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1 Factors associated with dog behavior problems referred to a behavior clinic

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**1 Abstract**

2 Undesirable behaviors are common in the domestic dog population. This study aimed at identifying  
3 similarities and differences in characteristics underlying two major groups of behavior problems,  
4 and their treatment outcome. The study focused on 335 dogs that visited a Behavioral Clinic in  
5 northern Italy between 2013-2016. These cases were categorized into 2 broad groups based on the  
6 diagnosis: an aggressive group (behavioral pathologies involving aggression), and an anxious group  
7 (behavioral pathologies not primarily involving aggression). Each dog underwent to a behavior  
8 consultation made by a veterinary specialist that used a basic history questionnaire focused on all  
9 aspect of dog's behavior, management and health issue. Several variables were selected from the  
10 questionnaires collected. We found a statistical association of the behavior problem with factors  
11 such as size, sex, age, time of onset, dogs' resting place, family composition and mounting  
12 behaviors involving people ( $p \leq 0.05$ ). Small and medium sized dogs were mainly anxious instead  
13 of aggressive; male dogs were mostly aggressive and female dogs (neutered and intact) were mainly  
14 anxious; dogs adopted from pet shops were all anxious. On average, aggressive dogs exhibited the  
15 problem 4 months after adoption. Anxious dogs exhibited the problem within one week of  
16 adoption. The resting place and diagnosis were statistically related ( $p \leq 0.05$ ): the 20% of dogs that  
17 slept on owners' bed were mainly anxious dogs (78% of these). Sixty-five per cent of anxious dogs  
18 and 33% of aggressive dogs showed mounting behaviors towards people. Most (72.3%)  
19 (N=242/335) of the dogs improved after behavior treatment. Aggressive dogs (96%, N= 232/242)  
20 improved more than anxious ones (4%; N = 10/242) ( $p \leq 0.05$ ). Moreover, owners of dogs with  
21 anxiety problems were significantly more prone to surrender the dog to a shelter or other people ( $p$   
22  $\leq 0.05$ ). Our work supports some previous findings and suggests some new information regarding  
23 factors associated with aggression and anxiety in domestic dogs. Anxiety problems appear more  
24 difficult and demanding for dog owners. A referral population is not likely representative of the  
25 entire population of dogs. To understand patterns of behavioral problems, we need more complete  
26 population data and we need data from dogs across their lifetime.

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30 *Keywords: aggression, anxiety, problems behavior, dogs*

