Rupandehi district, Nepal.

Materials and Methods

Research technical and manpower support was provided by DLSO (District Livestock Service Organization), Rupandehi, Nepal.

Fecal samples

For the fecal samples, the household dogs were first restrained and thereafter fresh fecal sample was collected per rectally using the gloved index finger. In stray dogs, samples were collected purposively from the ground immediately after voiding by stray dogs during early morning period using plastic gloves (samples marked as Male/female distinguished by external sex organs), preserved in 10% formalin solution and examined within 2-3 hours of collection. Fecal samples were collected by multiple assessors.

Experimental design

Cross sectional study was conducted for determination of prevalence of zoonotically important gastrointestinal parasites in pet and stray dogs. Questionnaire survey was carried out among dog owners to assess the raising behavior, deworming schedule, awareness about canine gastrointestinal parasitic zoonosis.

Pilot study was done to know the prevalence estimate which was found to be 46% with 5% precision keeping the level of confidence at 95% gives the sample size of 381.

Procedure

For this whole study, site was divided in 4 regions and from each region 50 samples was collected from both pet and stray dogs of respective region. Out of 400 samples, 200 samples were collected from pet dogs and 200 samples were collected from stray dogs.

Then after, preserved fecal samples from the dogs were analyzed by means of centrifuge-flotation method using modified Sheather's solution and zinc sulfate flotation media at DLSO laboratory with the help of technicians [17].

About 2-5 g of feces was taken and mixed with 10 ml floatation solution. The mixture was poured through a tea strainer into a beaker. The strained solution was poured into a 15ml centrifuge tube and it was filled with floatation solution until slight positive meniscus was formed. Then, cover slip was placed on the tube and centrifuged at 1200 rpm for 5 minutes. Then after, tube was removed from centrifuge and let it stand for 10 minutes. Again, cover slip was removed slowly and placed on a glass slide. Finally, slide was examined under light microscope at 10x magnification. Helminth identification was done with reference to text book of Veterinary Clinical Parasitology [18].

Preparation of floatation solution

Zinc Sulfate solution ($ZnSO_4$; SG 1.18–1.20)
(331 g $ZnSO_4$ + 1,000 ml warm tap water)
Modified Sheather's Solution (SG 1.27)
(454 g granulated sugar + 355 ml tap water + 6 ml formaldehyde)

Statistical Data Analysis

Data entry was done in Microsoft Excel 2007. For statistical analysis, we used R ver 3.2.2. Bivariate association between the outcome and individual explanatory variables were assessed using the Pearson's Chi Square test. $P<0.05$ was considered significant.

Results

From Fecal Samples

Out of 400 dogs' fecal samples examined, 235 (58.75%) were positive for presence of at least one of the zoonotic helminth. The prevalence of helminth parasites was 39% (n= 78) for pet dogs while it was 78.5% (n=157) for stray dogs. The prevalence of GI zoonotic helminth parasites was statistically highly significant (χ^2 = 64.382; p = 1.025e-15) between types of dogs (Figure 1, Table 1).

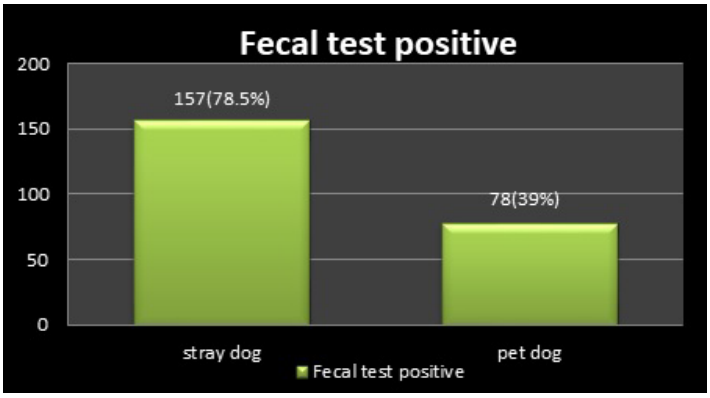

Figure 1: Overall prevalence of zoonotic helminths in pet and stray dogs.

