Original Article

A behavioral study of stray dogs in temples in Nakhon Ratchasima municipality, Thailand

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Abstract

The aim of this study was to investigate the reactions of stray dogs in temples to strangers by means of a stranger-approach test. Behavioral data of temples dogs was collected from 5 temples from September to November 2018. The dogs' behavior, social condition (alone, in pairs and with >3 dogs), reaction distances (0-2m, 2-5m and >5) and reaction behavior: neutral, avoidance, aggressive, vocalization, approach and tail movements were all observed. All the reaction behavior recorded was the dogs' initial reactions. After the 1st stranger-approach test, which was conducted in the 1st week, the observer tried to get the dogs used to him by feeding and grooming them once per week for 3 weeks. Then the 2nd stranger-approach test was conducted in the 4th week. The results showed that 40 dogs were observed in the 1st week's observation and 43 dogs in the 4th week's observation. More than 60% of the dogs were alone and more than 50% of the dogs were lying down before the test. The dogs' reactions in the 4th week were significantly different from those in the 1st week ($P<0.05$). In the 4th week, the number of dogs that reacted neutrally and approached the researcher increased and conversely, the number that avoided contact and barked decreased. The tail movements showed a significant difference between the 1st week and 4th week of observation ($P<0.05$). In the 4th week, the number of dogs which reacted and vocalized decreased significantly ($P<0.05$). More than 69.2% of the dogs reacted to the observer at a distance of >5m, however, there was only a marginally significant difference between the 1st and 4th week of observation ($P=0.06$). In conclusion, the reaction of the dogs was affected by their familiarity with the people who approached them. This is the first study of the reaction of stray dogs in temples to people in Thailand. Therefore, further research on stray dogs using the stranger-approach test is necessary.

Keywords: behavior, stray dog, temple, reaction

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Introduction

Stray dogs (*Canis familiaris*) have always been part of the developing world's landscape but exploding populations, increasing attacks on citizens and spiraling rabies epidemics have transformed this issue from a third world problem to a global public health priority (Strand, 2011). A survey in 2018 found that there were 70,000 cats and dogs in the northeastern provinces of Thailand (The Straits Times, 2018). The Department of Livestock Development (DLD) reported that the dog population was about 7 million and about 10% were stray dogs in 2017 (DLD, 2018).

In Thailand, where dogs are the animals most frequently reported as rabid, the disease is endemic and widespread (Kasempimolporn *et al*., 2007; Kasempimolporn *et al*., 2008; Kasempimolporn *et al*., 2011). Buddhist beliefs guide human-animal relationships in Thailand, and street dogs are not destroyed unless they are close to death (Nikki, 2013). Many Thai temples commonly receive stray cats and dogs from surrounding communities**.** Moreover, the unresponsiveness of the pet owners has caused the number of abandoned dogs to increase. Songpol (2017) reported that the temples in Thailand are overwhelmed by abandoned dogs and cats which is causing a serious problem that is beyond their control.

Ortolani *et al*., (2009) conducted a study of behavioral responses of village dogs to strangers' approach in Ethiopia. Gácsi *et al*., (2013) investigated the novel aspects of dogs' comprehension of human social behavior. Ruiz-Izaguirre *et al*., (2014) found that Mexican coastal village dogs were socialized to familiar humans but were not attracted to unfamiliar humans.

There are many Buddhism days in Thailand even at public holidays. Thai or foreign Tourists are interested in visiting temples to experience the Buddhist culture of Thailand. The stray dogs in temples will often meet people who are total strangers to them or with whom they are still unfamiliar. Whether or not the strangers' approach can influence the behavior of stray dogs in temples and even make them anxious, there are few studies in Thailand. Therefore, the objective of this research was to evaluate the attitudes of stray dogs in temples towards people by means of a stranger-approach test (Ortolani *et al*., 2009).