## 1 **Introduction**

2 Undesirable behaviors are common problems in the domestic dog population. So-called behavioral  
3 problems are risk factors for relinquishment of dogs to an animal shelter (Patronek et al., 1996).  
4 Dog bites to humans are a complex problem for public health (Weiss et al., 1998), and have a media  
5 focus and negative social effect. Some behavior pathologies, such as separation anxiety, pose  
6 problems in the field of animal welfare (Horwitz, 2002).  
7 Understanding the epidemiology of these problems is an essential key to establishing treatment and  
8 prevention programs. In the United States, 40% of the dog and cat population have been estimated  
9 to have behavioral problems (Voith, 1985). Other studies in the US have suggested a prevalence  
10 rate as high as 87% for dogs (Campbell, 1986). In the United Kingdom or Australia (Adams and  
11 Clark, 1989; O'Farrell, 1992), about 80% of dogs exhibit undesirable behaviors. In Denmark, 29%  
12 of the dogs show these kinds of problems, despite the fact that only 4 behaviors were analyzed:  
13 'dominance' toward the owner, inter-dog aggression, separation anxiety, and shooting phobia  
14 (Rugbjerg et al., 2003).  
15 Several studies show that aggression is the most frequent behavior pathology in dogs (Voith, 1985;  
16 Knol, 1987; Wright and Nesselrote, 1987; Landsberg, 1991; Hsu and Serpell, 2003; Bamberger and  
17 Houpt, 2006; Yalcin and Batmaz, 2007). Other frequent behavioral problems reported include  
18 inappropriate elimination (Voith, 1985; Landsberg, 1991) or different anxieties, such as separation  
19 anxiety disorder (Hsu and Serpell, 2003; Bamberger and Houpt, 2006; Yalcin and Batmaz, 2007).  
20 Dogs show generally more than one behavior problem (Campbell, 1986; Adams and Clark, 1989;  
21 Overall et al., 2001; Overall and Dunham, 2002; Hsu and Serpell, 2003; Bamberger and Houpt,  
22 2006; Fatjó et al., 2006; Yalcin and Batmaz, 2007). One of the main reasons dogs are given away,  
23 abandoned, or euthanized is a behavior problem.  
24 With the accumulation of the treatment experience for behavior problems, many behaviourists  
25 (veterinary surgeon specialized in behavior therapy) have started to characterize these behavior  
26 problems using retrospective techniques. Most studies have determined whether or not there were  
27 breed, sex, age or experiential risk factors for a given behavior problem (Borchelt, 1983; Line and  
28 Voith, 1986; Wright and Nesselrote, 1987; Blackshaw, 1991; Landsberg, 1991; McCrave, 1991;  
29 Clark and Boyer, 1993; Serpell and Jagoe, 1995; Lund et al., 1996; Galac and Knol, 1997; Neilson  
30 et al., 1997).  
31 There is considerable variation among studies about the most common behavior problems and the  
32 influence certain risk factors for these behaviors (Martinez et al., 2011).

1 This study sought to characterize similarities and differences in characteristics for two major groups  
2 of behavior problems, and their treatment outcome. The two groups were created based on  
3 phenotypic/phenomenological diagnosis: behavioral pathologies not primarily involving aggression  
4 and behavioral pathologies involving aggressions (Moyer, 1968; Overall, 1997; Overall, 2005;  
5 Overall, 2013). These diagnostic criteria relies on behaviors exhibited by dogs within specific  
6 contexts (Overall, 2013).

## 7 **Materials and methods**

### 8 **Subjects**

9 All behavioral case records for 335 dogs that were diagnosed with separation-related problems  
10 and/or aggression at a Behavioral Clinic in northern Italy between 2013-2016 were included in this  
11 study.

12 These cases were categorized into 2 groups based on the diagnosis: an *aggressive group* (150  
13 subjects) which included different forms of aggression (maternal aggression, play aggression, fear  
14 aggression, pain aggression, territorial aggression, protective aggression, inter-dog aggression,  
15 redirected aggression, food-related aggression, possessive aggression, predatory aggression,  
16 impulse-control aggression, idiopathic aggression) and an *anxious group* (185 subjects) which  
17 included dogs with behavioral pathologies not primarily involving aggression, including  
18 generalized anxiety, separation anxiety, different forms of fear and phobia, (Horwitz, 2009; Levine,  
19 2009; Luescher, 2009; Overall, 2013; Palestrini, 2009).

20 Each dog underwent to a behavior consultation made by a veterinary specialist (always the same  
21 person) that used a basic history questionnaire focused on all aspect of dog's behavior, management  
22 and health issue. Several variables of the dog's characteristics and history as well as on the physical  
23 and social environment of the dogs were selected from the questionnaires collected.

24 Home environment, management, age (current, age at acquisition), sex, reproductive status (entire  
25 or neutered/spayed), breed, number of adults and children in the household (children older than 18  
26 years were considered adults), source of dog (breeder, pet store, shelter, rescue, family, friends or  
27 stray), and number of dogs and cats in the household, dog's behavior during owner absence and  
28 aggressive behavior were also considered in the study.

### 29 **Statistical analysis**

30 Client responses to the questionnaire about behavior, anamnesis, management data (like number of  
31 family members, source of dog, etc) were scored and their absolute and relative frequencies were  
32 calculated and expressed as percentage. Chi-square tests were used to identify differences in  
33 characteristics shown by dogs diagnosed with separation anxiety and with aggression. Differences  
34 were considered to be statistically significant if  $p \leq 0.05$ .