Species	Prevalence (%)
Ancylostoma spp.	46.81
Toxocara spp.	37.87
Dipylidium spp.	22.98
Taenia spp	9.36
Trichuris spp	5.11
Diphyllobothrium spp	2.98

Table 1: Overall species wise prevalence.

The common parasites observed in present study were Ancylostoma spp. (46.81%), Toxocara spp (37.87%), Taenia (9.36%), Dipylidium spp. (22.98%), Trichuris spp. (5.73%) and Diphyllobothrium spp. (2.98%). (Figures 2, 3 and 4 & Tables 2, 3 and 4). The study revealed the occurrence of single helminth parasitic infection more common (78.72%) than concurrent mixed infection (21.28%) among positive samples (Figure 5).

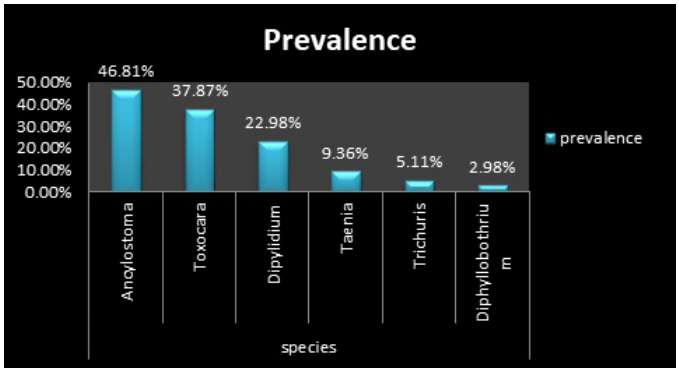

Figure 2: Species wise prevalence of parasites.

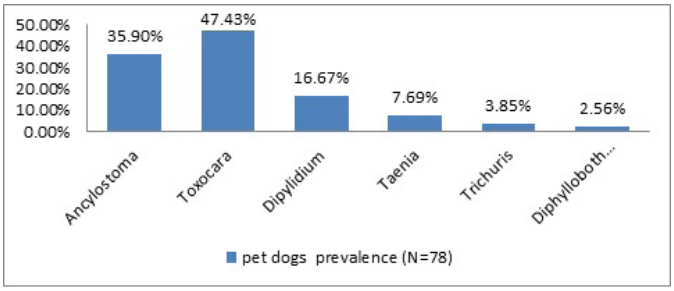

Figure 3: Species wise prevalence in pet dogs.

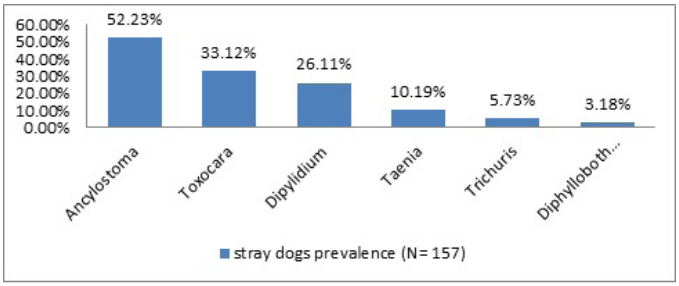

Figure 4: Species wise prevalence in stray dogs.

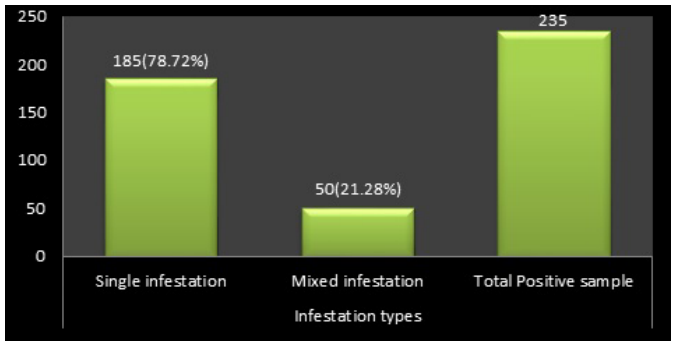

Figure 5: Infection type wise parasitic prevalence.

