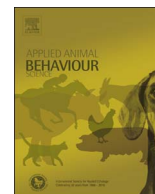




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Research Paper

Dogs predisposed to anxiety disorders and related factors in Japan

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ABSTRACT

Problem behaviours of dogs can be serious, because they could break the human-animal bond resulting in the dogs being relinquished. The aim of the present study was to investigate how many owners thought their dogs display anxiety related behaviours, how many owners were troubled by their dog's anxiety behaviours, how many owners know about veterinarians specializing in problem behaviours, and to know the factors affecting the development of anxiety disorders. We administered a questionnaire at pet shops in three large cities from north to south in Japan (Tokyo, Osaka, and Sendai) and obtained data on 262 dogs. The present study clarified that more than half of the owners thought that their dogs displayed anxiety related behaviours, and more than 20% of owners were troubled by such behaviour. These results suggest that dog owners across the country are troubled by the anxiety behaviour of dogs. We computed the odds ratios using simple linear regression analyses of paired responses to situations in which dogs showed anxiety behaviour, and we found significant associations between the situations. Multiple-comparison tests also revealed significant associations between the situations in which dogs showed anxiety behaviour and the factors affecting anxiety behaviours. The present study is the first to our knowledge to focus on owners troubled by their dog's anxiety related behaviours and the factors affecting anxiety related behaviours in Japan. We expect that this study will be the first step to educating owners troubled with their dog's problem behaviours and anxiety disorders.

1. Introduction

Recently, problem behaviours of dogs have garnered attention, because it could break the human-animal bond resulting in the dogs being relinquished. In the United States of America, it is said that the leading cause of death for young dogs is euthanasia, which is mainly attributed to their problem behaviours. In Japan, 14% of relinquishments of dogs to shelters is caused by problem behaviours such as separation anxiety, aggression toward owners, or aggression toward strangers (Advisory body to management of animal welfare, 2006). Therefore, this is an important issue requiring rapid response.

Many problem behaviours of dogs are caused by anxiety, which can lead to aggression toward owner or destructive behaviour. Some dogs develop anxiety disorders that include separation anxiety, storm phobia, fear of people or things, and generalized anxiety disorder. It is said that approximately 14% of all dogs are predisposed to separation anxiety (Landsberg et al., 1997). Dogs with anxiety disorders are prone to excessive barking, inappropriate elimination, destructive behaviour, and self-injury behaviour (Landsberg et al., 1997). Living with a dog

that exhibits these behaviours may be a heavy burden for some owners, and if they do not know how to treat these problem behaviours, it may cause owners to relinquish or euthanize them.

In addition, anxious dogs suffer from severe mental stress. A previous study reported that the cortisol levels of dogs with storm phobia increased more than twofold during thunderstorms (Dreschel and Granger, 2005). A significant positive correlation was also identified between cortisol levels in the hair of dogs and their reactivity to thunderstorms (Siniscalchi et al., 2013). Another study reported that dogs with an anxiety disorder had a shorter life-span than those without (Dreschel, 2010). Therefore, anxiety disorders are also important in terms of animal welfare.

However, canine psychological disorders are poorly understood in Japan. To begin with, there are only few veterinarians who diagnose and treat these behaviours. It is thought that many owners of dogs with problem behaviours are ignorant of which veterinarians to consult. Therefore, it is necessary to discover how many owners think that their dog's behaviour is problematic and are troubled by them.

Furthermore, previous studies reported that the development of

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anxiety disorders could be associated with many factors including breed, sex, age, the dog's age when owners obtained it, and the source from which the owner obtained the dog (Flannigan and Dodman, 2001; Takeuchi et al., 2001; McGreevy and Masters, 2008). However, the results from these studies are inconsistent; thus, it remains unclear if these factors are actually associated with anxiety disorders.

The aim of this study was to investigate how many owners think that their dog exhibit anxious behaviour or an anxiety disorder, whether pet dogs are afraid of certain situations, and whether the owners are aware of who to consult if their dogs have problem behaviours. The questionnaire also asked about certain factors that could influence the development of anxiety disorders.

2. Materials and methods

The present study was carried out with the approval of the Research Ethics Committee of the Tokyo University of Agriculture and Technology. The questionnaire was administered to the dog owners after receiving their agreement.

The questionnaire was designed specifically for use in the present study. The items were classified into two sections: basic information about the dog and specifics regarding its anxiety. The basic information included the dog's breed, sex, age, the dog's age when the owner obtained the dog, source, experience of pregnancy and/or rearing of pups (only for female dogs), and medical history. Information about the dog's behaviour in the following situations was also gathered: 'separation' (when the dog stays at home alone or the owner gets ready to leave), 'storm' (when the dog hears thunder or the sound of a storm), 'fireworks' (when the dog hears the sound of fireworks), 'sound' (when the dog hears loud or strange sounds), 'subject' (when the dog sees specific persons or objects or when the dog is taken to specific places), 'never-relax' (the dog is anxious all the time), and others. Other items regarding anxiety behaviour included the dog's age when the behaviours were first noticed by owners, whether owners thought their dogs had anxiety disorders, whether owners were troubled by their dog's behaviour, whether owners considered consulting anyone or did consult anyone about it, whether owners knew of veterinarians specialized in treating problem behaviours, and whether owners want to consult those veterinarians if necessary. In the section regarding anxiety behaviour, the responses were limited to 'yes' or 'no' except for the dog's age when it started showing such behaviour.