## 1 **Results**

2 Of all the dogs involved in the study, 44.8% (N=150/335) had a diagnosis involving aggression and  
3 55.2% (N=185/335) had a diagnosis involving anxiety without aggression. Within the anxious  
4 group 19.1% (N=64/335) had separation anxiety, alone, 36.1% (N=121/335) a mixed diagnosis of  
5 separation anxiety and other problem behaviors (i.e., generalized anxiety and fears/phobias). In the  
6 aggressive group, 19.1% (N=64/335) fear aggression and 25.7% (N=86/335) other form of  
7 aggressions (i.e. maternal, inter-dog, idiopathic, status related, etc.). Dogs exhibiting inter-dog  
8 aggression and status related aggression could also be anxious, but we decided to enhance the  
9 aggressive behavior and to gather these categories.

10 Mixed breed dogs comprised 41.2% (N=138/335) of our sample and pure breeds 58.8%  
11 (N=197/335). Of dogs with a diagnosis of aggression, 42.7% (N=64/150) were mixed breed dogs  
12 and 57.3% (N=86/150) pure breeds. Similar percentages were found for anxiety diagnosis: 40%  
13 (N=74/185) was mixed breed dogs and 60% (N=111/185) was pure breed dogs. The breeds were  
14 divided into groups according to the Official Dog Breeds List of the Italian Kennel Club: sheepdogs  
15 and cattle dogs (1), pinschers, schnauzers and molossers (2), terriers (3), Dachshunds (4), spitz and  
16 primitive type dogs (5), hounds and blood tracking dogs (6), pointing dogs (7), retrievers, search  
17 dogs, water dogs (8), companion dogs (9), greyhounds (10). Two additional groups were added  
18 because of owner identifications: pit ulls (11) and mixed breed (12). Table 1 describes the  
19 distribution of the breeds in the two groups of diagnosis.

20 In our sample, 46.2% (N=155/335) were medium sized dogs, 27.4% (N=90/335) large dogs, and  
21 27.4% (N=90/335) small dogs. The size of dogs was established on weight: small: < 11 kg,  
22 medium: from 11 to 30 kg, and large: > 30 kg (Dorn et al., 2017).

23 We found a significant association between the dogs' size and the diagnosis ( $p \leq 0.05$ ): small dogs  
24 were for 72.3% (N=65/90) anxious and for 27.7% (N=25/90) aggressive; medium dogs were 64%  
25 (N=99/155) anxious and 36% (N=56/155) aggressive; large dogs were more frequently in the  
26 aggressive category (60%-N=54/90) instead of in the anxious one (40%-N=36/90).

27 Most of the dogs were intact males (50.7%-N=170/335), 11% (N=37/335) were neutered males,  
28 16.7% (N=56/335) were intact females and 21.5% (N=72/335) were neutered females. There was a  
29 statistically significance effect of sex for the diagnostic groups ( $p \leq 0.05$ ). Figure 1 shows that  
30 neutered males were mainly aggressive and female (neutered and intact) were mainly anxious.  
31 Intact male were found in both diagnostic groups approximately equally (46%, N=79/170  
32 aggressive and 54%, N=91/170 anxious).

1 Most dogs referred to the clinic were 13 months - 4 years (56.1% of dogs, N=188/335). Age of the  
2 dog and diagnosis were statistically related ( $p \leq 0.05$ ): dogs aged less than 1 year were mostly  
3 anxious (about 75%, N=12/16).

4 We found a statistical association between diagnosis and source of adoption ( $p \leq 0.05$ ). Twenty-  
5 eight per cent of the dogs (N=94/335) were adopted directly from breeders, 22% (N=74/335) were  
6 acquired from a pet store, 21% (N=70/335) came from animal shelters, 19% (N=64/335) were  
7 transferred from another person, and the remaining dogs (10%, N=33/335) were strays. Dogs  
8 adopted from another person were mainly aggressive (97%, N=62/64), dogs that came from pet  
9 stores were all anxious and the ones from shelters or stray were a little bit more in the anxious  
10 group.