Species	Prevalence
Ancylostoma	28 (35.90%)
Toxocara	37 (47.43%)
Dipylidium	13 (16.67%)
Taenia	6 (7.69%)
Trichuris	3 (3.85%)
Diphyllobothrium	2 (2.56%)

Table 2: Species wise prevalence of parasites in pet dogs. Total positive samples, n=78.

Species	Prevalence
Ancylostoma	82 (52.23%)
Toxocara	52 (33.12%)
Dipylidium	41 (26.11%)
Taenia	16 (10.19%)
Trichuris	9 (5.73%)
Diphyllobothrium	5 (3.18%)

Table 3: Species wise prevalence of parasites in stray dogs. Total positive samples, n=157.

Deworming interval Sample examined	Prevalence
Within 3 months	89 27 (30.33%)
Within 3-6 months	65 27 (41.53%)
More than 6 months	28 13 (46.43%)
Not dewormed yet	18 11 (61.11%)

Table 4: Deworming interval and helminths prevalence.

The prevalence of gastrointestinal zoonotic helminths in pet dogs was significantly higher in dogs of age up to 1 year (puppy and adult, 52.44%) than the dogs of age above 1 years (Mature, 29.66%). The result showed that the prevalence of zoonotic helminths was significantly different (χ^2 = 10.551; p = 0.001161) between age groups of dogs (Figure 6).

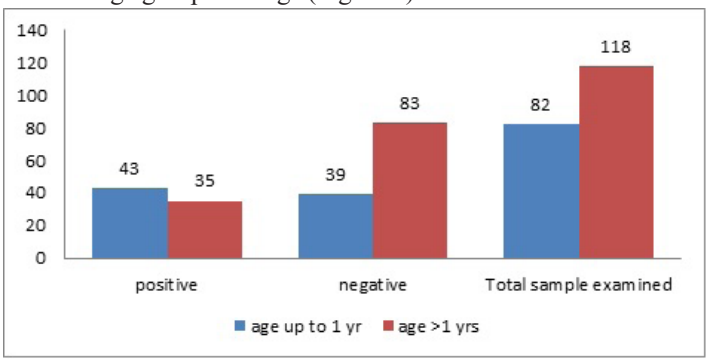

Figure 6: Age wise prevalence of parasites in pet dogs.

The prevalence of zoonotic helminth parasites was greater in pet male dogs (63.97%) than in pet female dogs (50.35%) and similar was the case in stray dogs (males 83.48% and females 71.76%). The result showed that the prevalence of zoonotic helminths was significantly different (χ^2 =7.254; p = 0.007074) between sex groups of dogs (Figures 7 and 8).

The prevalence of gastrointestinal zoonotic helminth parasites was high in crossbred pet dogs (44.16%) than in purebred pet dogs (35.77%) but it is not significant (χ^2 =1.399; p = 0.2369) (Figure 9). There was higher prevalence of gastrointestinal zoonotic helminth in non-dewormed pet dogs (61.41%) than in dewormed pet dogs (36.81%) which is statistically significant (χ^2 =5.1606; p = 0.02311) (Figure 10).

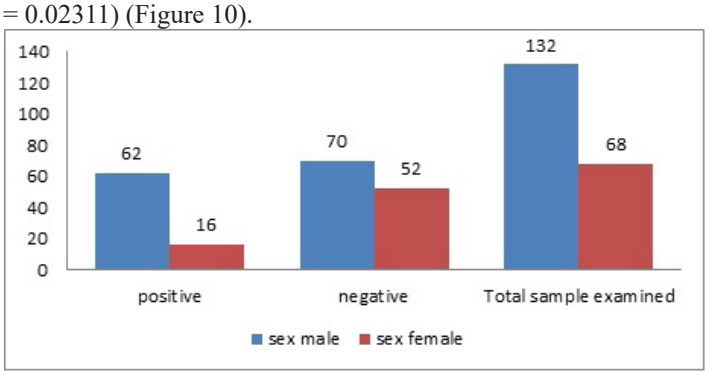

Figure 7: Sex wise prevalence of parasites in pet dogs.

