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RESEARCH PAPER

Dog husbandry practices and associated public health consequences in Ambo town, Oromia, Ethiopia

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Abstract

Dog owning is a common practice in Ethiopia, including Ambo town. Information on dog population and husbandry practices is essential to access poor husbandry practices that could increase the risk of dogborne diseases in Ethiopia. A cross-sectional study was conducted to assess the husbandry practices of dog owners, dog population characteristics and associated public health consequences in Ambo town. Two hundred dog-owning households were randomly selected and interviewed face-to-face. A pre-tested structured questionnaire was used to obtain information on household and dog demographic characteristics and husbandry practices. The collected data was analysed using STATA version 14 and logistic regression was used to assess the risk factors. Out of the 200 households, 83% keep local breeds of dogs, and of the 277 owned dogs, 74% were male. The primary purpose of keeping dogs is for security reasons (83.5%), and about 73% of the households keep only one dog, and the maximum number is five per household with an average number of 1.4. In 62% of the interviewed households, dogs have free access to the outdoor environment. Dogs don't have separate houses in 54.5% of the households, and most of those who have doghouse clean it less frequently or not at all. The most common means of dog feces disposal was into an open hole (47.5%) and thrown into the environment (23.0%). About 66% of households had never dewormed their dogs, and around 69% had never vaccinated their dogs. The overall result of the dog husbandry practice evaluation showed that about 63% of the dog-owning households had poor dog handling practices. Multivariable logistic regression analysis revealed that the elementary educational level of the householders, female sex, and local breed of owned dogs are associated with poor dog husbandry practice. The current dog husbandry practices in Ambo town had a public health risk related to dog-borne zoonosis. Therefore, awareness regarding responsible dog ownership and improving dog husbandry practices are needed to intervene in dog-related zoonotic diseases for the community owning dogs.

Keywords: Ambo, Dogs, Husbandry practices, Risk factors, Zoonosis

Introduction

Dogs are the most common animal species kept in households around the world. In many industrialized countries, dogs are important for humans as pets or as part of the family (McNicholas *et al*., 2005; Chomel and Sun, 2011). Dogs are kept for various reasons, such as companionship, security, pleasure, protection, and comfort (Podberscek, 2006). In many developing countries, data on dog ownership and population is scarce. However, the purpose of keeping a dog is not entirely different, and it is believed to be for companionship, security, and breeding purposes (Awah-Ndukum *et al*., 2004).

Pet ownership is common throughout the world (Murray *et al.,* 2010). Perrin (2009) estimated that 56% of Canadian homes have at least one

dog or cat. Ethiopian dog population is not known, however, the number of dogs in Ethiopian households is increasing, and many families keep one or more dogs for either hunting or guard purposes. In Ethiopia, increased numbers of dogs are seen around abattoirs, butcher shops, marketplaces, and streets (Yacob *et al*., 2007).

Mental and physical benefits of pet ownership have been reported, particularly among children, the elderly, and mentally retarded individuals (Reaser *et al*., 2008; Friedmann and Son, 2009). However, despite these benefits, there are also potential health hazards associated with pet ownership and contact. Dogs serve as companion animals and probably have the closest contact with man, which increases the risk of zoonosis compared to other domestic animals because dogs are known reservoirs of zoonotic diseases. Dog-borne zoonosis is an emerging public health issue, especially as dog ownership increases and pet definitions expand to include new and exotic animals. Still, in the Ethiopian context, pets include mainly dogs and cats. In Ethiopia, many pet owners are often unaware of the risks pets may pose and, as a result, engage in husbandry and hygiene practices that increase the likelihood of acquiring diseases (Angela and Yvonne, 2012; Negash *et al*., 2014).

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People can acquire pet-associated zoonotic organisms through the skin and mucous membranes (via animal bites, scratches, or direct or indirect contact with animal saliva, urine, and other body fluids or secretions), ingestion of animal fecal material, inhalation of infectious aerosols or droplets, and through arthropods or other invertebrate vectors (Mani and Maguire, 2009). Although any exposed person can become infected with a zoonotic pathogen, risks are particularly high for those with a compromised or incompletely developed immune system, such as the young (< 5 yrs.), elderly (≥ 65 yrs.), pregnant, and those with immune function-reducing conditions or treatments (e.g., diabetes, cancer, infection with human immunodeficiency virus (HIV), chemotherapy) (Abbas *et al*., 2007). The increased disease risk for children is additionally imparted through closer physical contact with household animals, reduced hand hygiene, and behaviors that include pica and exploration of the environment through mouthing. In addition to children, other members of the family could also be at risk because dogs often have frequent, close interactions with all household members, such as licking hands and sleeping in beds (Westgarth *et al*., 2008), which can further increase pet-associated disease risks. In urban areas, where hygienic practices are poor, dog feces represent an important pollution factor. In addition, wind can carry and spread viable pathogens present in dog feces, contaminating food, which may later be a source of infection (Tarsitano et al., 2010). Parasite eggs can also be carried into human houses if adhered to shoes or animals' paws (Deplazes *et al*., 2011).