11 No statistical differences in diagnosis were seen with respect to the age of adoption: 47% of dogs  
12 (N=157/335) were adopted between 51 days and three months of age, 36.2% (N=121/335) after  
13 three months and 16.8% (N=57/335) before 51 days.

14 The time of onset of the problem was associated with diagnosis ( $p \leq 0.05$ ). In particular, dogs that  
15 presented the problem approximately one week after adoption were mainly anxious (84%,  
16 N=98/117), as opposed to dogs that exhibited the problem about 4 months after adoption that were  
17 mainly aggressive (61%, N=37/61) (figure 2).

18 We found a statistical association between family composition and diagnosis ( $p \leq 0.05$ ). Dogs that  
19 with lived with singles (75%, N=36/49) and with couples (65%, N=81/125) were more frequently in  
20 the anxious category instead of in aggression one. The percentages of dogs with different type of  
21 diagnosis living in household with children were similar: anxiety 54% (N=73/136) and aggression  
22 46% (N=63/136).

23 About 50% (N=160/335) of dogs had a dog basket, 14.3% used the sofa (N=48/335) and 20.6%  
24 (N=69/335) slept on owner's bed. The resting place and diagnosis were statistically related ( $p \leq$   
25 0.05): the dogs that slept on owners' bed were mainly anxious dogs (78%) (N=54/69). For other  
26 resting areas the percentage of anxious or aggressive dogs were similar (figure 3).

27 Mounting behavior involving people was seen in 24.8% (N=83/335) of the subjects. Of these, 67%  
28 (N=56/83) were anxious and 33% (N=27/83) aggressive ( $p \leq 0.05$ ). No differences were seen in  
29 mounting behavior towards other dogs between the aggressive and non-aggressive groups.

30 Most (72.3%) (N=242/335) of the dogs improved after behavior treatment. Aggressive dogs (96%,  
31 N= 232/242) improved more than anxious ones (4%; N = 10/242) ( $p \leq 0.05$ ).



1 The number of visits for each patient and the use of pharmacology were associated with the  
2 diagnosis ( $p \leq 0.05$ ). In particular, of dogs that had 2 visits 67% ( $N=32/48$ ) were diagnosed as  
3 anxious and 33% ( $N=16/48$ ) as aggressive, whereas those who had 3 visits were all diagnosed as  
4 anxious ( $N=24/24$ ) (figure 4). Pharmacological therapy was given to 72% ( $N=140/194$ ) of dogs  
5 with anxiety and to 28% ( $N=54/194$ ) of dogs with aggression (figure 5).

6 Owners of dogs with anxiety problems were significantly more inclined to (65%) ( $N=34/52$ ) to  
7 surrender the dog to a shelter or to other people than were owners of dogs with aggression problems  
8 (35%,  $N=18/52$ ) ( $p \leq 0.05$ )

## 9 **Discussion**

10 Dogs exhibit a range of behaviors related to their emotional state (Beaver, 1982). Behaviors are  
11 influenced by three main factors not independent one from each other: genetics, experience and  
12 environment (Gottesman and Hanson, 2005). Behavior problems in companion animals present  
13 serious public, health, economic and animal welfare concerns (Col et al., 2016). The aim of this  
14 study was to evaluate possible factors that may correlate with a specific diagnosis of anxiety or  
15 aggression. Aggression is the most frequent behavior problems in dogs (Voith, 1985; Knol, 1987;  
16 Wright and Nesselrote, 1987; Landsberg, 1991; Hsu and Serpell, 2003; Bamberger and Houpt,  
17 2006; Yalcin and Batmaz, 2007). Other recurrent behavioral problems include inappropriate  
18 elimination (Voith, 1985; Landsberg, 1991) and various anxieties, such as separation anxiety  
19 disorder (Overall et al., 2001; Bamberger and Houpt, 2006; Yalcin and Batmaz, 2007, Palestrini et  
20 al., 2010; Blackwell et al., 2013).