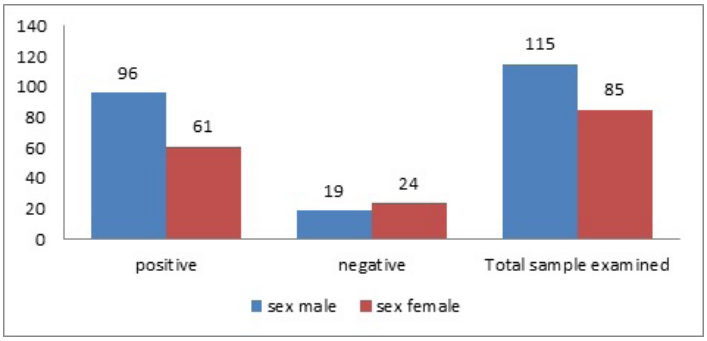

Figure 8: Sex wise prevalence of parasites in stray dog.

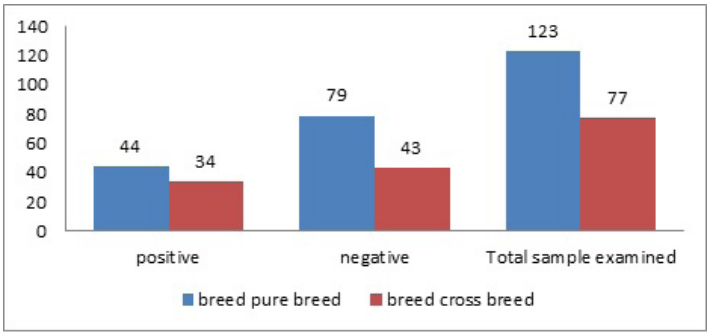

Figure 9: Breed wise prevalence of parasites in pet dogs.

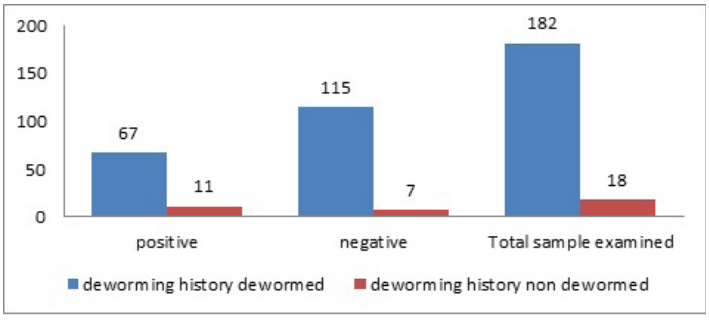

Figure 10: Prevalence of parasites among dewormed and non-dewormed pet dogs.

From Pet owner Survey

Responsible person to look after pet mostly for feeding and other management:

Out of 200 respondents, 46 (23%) family have their children to look after their pet mostly for feeding and other management practices, 80 (40%) family have their parents to look after their pet mostly, 58 (29%) family have both parents and children to look after pet and 16 (8%) family have their workers to look after their pet dogs.

System of rearing pet dogs:

Out of 200 respondents, 42 (21%) confine their pets in the kennel, 67 (33.5%) share same house with their pets, 75(37.5%) leave their pets partially to roam freely from house during morning and evening and 16 (8%) leave their pets free mostly to move about and outside compound during day time.

Place for defecating the pet dogs and disposal of feces:

Among 200 respondents, 78 (39%) replied that they let their pet to defecate within their house premises and 122 (61%) replied that they let their pet defecate outside the house premises. Among 78 respondents, 35 (17.5%) told that they dispose their pets' feces in the toilet, 27 (13.5%) dispose outside the compound , 16 (8%) dispose within the compound premises and 122 (61%) respondents told that they don't have to care at all as they let their pets defecate freely outside their house.

Playing habit of children with their pets:

Among 200 respondents, 128 (64%) have children in their house whereas 72 (36%) do not have children. Among 128 respondents having children, 105 (52.5%) have their children often play with their pets.