Materials and Methods

Study sites: Temples in downtown Nakhon Ratchasima municipality which were found to have more than five dogs from a visual survey (Crump and Scott, 1994) were selected for purposive sampling. Then 5 other temples (N14°58′26.202″/ E102°07′03.443″; N14°57′49.084″/E102°05′40.939″; N14°58′26.325″/E102°05′23.992″; N15°00′13.501″/ E102°07′30.811″; and N15°00′21.139″/ E102°08′13.965″) were also chosen at random for study sites from a list of temples. The procedures of the experiment were performed with the advice of the Institutional Animal Care and Use Committee, Nakhon Ratchasima Rajabhat University, Nakhon Ratchasima, Thailand. The study was conducted from September to November 2018.

Data collection: A modified method was used according to Ortolani *et al*. (2009):
Social condition: The total number of dogs in the temples was observed by visual survey. The social condition (living alone, in pairs, living with >3 dogs) was recorded.

Behavior before the stranger-approach test: The dogs' behavior was recorded.

Reaction to approach: The reaction behavior: neutral, avoidance, aggressive, vocalization (barking, growling or bark-growling), approach and tail movements: wagging, erect without wagging and tail down (including tucking a tail between the legs; or with the tail hanging low) were observed using the stranger-approach test.

All the reaction behavior was recorded when researcher A approached the dogs and observed their initial reactions. Aggressive dogs were defined as individuals who bared their teeth at researcher A for more than 3s, moved towards researcher A snapping their jaws, and/or attempted to bite him and barked, growled or both. Observations of the dogs' behavior were made on foot by two researchers with one (researcher B) collecting the behavioral data, while the other (researcher A) approaching each dog. When researcher A approached a dog, starting from a distance of 10-15 m, researcher B recorded the dog's reaction time and distance. Approaches were made by walking slowly in a direct line towards each dog avoiding any eye contact and keeping a relaxed and normal straight posture with the arms by the sides. After the 1st stranger-approach test, conducted in the 1st week, researcher A tried to get the dogs used to him by feeding and grooming them once per week for 3 weeks. The 2nd stranger-approach test was conducted in the 4th week. The procedures of the experiment were performed with the advice of the Institutional Animal Care and Use Committee, Nakhon Ratchasima Rajabhat University, Nakhon Ratchasima, Thailand.

Reaction distances: The dogs' reaction distances of 0-2m, 2-5m and >5m to the researcher's approach were recorded.

Statistical analyses: All statistical analyses were performed using the statistical software SPSS version 16.0 (SPSS, Inc., Chicago, IL) with a significance level of 0.05. The Chi-Square Test was used when comparing the behavioral data between the 1st week and 4th week of observation. A logistical regression (LR) model was used with behavior before the approach, with the number of dogs and tail movements as predictors of the dogs' reaction/non-reaction and vocalization/non-vocalization (i.e. barking, growling or barking-growling). The Hosmer and Lemeshow test was used to check the goodness of fit of the final model.

Results

Social condition: 40 dogs were observed during the 1st week of observation (visual surveys) and a total of 43 dogs in the 4th week of observation. There were 3 abandoned puppies found in the 4th week. The sex of the dogs was not classified, because during each visual survey some of the dogs were under a car and their sex could not be determined. The social condition of the dogs in the 1st and 4th week of observation was not significantly different (P>0.05). The number of single dogs in the 1st and 4th week of observation was 26 (65%) and 27 (62.8%), respectively. The number of dogs in pairs in the 1st and 4th weeks was 8 (20%) and 4 (9.3%), respectively (Table 1).

Behavior before the stranger-approach test: Before the stranger-approach test was conducted in the 1st and 4th week of observation, 50% or 65.1% of the dogs were lying down; 30% or 11.6% of the dogs were walking; 15% or 7% of the dogs were standing and 2.5% or 14% of dogs were sleeping. Less frequent types of behavior were running and sitting (Table 1). There were no significant differences (P>0.05) in the dogs' behavior before the stranger-approach test was conducted in the 1st and 4th weeks of observation.