21 No breed prevalence related to diagnosis was found in our study. Breed-associated risk for behavior  
22 problems is associated with the breed distribution in the geographic area (Overall, 1997; Reisner et  
23 al., 2005) and the popularity of the breed, but this apply for any risk, that must be calculated with  
24 respect to the population (Svartberg, 2006).

25 In our sample, smaller sized dogs were over-represented in the anxiety group. A recent study found  
26 a strong negative correlation between body-size and unwanted behaviors: smaller dogs had  
27 significantly more compulsive behaviors, mounting behavior, separation-related problems, urine  
28 marking, but most importantly, dog-directed fear, and non- social fear (McGreevy et al., 2013).  
29 Martinez et al. (2011) reported that increasing body size was also related to a reduced emotion of  
30 fear. Data showed by Martinez indicated that larger dogs were over-represented in their study in  
31 aggression to people. Conversely, Tiira and Lohi (2015) found that the size of the dog may not be  
32 a major factor for fearfulness.



1 In our study, neutered males were more in the aggressive category than the anxious one. Castration  
2 has been reported to decrease aggression to other dogs in 62% of cases (Hopkins et al., 1976), but  
3 there are no data on true effects on problematic behaviors or specific diagnosis (Overall, 2013).  
4 Neuter/spay status (Messam et al., 2008) has been reported to have important relationships with dog  
5 aggressiveness, which is observed to be lower in neutered/spayed individuals (Borchelt, 1983;  
6 Gershman et al., 1994; Messam et al., 2008). Testosterone acts as a behavior modulator that makes  
7 dogs react more intensely. When an intact dog decides to react, it reacts more quickly, with greater  
8 intensity, and for a longer period of time (Overall and Love, 2001). Male dogs are more often  
9 involved in dog bite episodes than females (Gershman et al., 1994; Cameron, 1997; Overall and  
10 Love, 2001; Fatjo et al., 2007, Casey et al., 2014). In our sample, females more commonly had  
11 anxiety disorders not involving aggression. There was no difference in the proportion of neutered  
12 females and intact females with aggression diagnoses, which differs from other results showing that  
13 aggression is more commonly observed in spayed females (Borchelt, 1983; Wright and Nesselrote,  
14 1987; Wright 1991). Guy et al. (2001) found that in the population they studied, both neutered  
15 males and spayed females were more common than intact dogs when considering aggression, a  
16 result that differed from the population Blackshaw (1991) studied. There are no good population-  
17 level data on effects of sex and aggression that controls for potentially confounding factors like  
18 reasons for neutering (Overall, 2013; Casey et al., 2014).

19 Female dogs have been reported to have more phobias (Bamberger and Houpt, 2006) and a higher  
20 demand for affection (Bradshaw et al., 1996), while certain immature behaviors and inappropriate  
21 elimination were more common in males (Landsberg, 1991).

22 We found that dogs less than 1 year most commonly had diagnoses involving anxiety. Dogs older  
23 than 1 year showed a similar percentage of aggression and anxiety. We found that aggressive dogs  
24 were reported to begin to exhibit aggression 4 months after adoption and anxious ones showed the  
25 behavior within a week of adoption.

26 We found no differences in diagnosis regarding the age of adoption.

27 Source of acquisition may affect behavior problems (Hsu and Sun, 2010). Our results showed that  
28 all 74 dogs acquired from a pet store had a diagnosis of anxiety. Dogs from pet stores have been  
29 shown to be over-represented for some behavioral conditions (Pierantoni et al., 2011; McMillan,  
30 2017). Because of how dogs sold through pet stores and/or born in commercial breeding  
31 establishments are bred, housed, weaned, transported, handled, homed, and raised, potential  
32 contributing factors for these reported outcomes are numerous (McMillan, 2017).