Owners' knowledge and awareness about canine helminth zoonoses:

Out of 200 respondents, 64 (32%) were aware about canine helminth zoonotic diseases while 136(68%) were unaware about it.

Regularity in deworming pets:

Among 200 respondents 28 (14%) respondents were deworming their pet regularly at more than 6 month interval, 65 (32.5%) deworming regularly at 3-6 months interval while 89 (44.5%) respondents were deworming their dogs at regular interval of 3months and 18 respondents never dewormed their dogs.

First consultation person or organization if the pet is ill:

Among 200 respondents, 123 (61.5%) first consulted with technicians, 62 (31%) consulted with veterinary doctors or nearby private clinics having veterinary doctors while 15(7.5%) consulted to the government veterinary hospital officials firstly when their pet was ill.

Discussion

Prevalence of GI helminth in dogs of Rupandehi, Nepal is presented

first time by this study. The prevalence of zoonotic helminths in stray dogs was higher (78.5%) than in pet dogs (39%) which is similar to Shrestha (2011) who also found higher prevalence (64%, female and 68.63%, male respectively) in stray dogs and lower prevalence (18.67%, female and 22.86%, male respectively) in pet dogs.

Higher prevalence than this study was reported by Davoust et al. [19] in north-east Gabon (94.1%), Umar [20] in Kaduna State, Nigeria (93.8%), Eguía-Aguilar et al. [21] from Mexico (85%), and Lavallen et al. [21] in Argentina (89.13%). The higher prevalence in stray dogs can be explained by no deworming history, free- roaming, feeding from garbage and wastes found in ground [23]. In contrast, Martínez-Moreno et al. [24] from Spain, Minnaar et al. [25] from South Africa mentioned lower prevalence than this study, 71% and 76% respectively. However, Sowemimo & Asaolu [26], from Ibadan reported a very low prevalence (24%) than what was obtained in this study. This variation are defined by differences in climate, geographical location, sampling protocols, health care and management practices, diagnostic techniques, control strategies and public awareness [24,27].

The common parasites observed in present study were Ancylostoma spp. (46.81%), Toxocara canis (37.87%), Dipylidium caninum (22.98%), Taenia (9.36%), Trichuris vulpis (5.73%) and Diphyllobothrium (2.98%). The predominant parasites encountered in current study were Ancylostoma spp. and T.canis which supports the findings of [28-32], in which Ancylostoma spp. and T. canis were predominant too. Biu, et al. [33], also reported that the most common parasite in dogs was Ancylostona caninum (51.9% of dogs infected in a sample of 138 dogs). A study from Ethiopia found frequent parasite being Toxocara canis (78.89%) [34], and another study from Nepal reported 52 % posi¬tivity for this same parasite [35], which back support the findings of this study.

The occurrence of single helminth parasitic infection (78.72%) was seen more common than concurrent mixed infection (21.28%) in the study. This is similar to the findings of Katagiri & Oliveira-Sequeira [36]; Swai et al. [32]; Shrestha [31], who found single and mixed helminth infections as 31.4% and 18.5%; 73.8% and 12.8%; 81.91% and 18.09% respectively. This result differs from the finding of Zewdu et al. [30], who found higher prevalence of concurrent mixed infections. This difference may be attributed to the level of awareness about dog parasite, regular deworming, housing and other management activities [24,27]. The greater occurrence of single helminth parasitic infection implies that single antihelminthic drug could be used to control GI helminth parasites [37].