Despite the high risk for dog-associated disease risk in people, pet husbandry practices have not been thoroughly investigated in Ethiopia. Studies in different parts of the world have noted the frequency of close contact between pets and people (e.g., licking of hands and sleeping in household member beds) (Overgaauw *et al*., 2009). Moreover, pet ownership patterns practiced by individuals (Ramon et al., 2010), poor husbandry and

health care practices within pet-owning households (Volk *et al*., 2011), and poor hand hygiene (Overgaauw *et al*., 2009) pose a higher risk of disease (Leonard *et al*., 2011). In Ethiopia, little attention is given to dog husbandry practice, and there is low awareness of different dog-related zoonotic diseases (Negash *et al*., 2014). Considering the limited information on dog husbandry practices and the risk of zoonotic disease in Ambo town, the objective of this study was to assess the dog husbandry practices, the dog population characteristics and associated public health consequences in Ambo town, Oromia, Ethiopia.

Materials and methods

Description of Study Areas

This study was conducted in Ambo town, situated at 8°56'30" - 8°59'30" N latitude and 37° 47'30" - 37°55'15"E longitude in central Oromia, Ethiopia. Ambo town is the administrative center of West Shoa zone, located 114 km west of Addis Ababa. The altitude of the area ranges from 1380-3030 meter above sea level (m.a.s.l), characterized by a mid-altitude, which is locally named *Bada-dare*. The temperature ranges from 15°C-29°C with an average temperature of 22°C. It receives a mean annual rainfall ranging from 800-1000 mm with an average of 900 mm. The highest rainfall concentration occurred from June to September, and the mean monthly relative humidity varies from 64.6% in August to 35.8% in December, which is comfortable for human life and livestock production (CSA, 2021).

Study population

The target population were households in Ambo town and dogs managed under different systems. The study population consisted of dogs-owning households in Ambo town who managed dogs under indoor and outdoor management systems.

Study Design

A questionnaire-based cross-sectional survey was conducted on two hundred participants selected from dog-owning households in Ambo town. A structured questionnaire was prepared in English and later translated into the local language (Afaan Oromo). The questionnaire was pre-tested in one of the kebeles out of the selected once on 5% of the sample size, and necessary amendments were made before the start of the actual study. The questionnaire targeted to obtain information on dogs' sex (male, female), housing status (indoor, outdoor), breed of dog (local, cross or exotic based on the information obtained from the owners), vaccination status (vaccinated, not vaccinated), purpose of keeping (companion, security, both), and feeding (commercial canned/ dry food, home-cooked dog food, home cooked human food, raw meat, leftover), presence of doghouse (present/absent), practice of doghouse cleaning (no dog house, frequency of cleaning of doghouse present), presence of specific defecation area (present/absent), dog feces disposal practice, contact while handling sick or dead dog, and deworming practices.

Sampling Method

There are six *Kebeles* (the smallest administrative structure) in Ambo town, of which two were selected randomly using a lottery system for this study. The sample size was calculated using the formula given by Arsham (2002), N = 0.25/SE2, where N = sample size and SE (standard error = 5%). Accordingly, the calculated sample size was 100, which was doubled to 200. Two hundred dog-owning households were selected from the two kebeles (100 for each) assuming that the dog ownership in the two kebeles is proportional. Since there is no dog ownership registration in the country, ownership was verified by house-to-house surveying as some dogs spend most of their time out of home, a household is considered as the owner of a dog when they claim ownership of at least one dog, even if they do not provide basic needs such as feed and shelter as described by Gebremedihin *et al*. (2020). During the questionnaire survey, every other household-owning dog was included until the proposed sample size was achieved. From the family, preferably the head

of the household, is interviewed, but in the absence of households any member of the family above 18 years of age is considered.