Table 1 Social condition and behavior of dogs investigated before behavioral study

Items	1st week		4th week		Pearson Chi-Square (df)	P-value
	Number of dogs	%	Number of dogs	%		
No. of dogs						
Living alone	26	65	27	62.8	3.248 (2)	0.197
In pairs	8	20	4	9.3		
living with >3 dogs	6	15	12	27.9		
Behavior						
Lying down	20	50	28	65.1	8.903 (5)	0.113
Standing	6	15	3	7		
Walking	12	30	5	11.6		
Running	1	2.5	0	0		
Sleeping	1	2.5	6	14		
Sitting	0	0	1	2.3		

Reaction to approach: The results of the 1st week's observation show that 45% of the dogs ignored researcher A. 25% of the dogs just ran away from researcher A. 12.5% of the dogs showed vocalized behavior (i.e. barking, growling or bark-growling). Only one dog showed aggressive behavior towards researcher A. 12.5% of the dogs approached researcher A (Table 2). There were significant differences in the results between the 1st and 4th weeks using the Chi-square Test (P=0.05) and the number of dogs whose behavior was neutral increased by 69.8 % (P<0.05) The number of dogs that ran away from researcher A and vocalized decreased from 11% to 2.3% (P<0.05). The number of dogs which approached researcher A increased in the 4th week of observation compared to the 1st week of observation (P<0.05). Therefore, the total number of non-reacting dogs in the 4th week was significantly more than those in the 1st week of observation (P<0.05). There was a significant difference also in tail movements when the 1st week and 4th week of observation were compared (P<0.05). The number of dogs showing tail movements such as wagging, erect without wagging and tails down decreased in the 4th week of observation (Table 2).

The number of dogs which showed no differences in tail movements increased because the number of dogs showing neutral behavior increased (Table 2). The number of dogs that reacted significantly decreased in the 4th week of observation (P<0.05). The number of dogs that vocalized decreased significantly in the 4th week of observation as well (P<0.05).

Reaction distances: More than 62.9 % of the dogs started to react to researcher A at distances of more than 5m; and 23.1% of the dogs started to react to researcher A at distances of 0-2 m during the 4th week of observation (Table 2), however, there was only a marginally significant difference between the 1st and 4th week of observation (P=0.06).

From the results of a logistical regression analysis of reactions to the stranger approach test, it was found that the number of dogs and tail movements of the dogs were significant predictors of the dogs' reactions or non-reactions (P<0.05). The behavior of the dogs before the stranger approach test was not a significant predictor of the dogs' reactions or non-reactions (P>0.05) (Table 3).

From the results of a logistical regression analysis of the reactions to the stranger approach test in terms of the dogs' behavior before approach, the number of dogs and tail movements, it was found that only the tail movements of the dogs were a significant predictor of the dogs' vocalizing or non-vocalizing behaviors (P<0.05). The behavior performed before the stranger approach test and the number of dogs were not significant predictors of the dogs' vocalizing or non-vocalizing behavior (P>0.05) (Table 4).

Discussion

Social condition and Behavior before the stranger-approach test: Abandoned puppies were still found in the temple and the responsibility of the pet owners was a problem to the temple. The sex of the dogs was not classified, because during each visual survey some of the dogs were under a car and their sex could not be determined. The social condition and behavior of the dogs were not different between the 1st and 4th week observation and this may relate to the stable social condition of the dogs in each temple.

Table 2 Reactions of dogs in the stranger-approach test.

Items	1st week		4th week		Pearson Chi-Square (df)	P-value
	Number of dogs	%	Number of dogs	%		
Reaction to approach						
Neutral	18	45	30	69.8	9.475 (4)	0.050
Avoidance	10	25	5	11.6		
Aggressive	1	2.5	0	0		
Approach	5	12.5	7	16.3		
Vocalizing*	6	12.5	1	2.3		
Reacting dogs	22	55	13	30.2	5.213 (1)	0.022
Non-reacting dogs	18	45	30	69.8		
Vocalizing	7	17.5	1	2.3	5.479 (1)	0.019
Non-vocalizing	33	82.5	42	97.7		
Tail position						
Wagging	16	40	7	16.3	9.489 (3)	0.023
Erect without wagging	4	10	1	2.3		
Down	5	12.5	7	16.3		
Nothing	15	37.5	28	65.1		
Reaction distance						
0-2 m	0	0	3	23.1	5.629 (2)	0.06
2-5 m	3	13.6	1	7.7		
>5 m	19	86.4	9	69.2		

*Vocalizing included barking, growling or bark-growling

Table 3 The table below shows the results from a logistical regression analysis of reactions to the stranger approach test in terms of dogs' behavior before approach, the number of dogs and tail position (LRT: $\chi^2 = 63.256$, df = 3, N = 83, P = 0.000). The reference category is: reaction/non-reaction.