In the pet dogs of age up to 1 years, prevalence of helminths was significantly higher (puppy and adult, 52.44%) than the dogs above 1 years (Mature, 29.66%). Results seems to be consistent with findings of Giri [29]; Swai et al. [32]; Gongol [38]; Jones et al.. Abere et al. [39], adds that the parasites prevalence is strongly associated with age and is higher in younger dogs than adults. Furthermore, recent study also mentions the higher infection in young than in adults [40]. This is highlighted by underdeveloped immune system of young dogs, and effect of lactation which is the major route of parasite transmission to the young dogs [41]. Also, lower prevalence in older dogs is due to the fact that parasite specific immunity usually acquired with advance of age or probably as consequence of single or repeated exposures [42].
The prevalence of zoonotic helminth parasites was greater in male pet dogs (63.97%) than in female pet dogs (50.35%) and similar was the case in stray dogs, (83.48%, male versus 71.76%, female). In addition, Mirzaei [43] stated that the male dogs showed higher percentage 13.3% than the female dogs 13.2%. Moreover, Zelalem and Mekonnen [44] also found that, prevalence of gastrointestinal helminths was higher in male dogs (79.2%) than female (76.8%) dogs. Biu et al, 2012 also found that most affected dogs were males (57.1% vs. 52.5%) than females.

Crossbred pet dogs (44.16%) resulted in higher prevalence of GI zoonotic helminths than in purebred pet dogs (35.77%) which is not significant and is consistent with the study of Ethiopia [45]. Higher prevalence in crossbred dogs highlights that low-income people generally rear crossbred dogs and they may not be able to afford to carry out biosecurity measures, deworming [46], roaming freely leads to contaminated garbage feeding and drink dirty water on the streets [23]. However, purebred dogs are generally owned and thus generally receive better care, including deworming and access to clean food and water [27,47].

Significantly higher prevalence of GI zoonotic helminths in non-dewormed pet dogs (61.41%) than in dewormed pet dogs (36.81%) shows the effectiveness of anthelmintic usage in dogs. Similar result was found by Satyal et al. [35]. The lowest prevalence (30.33%) of GI zoonotic helminths was found in dogs that were regularly dewormed within 3 months of interval and higher prevalence (41.53%) was found in dogs that were dewormed lately within 3-6 months. Likewise the highest prevalence (46.43%) was found in dogs which were dewormed at the interval of more than 6 months which shows that the period of deworming has also effect in helminths occurrence. This is due to decrease in the effect of anthelmintic drugs with advance of time [9].

All in all, our study reports higher prevalence (58.75%) of GI helminths at Rupandehi, Nepal. Ancylostoma spp. and Toxocara spp. are the predominant parasites that bear potential zoonotic importance. Application of the One Health concept, in which the collaborative work of multiple disciplines aims to help attain optimal health for people, animals and our environment, has to be advocated to improve the management of intestinal parasitic helminth infections and to minimize the risk of exposure for humans and dogs both. Study needs to be replicated in other districts of Nepal to give an overall variation of helminth infection among dogs.