Data Collection

The questionnaire data was collected using face-to-face interviews, which consisted of three parts. The first part captured information on household demographic characteristics such as gender, age, religion, and level of education of the household head. The second part explores questions related to the demographic variables of the owned dogs, such as number of dogs per household, sex, breed, and reason for keeping dogs. The third part focused on management practices such as housing, feeding, and watering dogs, presence of fixed defecation area, cleaning of dog feces, disposal of dog feces, disposal of dead dogs, and health management practices such as deworming, vaccination, handling of sick dogs and veterinary care when sick were included. Management practices such as housing, dog house cleaning, dog feces disposal, that could favor dog-borne zoonosis in humans were addressed.

Ethical approval

All the participants in this study were treated according to the ethical standards of Ambo University, and the protocol was assessed and approved by the Ambo University Research Ethics Review Committee. The participants were informed about the purpose and the methods of the study. Verbal consent was obtained from each participant before the commencement of the study.

Data management and analysis

Data generated from the questionnaire survey were entered into Microsoft Excel 2010, cleaned, and coded, while statistical analysis was performed using the Stata® software package (version 14.0; Stata Corporation, College Station, USA). Descriptive statistical analysis, such as frequency, was applied to summarize the data regarding the demographic variable of dogs and households, and the findings were presented using tables and figures. The responses to the dog management questions were scored 1 when the answer was correct and it received 0 when the response was wrong based on the risk of the dog management practice on the health of the household/community or on the dog itself. The outcome variables were then the sum of the scores to practice questions (n = 11). Consequently, the maximum achievable score was 11, and the lowest score was 0. Finally, the outcome variable was categorized as good practice when the sore was above the average and poor when it was below the average score. Logistic regression was applied to assess the association between household and dog-related demographic variables (independent) with the level of dog management practice (dependent variable). Univariable logistic regression was computed using the crude odds ratio and p-values. Those non-collinear variables with p-value <0.25 were selected for multivariable logistic regression to identify predictors of risky dog management practices. The odds ratio (OR) and the 95% confidence intervals (CI) were calculated, and $\alpha = 0.05$ was considered in all the analyses.

Results

Socio-demography characteristics of the dog-owning households

Out of the 200 dog-owning households, 112 (56%) were male-headed, while most of them were above the age of 40 years old (44.5%). Regarding the religion of the dog-owning communities, the majority of them were Christians, which are 192 (96%) out of the 200. With the education level, more than half, 56.5%, had attended elementary education level, while 22.0% and 21.5% had secondary and diploma/degree level education (Table 1).

Table 1. Socio-demography characteristics of the dog-owning households

Variable	Category	Frequency	Percent
Gender	Male	112	56.0
	Female	88	44.0
Age	<30 years	42	21.0
	30-39 years	69	34.5
	>40 years	89	44.50
Religion	Christian	192	96.0
	Muslim	4	2.0
	Others	4	2.0
Educational level	Elementary	113	56.5
	Secondary	44	22.0
	Diploma & above	43	21.5

Demographic characteristics of the owned dogs in the study areas

As described in Table 2, of the 200 households, most of the households keep local breeds of dogs (83.5%), and the rest are crossbreed (8.5%), both cross and local (7.0%) or pure exotic breeds (1.0%). Of the 277 owned dogs recorded in this study, most of them are male (74.0%), and the remaining 26% are female. In the study area, more individuals kept dogs for security reasons (83.5%), whereas only a few (9.5%) of the owners kept dogs for companionship and (7.0%) for both security and companion reasons. With the number of dogs kept per household, 73% of the households keep only one dog, 18.5% keep two, 6.0% keep three, 2.0% keep four, and 0.5% keep five dogs wth an average of 1.4 dogs per household.

Table 2. Characteristics of dog population owned by households in Ambo town

Variables	**Category**	**Number**	**Percent**
Breed of dog	Exotic or cross	19	9.5
	Local breed	167	83.5
	Local and crossbreed	14	7.0
Sex of dog	Male	205	74.0
	Female	72	26.0
No. dogs per household	One	146	73.0
	Two	37	18.5
	Three	12	6.0
	Four	4	2.0
	Five	1	0.5
Reason for keeping the dog	Companionship	19	9.5
	Security	167	83.5
	Both	14	7.0

Exotci breed are dog breeds that are pure exotic, crossbreed are those exotic breed of dogs hybrid with the local and local are pure indigenous dog breed of Ethiopia