We distributed the questionnaires to dog owners at pet shops in Tokyo, Osaka, and Sendai, which are urban areas in the Kanto, Kansai, and Tohoku areas respectively, in Japan.

Data was analysed using R software (ver. 3.2.1). A chi-square test was used to compare the frequency distribution in data from the three different cities. Frequency distribution was compared for the percentage of dogs that were perceived as having anxiety disorders, the percentage of owners who were troubled with their dog's behaviours, the percentage of owners who thought to consult with specialists about their dogs, the percentage of owners who knew a veterinarian who performed behaviour consultations, and the percentage of owners who want to consult such veterinarians if necessary.

A generalized linear model (GLM) with binomial distributions was used, with the response to one situation used as the response variable and the response to the other situation used as the explanatory variable. To calculate the odds ratios, we used coefficients estimated by a simple linear regression analysis of paired responses to situations. We also assessed the significance of the association between paired responses with p values in the simple linear regression analysis. We used the lmer function of the R software (ver. 3.2.1) for this analysis.

Another GLM with binomial distributions was utilized to determine factors related to anxiety behaviours such as age, sex, and breed of the dogs. Response variables included whether owners thought their dogs had an anxiety disorder and whether the dog displayed anxiety behaviour in each situation; explanatory variables included sex, breed, age,

the dog's age when the owner obtained them, source, and the area where the questionnaire was distributed. For significant explanatory variables, we used multiple-comparison tests to detect significant differences between groups with Holm correction. Likelihood ratio tests were employed to test significance. The lmer function of the R software (ver. 3.2.1) was used for this analysis as well.

3. Results

We obtained data from 262 dogs (Tokyo: 69, Osaka: 99, Sendai: 94) belonging to 33 pure and mixed breeds. The breeds were classified into 14 groups, and those with fewer than five dogs were grouped together as 'others.' The mean age of the dogs was 59.5 months, and the mean age of the dogs when the owners obtained them was 5.0 months. On the basis of a previous study, the dogs were classified into four groups according to age: juvenile (< 23 months of age), young adult (24–59 months of age), adult (60–95 months of age), and senior (> 96 months of age) (Lit et al., 2010). Similarly, based on Houpt (2011), the dogs were classified into four groups according to the age at which the owner obtained it: puppy 1 (< 1 month), puppy 2 (between 1 and 2 months), puppy 3 (between 2 and 3 months), and puppy 4 (> 3 months). Regarding the gender of the dogs, there were 75 males, 64 castrated males, 61 females, 57 spayed females, and 5 non-respondents. Of the 262 dogs, 176 were sourced from pet shops, 47 from breeders, 25 from acquaintances, 5 from shelters, 8 from others, and 1 non-respondent. No data was provided regarding pregnancy, rearing, or medical history, and so, this information was excluded from the analysis.

Anxiety behaviours reported by the dog owners are summarized as follows: 'separation': 59 (Tokyo: 17, Osaka: 20, Sendai: 22), 'storm': 105 (Tokyo: 35, Osaka: 29, Sendai: 41), 'fireworks': 68 (Tokyo: 18, Osaka: 16, Sendai: 34), 'sound': 150 (Tokyo: 41, Osaka: 61, Sendai: 48), 'subject': 27 (Tokyo: 10, Osaka: 7, Sendai: 10), and 'never-relax': 4 (Tokyo: 2, Osaka: 1, Sendai: 1). Only four dogs were reported to be in the 'never-relax' behavioural category; hence, we excluded this category from further analysis.

There were no significant differences between the areas in which the questionnaires were administered and the percentage of dogs who their owners perceived as having anxiety disorders ($\chi^2 = 0.489$, $p = 0.783$; Fig. 1a), the percentage of owners troubled with their dog's behaviour or anxiety ($\chi^2 = 2.061$, $p = 0.724$; Fig. 1b), the percentage of owners who considered consulting anyone or did consult anyone about their dog's behaviour ($\chi^2 = 1.492$, $p = 0.474$; Fig. 1c), if the dog owners knew veterinarians who did behaviour consultations ($\chi^2 = 0.517$, $p = 0.772$; Fig. 1d), and if they want to visit the veterinarian for behaviour consultation ($\chi^2 = 5.021$, $p = 0.285$; Fig. 1e).

The odds ratios obtained by simple linear regression analysis of paired responses to situations asked in the questionnaire are shown in Table 1a. We found significant associations between 'separation' and 'subject,' 'storm' and 'fireworks,' 'storm' and 'sound,' and 'fireworks' and 'sound' (Table 1b).

Multiple-comparison tests also revealed significant associations between various factors and the situations in which the dogs showed anxiety behaviour. 'Separation' was affected by the source; however, there was no significant difference between source groups (Table 2 and Fig. 2). 'Storm' was affected by age. In addition, senior dogs showed anxiety behaviour in 'storm' significantly more than juvenile dogs; however, there were no significant differences between other age groups (Table 2 and Fig. 3). 'Fireworks' was affected by age and living area. In addition, young adult, adult, and senior dogs showed anxiety behaviour in 'fireworks' significantly more than juvenile dogs; however, there were no significant differences between other age groups (Table 2 and Fig. 4a). Additionally, there was no significant difference between area groups (Table 2 and Fig. 4b). 'Sound' was affected by sex and age; however, there were no significant differences between sex and age groups (Table 2 and Figs. 5a,b). 'Subject' was affected by sex and source. In addition, dogs from a shelter showed anxiety behaviour in

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