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References

1. Brickner I. The impact of domestic dogs Canis familiaris on wildlife welfare and conservation: a literature review. With a situation summary from Israel. University of Harare, Zimbabwe. 2002.
2. Romero NC, Mendoza MG, Bustamante LP, et al. Presenciay viabilidad de Toxocara spp. en suelos de parques públicos, jardines de casas y heces de perros en Nezahualcóyotl, México. Revista Científi ca FCV-LUZ. 2011; 21: 195-201.
3. Roldan WH, Cavero YA, Espinoza YA, et al. Human toxocariasis: a seroepidemiological survey in the amazonian city of Yurimaguas, Peru. Revista do Instituto de Medicina Tropical de São Paulo. 2010; 52: 37-42.
4. Overgaauw AP, Van KF. Veterinary and public health aspects of Toxocara spp. Veterinary Parasitology. 2013; 193: 398-403.
5. Traub RJ, Robertson ID, Irwin PJ, et al. Canine gastrointestinal parasitic zoonoses in India. Trends in Parasitology. 2005; 21: 42-48.
6. Naquira C. Las zoonosis parasitarias: problema de salud pública en el Perú. Revista Peruana de Medicina Experimentaly Salud Pública. 2010; 27: 494-497.
7. Maha AS, Hossein SL. Captive dogs as reservoirs of some zoonotic parasites. Research Journal of Parasitology. 2009; 4: 115-122.
8. World Health Organization. World Society for Protection of Animals. Guidelines for the dog population management. WHO. Genebra. 1998; 212.
9. Bahrami A, Doosti A, Nahravanian H, et al. Epidemiological survey of gastrointestinal parasites in stray dogs and cats. Journal of Applied Sciences Research. 2011; 7: 1944-1948.
10. Aydenizoz OM. Soil contamination with ascarid eggs in playgrounds in Kirikkale, Turkey. Journal of Helminthology. 2006; 80: 15-18.
11. Schantz PM. Parasitic zoonoses in perspectives. Int J Parasitol. 1991; 21: 161-170.
12. Shimelese S. The prevalence of gastrointestinal helminths of dogs in Debre Zeit Area. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Ethiopia. 1994.
13. Dalimi A, Sattari A, Motamedi G. A study on intestinal helminthes of dogs, foxes and jackals in the western part of Iran. Vet. Parasitol. 2006; 142: 129-133.
14. Akao N, Ohta N. Toxocariasis in Japan. Parasitol Int. 2007; 56: 87-93.
15. Kaewthamasorn K, Niwetpathomwat A, Assrasakaron S, et al. A surveillance of canine gastrointestinal parasites fecal samples from public areas of Bangkok, Thailand. Journal of Animal and Veterinary Advances. 2006; 5: 1209-1213.
16. World Health Organization. Basic laboratory methods in medical parasitology. WHO. Geneva, Switzerland. 1991.
17. Soulsby EJL. Helminths, Arthropods and Protozoa of Domesticated Animals 7th ed. Bailliere Tindall, London. 1982.
18. Davoust B, Normand T, Bourry O, et al. Epidemiological survey on gastrointestinal and blood-borne helminths of dogs in north east Gabon. Onderstepoort Journal of Veterinary Research. 2008; 75: 359-364.
19. Umar YA. Intestinal Helminthoses in Dogs in Kaduna Metropolis, Kaduna State, Nigeria, Iranian Journal of Parasitology. 2009; 4: 34-39.
20. Eguía-Aguilar P, Cruz-Reyes, A Martínez-Maya JJ. Ecological analysis and description of the intestinal helminthes present in dogs in Mexico City. Vet Parasitol. 2005; 127: 139-146.
21. Lavallen CM, Dopchiz MC, Lobianco E, et al. Intestinal parasites of zoonotic importance in dogs from the District of General Pueyrredón Buenos Aires, Argentina. Revue de Médecine Vétérinaire. 2011; 22: 19-24.
22. Azian MY, Sakhone L, Hakim SL, et al. Detection of helminth infections in dogs and soil contamination in rural and urban areas. Southeast Asian J Trop Med Public Health. 2008; 39: 205-212.
23. Martínez-Moreno FJ, Hernández S, López-Cobos E, et al. Estimation of canine intestinal parasites in Córdoba (Spain) and their risk to public health. Vet Parasitol. 2007; 143:7-13.
24. Minnaar WN, Krecek RC, Fourie LJ. Helminths in dogs from a peri-urban resource-limited community in Free State Province, South Africa. Vet Parasitol. 2002; 107: 343-349.
25. Sowemimo OA, Asaolu SO. Epidemiology of intestinal helminth parasites of dogs in Ibadan, Nigeria. J Helminthol. 2008; 82: 89-93.
26. Zanzani SA, Gazzonis AL, Scarpa P, et al. Intestinal parasites of owned dogs and cats from metropolitan and micropolitan areas: prevalence, zoonotic risks, and pet owner awareness in Northern Italy. Biomed Res Int. 2014.
27. Cho SY, Kang SY, Ryang YS. Helminthes Infections in the Small Intestine of Stray Dogs in Ejungbu City, Kyunggi Do, Korea. Kisaengchunghak Chapchi.1981; 19: 55-59.
28. Giri DR. Screening of Zoonotic helminths in canines of Kathmandu district brought to Central Veterinary Hospital, Tripureshwor. B.V.Sc. & A.H., Internship report IAAS, TU, Nepal. 2010.
29. Zewdu E, Semahegn Y, Mekibib, B. Prevalence of helminth parasites of dogs and owners awareness about zoonotic parasites in Ambo town, central Ethiopia. Ethiop. Vet. J. 2010; 14: 17-30.
30. Shrestha NR. Prevalence of gastro-intestinal helminths parasites in dogs of Kathmandu. B.V.Sc A.H., Internship final report. HICAST, PU. 2011.
31. Swai ES, Kaaya EJ, Mshanga SA, et al. A Survey on Gastro-Intestinal Parasites of Non-Descript Dogs in and Around Arusha Municipality, Tanzania, Int. J. Ani. and Vet. Adv. 2010; 3: 63-67.
32. Biu AA, Aitiya G, Paul BT, et al. Incidence of gastrointestinal helminths ova of Nigerian local dog Canis familiaris resident on University of Maiduguri Campus, Maiduguri, Nigeria. Journal of Agriculture and Vet¬erinary Science. 2012; 4: 63-68.
33. Tadiwos A, Basaznew B, Achenef M. Gastrointestinal helminth parasites of pet and stray dogs as a potential risk for human health in Bahir Dar town, north-western Ethiopia. Veterinary World. 2013; 6: 388-392.
34. Satyal RC, Manandhar S, Dhakal S, et al. Prevalence of gastrointestinal zoonotic helminths in dogs of Kathmandu,