Dog husbandry practices in the study area

Out of interviewed households, 62.0% of them allow their dog free access to the outdoors either during the day or night. Of the 200 households, 70.5% of households provided their dogs with home-cooked human food. In contrast, 17% of the households provided leftover, 6.5% home-cooked dog food, 3.5% raw meat from a butcher without cooking, and only 2.5% provided commercial dry food. In this study, 54.5% of households did not have a specific separate house for dogs. Most of the households that have houses for their dogs cleaned the dog's house once in one to two weeks (23.0%), and the rest cleaned in more than two weeks. The most common means of dog feces disposal was into a hole (47.5%) and thrown into the environment (23.0%). About 66.5% of households never dewormed their dogs, whereas 23.5% reported deworming at least once a year, and 7.0% had dewormed for more than two years. In most of the households, 69.5% reported that they did not vaccinate their dogs. About 87.5% of households reported that their dogs did not have a specific area to defecate. None of the dog-owning households had vaccinated their dog for rabies in the last two consecutive years (Data not shown). In this study, the most common means of disposal of a dead dog is to throw it into the environment 45.5% (Table 3).

Table 3: Dog husbandry practices in related questions to assess the risk of zoonotic disease.

Question	Response	Numbers of Households (%)
Way of dog-keeping	Indoor only	76 (38.0)
	Loose either during the day or night	124 (62.0)
The feed type provided to the dog	Commercial dry food	5 (2.5)
	Home-cooked dog food	13 (6.5)
	Home-cooked human food	141 (70.5)
	Raw meat	7 (3.5)
	Leftover	34 (17)
Water source	Pipe water	165 (82.5)
	From it found (no pipe water provided)	35 (17.5)
Practice of cleaning doghouse/feces	Have no doghouse	109 (54.5)
	Less than once a week	46(23.0)
	More than a week or when dirty	45(22.5)
Deworming	Every six months to one year	53(26.5)
	More significant than two years/vet	14 (7.0)
	None	133 (66.5)
Vaccination	Yes	61 (30.5)
	No	139 (69.5)
Fixed area for defecation	No	175 (87.5)
	Yes	25 (12.5)
Disposal of dog feces	In waste desposal hole	95 (47.5)
	No cleaning	59 (29.5)
	Throw into the [illegible]	46 (23.0)
Treatment of sick dog	Local treatment	109 (54.5)
	Veterinary clinic	91 (45.5)
Contact while managing diseased dogs.	By bare hand	44 (22.0)
	Use protective materials	64 (32.0)
	Do nothing	92 (46.0)
Disposal of dead dog	Hole	86 (43.0)
	Take to disposal area	23 (11.5)
	Throw to the garbage for hyena	91 (45.5)

Logistic regression analysis for risk factors associated with poor dog husbandry practices

The result of the current study showed that 126 (63%) of the dog-owning households had poor dog-handling practices. The result of the logistic regression analysis is presented in Table 4. A total of 8 independent variables were analyzed, of which six were passed for multivariable logistic regression. Two of th variables namely age and religion of the households were excluded from the multivariable logistic regression for the p-value >0.25. The multivariable logistic regression analysis showed a significant association ($p<0.05$) between the educational level of the householders and the sex and breed of owned dogs with poor or risky dog management practices compared to their counterparts. Consequently, dog owners with an elementary education level and those owning only female dogs had significantly poor management practices compared to those better-educated people and those owning only male dogs. Households keeping only local breeds of dogs had poor management practices compared to those keeping exotic or cross-breed dogs.

Table 4. Logistic regression analysis of poor dog handling practice and risk factors