Predictors	OR	P-value	95.0% CI for OR	
			Lower	Upper
Behavior before approach	1.529	0.113	0.905	2.584
No. of dogs	0.253	0.036	0.070	0.912
Tail position	0.120	0	0.048	0.301

OR= Odds ratio; CI=Confidence Intervals

Table 4 The table below shows the results from a logistical regression analysis of reactions to the stranger approach test in terms of dogs' behavior before approach, number of dogs and tail position (LRT: $\chi^2 = 15.147$, df = 3, N = 83, P = 0.002). The reference category is: vocalizing/non-vocalizing.

Predictors	OR	P-value	95.0% CI for OR	
			Lower	Upper
Behavior before approach	0.462	0.134	0.168	1.268
No. of dogs	0.770	0.604	0.286	2.071
Tail position	0.292	0.003	0.129	0.662

OR= Odds ratio; CI=Confidence Intervals

Reaction to approach: This study focused on the reactions of dogs when a stranger approached them. Only 17.5% of the dogs vocalized when they met a "stranger" for the first time. After 'the stranger' had fed and played with the dogs 3 times, the dogs got used to him. The number of dogs that vocalized decreased by the 4th time of meeting. The authors claim that dogs were able to remember people after 3 meetings in this study, which is the same as Lomber and Cornwell (2005), who claimed that dogs are able to discriminate between their handler and another person based solely on face recognition. In fact, a deeper study of dogs' cognitive ethology should be conducted in the future.

The behavioral variables correlated with each other and had a predictive value over each other: Reaction behavior predicted reaction distances by 48.6% (λ=0.486), and tail movements by 40% (λ=0.40), and the behavior before being approached by 28.6% (λ=0.286). The reaction behavior did not predict the number of dogs (λ=0).

Our results found that avoidance was the most common reaction exhibited by stray dogs in temples, which is similar to the results of Ortolani *et al*., (2009). A common and potentially serious canine behavioral problem confronting pet owners and small animal practitioners is dominance aggression (Taphorn and Draper, 1991) but other causes, such as play, fear, health factors, protective and re-directed aggression, have been reported as well (Guy *et al*., 2001). Our findings showed that fewer than 20% of the dogs immediately responded to researcher A's presence by vocalizing. The function of vocalizing by stray dogs in temples was to warn off intruders (Lord *et al*., 2009). The authors agree with Ortolani *et al*., (2009) that the different responses of dogs to people may also reflect their previous experiences.

Ortolani *et al*. (2009) realized that although avoidance and the aggressive behavior of dogs made it very difficult to approach them, it was found that the dogs that vocalized could be approached if they

vocalized a few seconds after they were approached or when the dogs vocalized first and then approached people themselves. However, in our study we recorded the initial reaction of dogs when researcher A approached. It would be useful to add different factors to those used in this study in further studies.

Reaction distances: Normally, more than 80% of dogs reacted at a distance of more than 5m from researcher A (stranger). When the dogs were familiar with researcher A, the number of dogs that reacted decreased. Also, the number of dogs showing neutral behavior increased, possibly due to the fact that the number of their escape routes might have decreased (Grandin and Deesing, 2014). Although the authors of this study were only concerned with the reactions of dogs to familiar and unfamiliar people, there still needs to be an investigation of the emotional life of dogs and how this relates to the dogs' welfare, emphasizing the crucial role of tail movements in specific communication (Siniscalchi *et al*., 2013).

In conclusion, the reaction of dogs is affected by the approach of both familiar and unfamiliar people. The number of dogs and tail movements are related to the number of reacting/non-reacting dogs. Only the tail movements are related to vocalizing or non-vocalizing. This is the first study of reactions of stray dogs to people in temples in Thailand. It will also be necessary to analyze some other emotions (such as fear, playfulness) of stray dogs in temples in reaction to familiar and unfamiliar people. Therefore, further research is needed.

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