Nepal. International Journal of Infection and Microbiol¬ogy. 2013; 2: 91-94.
35. Katagiri S, Oliveira-Sequeira T C. Prevalence of dog intestinal parasites and risk perception of zoonotic infection by dog owners in São Paulo State, Brazil. Zoonoses Public Health. 2008; 55: 406-413.
36. Boray JC, Strong MB, Allison JR, et al. Nitroscanate: A New Broad Spectrum Anthelmintic against Nematodes and Cestodes of Dogs and Cats. Australian Veterinary Journal. 1979; 55: 45-53.
37. Gongol L. Prevalence of Gastrointestinal helminthes in Household dogs in vicinity of IAAS, Rampur, Chitwan. B.V.Sc. & A.H., Internship report. IAAS, TU, Nepal. 2011.
38. Abere T, Bogale B, Melaku A. Gastrointestinal helminth parasites of pet and stray dogs as a potential risk for human health in Bahir Dar Town, North-Western Ethiopia. Vet World. 2013; 6: 388-392.
39. Ahmed WM, Mousa WM, Aboelhadid SM, et al. Prevalence of zoonotic and other gastrointestinal parasites in police and house dogs in Alexandria, Egypt. Veterinary World. 2014; 7: 275-280.
40. Lloyd S, Soulsby EJL. Prenatal and transmammary infections of Toxocara canis in dogs: effect of benzimidazole-carbamate anthelmintics on various developmental stages of the parasite. Journal of Small Animal Practice. 1983; 24: 763-768.
41. Ramirez-Barrios RA, Barboza-Mena G, Munoz J, et al. Prevalence of intestinal parasites in dogs under veterinary care in Maracaibo, Venezuela. Escalona F. Veterinary Parasitology. 2004; 121: 11-20.
42. Mirzaei M, Fooladi M. Prevalence of intestinal helminthes in owned dogs in Kerman city, Iran. Asian Pac. J. Trop. Med. 2012; 5: 735-737.
43. Zelalem G, Mekonnen A. Prevalence of Gastrointestinal Helminthes among Dogs in Bahir Dar Town, Ethiopia. World Appl. Sci. J. 2012; 19: 595-601.
44. Degefu H, Tefera A, Yohannes M. Zoonotic helminth parasites in faecal samples of household dogs in Jimma town, Ethiopia. J PublicHealth Epidemiol. 2011; 3: 138-143.
45. Minnaar WN, Krecek RC. Helminths in dogs belonging to people in a resource-limited urban community in Gauteng, South Africa. Onderstepoort Journal of Veterinary Research. 2001; 68: 111-117.
46. Ortega-Pacheco A, Rodriguez-Buenfil JC, Bolio-Gonzalez ME, et al. A survey of dog populations in urban and rural areas of Yucatan, Mexico. Anthrozoos. 2007; 20: 261-274.