Variable	Category	No. HH with Good practice	Univariable logistic regression		Multivariable logistic regression	
			OR (CI)	p-value	OR (CI)	p-value
Gender of HH	Female	35 (39.8)	Ref			
	Male	49 (43.8)	1.05 (0.59, 1.87)	0.869		
Age of HH	<30 years	28 (66.7)	4.73(2.08, 10.79)	0.000		
	30-39 years	23 (33.3)	Ref			
	>40 years	33 (37.1)	1.21(.60, 2.41)	0.593		
Religion of HH	Christian	78 (40.6)	Ref			
	Muslim/Others	6 (75.0)	1.74 (0.42, 7.19)	0.442		
Educational Level of HH	Elementary	19 (16.8)	Ref		Ref	
	Secondary	26 (59.1)	7.16(3.20,15.98)	0.000	7.51(3.06, 18.45)	0.000
	Diploma/Degree	39 (90.7)	33.60(12.67,89.09)	0.000	46.33(14.88,144.21)	0.000
Breed of dog	Exotic/Hybrid	14 (77.8)	5.44(1.85, 16.04)	0.002	6.90(1.78, 26.80)	0.005
	Local and cross	8 (53.3)	1.83(0.63, 5.31)	0.266	2.81(0.63, 12.50)	0.174
	Local	62 (37.1)	Ref			
Sex of the dogs	Female	3 (18.8)	Ref			
	Male/Female	14 (26.9)	2.10(0.42, 10.57)	0.368	3.31 (0.35, 31.22)	0.296
	Male	67 (50.8)	5.83(1.27, 26.69)	0.023	16.34 (1.95, 37.20)	0.010
No. of dogs per HH	One	71 (48.3)	3.62(1.42, 9.26)	0.007		
	Two	8 (22.9)	Ref			
	Three or more	5 (27.8)	1.83(0.47,7.20)	0.370		
Reason for keeping the dog	Companionship	14 (77.8)	5.44(1.84,16.03)	0.002		
	Both purpose	8 (53.3)	1.83(0.63,5.31)	0.266		
	Security	62 (37.1)	Ref			

Ref: Reference, HH: households, No: number, OR: Odds ratio, CI: Confidence interval

Discussion

In this study, the population of local breed of dogs owned per household were more than that of cross-bred or exotic breed of dogs, which is similar to the report of Negash et al. (2014). A report from Cameroon showed a low population of local breed dogs. The population of male dogs in this study was higher than that of females, which is supported by different studies, indicating the preference of male dogs for security and guarding purposes (Njong et al., 2012; Negash et al., 2014; Gebremedhin et al., 2020b). The predominance of male dogs over female dogs could be explained by the fact that female dogs have disturbing behaviour during mating season. Dog owners prefer male dogs because of unwanted pregnancies in females as well.

In the study area, most of the households kept dogs for security purpose, which is in line with what has been reported by Zewdu et al. (2010) from Ambo. However, according to the report from northern Ehiopia by Negash et al. (2014), the number of dogs kept as companions was higher than in the present study. Also, Njong et al. (2012) from West Africa reported a lower number of dogs used as companionship compared to the current finding. With regards to the dog keeping practices in the present study area, most dog owning households kept dogs free in the outdor for at least half of the day as it was reported by Zewdu et al. (2010).

According to the current result, many of the dogs were fed with home-cooked human food and leftovers. Inconttrast to this, the report from Ontario, Canada, by Stull et al. (2013) showed the majority of the dogs were provided with commercial canned/dry food. However, the difference in the feeding style might be due to the levels of education, standard of life, income, availability of the feeds, and the value of the dogs in the household.

According to the previous study result from the current study in the area, the households cleaned their dogs' houses at intervals of 1-2 months (Zewdu et al., 2010), but in the present study, many households' clean dogs' house once in two weeks. The difference between these findings could be the result of veterinary health intervention and increased awareness of zoonotic disease. However, a study conducted in Ontario, Canada, revealed that the majority of households clean doghouses on a weekly and daily basis (Stull et al., 2013).

In the absence of proper health management of dogs, it is believed that dog feces could carry infectious agents that could be pathogenic to other dogs, animals, and humans. Most households declared that dogs did not have a specific area to defecate, which means the dog feces contaminate the household's compound or even the outside environment, as most dogs get free access to the outdoors. A similar finding was also reported from Cameroon (Njong et al., 2012). Moreover, in the current study, the most common means of dog feces disposal for households who have a doghouse is into an open hole or to an external environment. Reports from various parts of the world show the presence of several types of microorganisms potentially pathogenic for humans in dog feces. Diarrhoeagenic bacteria such as Campylobacter, Salmonella, Yersinia and E. coli; and protozoa such as Giardia, Toxoplasma, Leishmania spp., Cryptosporidium; roundworms such as Toxocara canis and antibiotic-resistant bacteria such as methicillin-resistant Staphylococcus aureus pose threat to public health (Bianciardi et al., 2004, Lefebvre et al., 2008, El-Tras et al., 2011, Cinquepalmi et al., 2012, Marami et al., 2021, Gebremedhin et al., 2019, Gebremedhin et al., 2020a, Gebremedhin et al., 2021a, Gebremedhin et al., 2021b). When dog feces are left on the ground, it will pollute the water supply, rivers, streams, creeks, and other local waterways, which could be a potential route of infection to people or animals drinking the contaminated water. Moreover, the contamination of the environment with dog feces could also create an unpleasant odor, which is not comfortable for people. Hence, dog feces and other biological waste need to be appropriately disposed of by burning, incineration, burying, etc., to altogether avoid access to people or other animals.

According to the result of the present study, most of the dogs were not dewormed, but

reports from Cameroon indicated that most of the dog owners deworm their dogs at least once a year (Njong et al., 2012). Regular deworming of dogs could not only improve the health of dogs by controlling parasitic infections but also avoid zoonotic parasitic infections such as Toxocara canis, Echinococcus granulosus, Anchlostoma caninum, etc. In fact, deworming dogs depends on the economic status, availability of veterinary services, and awareness of the households about the zoonotic disease of dogs.

According to the current study findings, the major risk factors for poor dog management practices in the study area were the level of education, sex of the dog, and purpose of keeping. The association of poor dog management practices with less educated households implies a positive effect of education for better awareness of hygienic practices and zoonotic diseases (Adesokan et al., 2018). This indicates the possibility of educating the dog-owning community to improve the poor practice. On the other hand, households keeping male dogs had better management practices compared to female dogs. This could be probably related to the purpose of keeping dogs, as male dogs are preferred to female dogs by the owners because of the disturbing behavior of female dogs during breeding periods by groups of male dogs, and males are also chosen for better guarding (Gebremedhin et al., 2020b).

Consequently, male dogs could have less access to the outside, and most of the time, they had separate houses for living and were provided with appropriate feed and better health care service. One report from Kenya explained the preference of male dogs for better guarding and hunting. Thus, there is a tendency to provide better husbandry practices for male dogs (Kitala et al., 2001).

In relation to the breed of dogs, people keeping only local breeds of dogs demonstrated poor dog husbandry practices compared to those keeping either cross or pure exotic breeds of dogs. This could probably be related to the value of dogs, as exotic or crossbreeds are mostly purchased and are kept more as companion pets. The ownership of such dogs could also be related to the economic level of households because they are mostly hand-fed and are not able to search for their food outdoors as the local breeds of dogs do.

On the other hand, the majority of the dogs in the study area were not vaccinated, when combined with the free access to the outdoor environment probably for searching food and coming back home coul increase the public health risk. In this situation, dogs having access to outdoor environment might have contact with wild canids such as foxes and hyenas during the night, which implies the risk of diseases like rabies to the dog-owning households as well as to society (Gebremedhin et al., 2020b). A systematic review conducted in Ethiopia recently demonstrated a significantly higher prevalence of rabies in Ethiopia, which is estimated at 32%. This high prevalence of rabies is associated with an increasing number of stray dogs in Ethiopia, coupled with a lack of dog vaccination practice and low public awareness (Belete et al., 2021).

Generally, the present study revealed a higher proportion of dogs in the study area have free access to an outdoor environment, no vaccination, no deworming, and no separate house. The dog feces cleaning and disposal practices are non-hygienic, indicating a possible risk of dog-borne zoonosis in the area. Consequently, the dog handling practice in the study area is poor, implying that it is risky for people who own dogs and the neighboring communities due to the possibility of dog-borne zoonosis. As a limitation, the sample size is relatively smaller, which might have affected the precision of our estimates, which uncovered a wider confidence interval. It is believed that the economic status of the household could affect the dog management level, and the reluctance of the participants to disclose their monthly income limited the number of possible predictors.

Conclusion

In this study, dog husbandry practices are noted to be poor, which is likely to favor the spread of dog-related zoonotic diseases to humans.

Most households allow their dogs to roam outdoor freely, especially during the night, and most dogs do not have separate housing. Little attention was also given to the proper disposal of dog-related wastes, which is a potential threat to the spread of zoonotic infection. The veterinary service provided to the dog is very minimal as the majority of the dogs were not vaccinated or not dewormed. Risk factors, such as lower level of education, owning female dogs, and keeping dogs only for security purposes, are identified as being associated with poor husbandry practices in the study area. Therefore, awareness regarding responsible dog ownership and farming practices to intervene in dog-related zoonotic diseases is needed for the community owning dogs. Further surveillance of dog-borne zoonosis is suggested at the nationwide level for well-versed intervention of dog-borne zoonotic diseases.

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