1 The majority of dogs adopted from shelters and the majority of stray dogs in this study were  
2 diagnosed with anxiety, whereas dogs adopted from another person were mainly diagnosed with  
3 aggression.

4 We found that sleeping on the bed and mounting people were more prevalent in anxious dogs than  
5 aggressive dogs.

6 We found that dogs that improved with the suggested treatment plan more often had diagnoses  
7 involving aggression, rather than anxiety diagnoses that did not involve aggression. The suggested  
8 treatment plan included a combination of the following four basic strategies: education and  
9 modification of the client's behavior, changes to the patient's environment, changes of the patient's  
10 behavior and pharmacological therapy. Behavioral protocols were kept as simple as possible to be  
11 easily integrated into the owner's daily routine, clarifying owner-animal communication and  
12 keeping to the application of the basic learning principles. General outcomes of the behavioral  
13 treatments were based on the records of follow-up calls and on the follow-up visits 1-2 months after  
14 the first visit by the veterinary behaviorist.

15 The number of visits as much as the administration of pharmacological therapy could be a diagnosis  
16 or a condition effect, but also due to the clinician or owner decision. There are three factors, which  
17 may not be independent, which could be involved in these points.

18 Although the number of visits could be due to other things than just the diagnosis, in our study  
19 anxious dogs had more follow-up visits and were prescribed more with pharmacological therapy.  
20 Moreover, owners of anxious dogs thought more about surrendering their dog to other people.  
21 Anxiety related problems, in particular separation anxiety, represent one of the principal causes for  
22 the breakdown of the human-companion animal bond and lead to surrender of numerous dogs to  
23 shelters (Van der Borg et al., 1991; Houpt et al., 1996; Sherman and Mills, 2008; Diesel et al.,  
24 2010; Sargisson, 2014).

## 25 **Conclusion**

1 Our work supports some previous findings that, in a referral population, more dogs with aggressive  
2 diagnoses are male and dogs solely with anxiety-related diagnoses are mostly female, aged less than  
3 a year and adopted from pet stores and suggest some new information regarding factors associated  
4 with aggression and anxiety in domestic dogs.

5 It could be though that aggression is mentally and emotionally charged for human, but from these  
6 results, anxiety problems appear more difficult and demanding for dog owners. Aggression is clear  
7 and context dependent and most often you can control that context. Anxiety is diffused and  
8 generalized and occurs in contexts that are less amenable to manipulation.

9 A referral population is not likely representative of the entire population of dogs. To understand  
10 patterns of behavioral problems, we need more complete population data and we need data from  
11 dogs across their lifetime.

12

### 13 **Authorship statement**

14 The idea for the paper was conceived by Clara Palestrini. The experiments were designed by Simona  
15 Cannas and Clara Palestrini. The experiments were performed by Zita Talamonti, Anna Picciolini  
16 and Silvia Mazzola. The data were analyzed by Simona Cannas and Michela Minero. The paper  
17 was written by Simona Cannas and Clara Palestrini.

18

### 19 **Conflict of interest statement**

20 The authors of this paper do not have a financial or personal relationship with other people  or  
21 organizations that could inappropriately influence or bias the content of the paper.

22

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9

1 **Figures**

2

3 Figure 1. Distribution of dogs' sex in the two groups of diagnosis (\* $p \leq 0.05$ )

4

5 Figure 2. Time of onset of the problem behavior in the two groups of diagnosis (\* $p \leq 0.05$ )

6

7 Figure 3. Dogs' resting place in the two groups of diagnosis (\* $p \leq 0.05$ )

8

9 Figure 4. Number of visits requested in the two groups of diagnosis (\* $p \leq 0.05$ )

10

11 Figure 5. Use of a pharmacological therapy in the two groups of diagnosis (\* $p \leq 0.05$ )

12

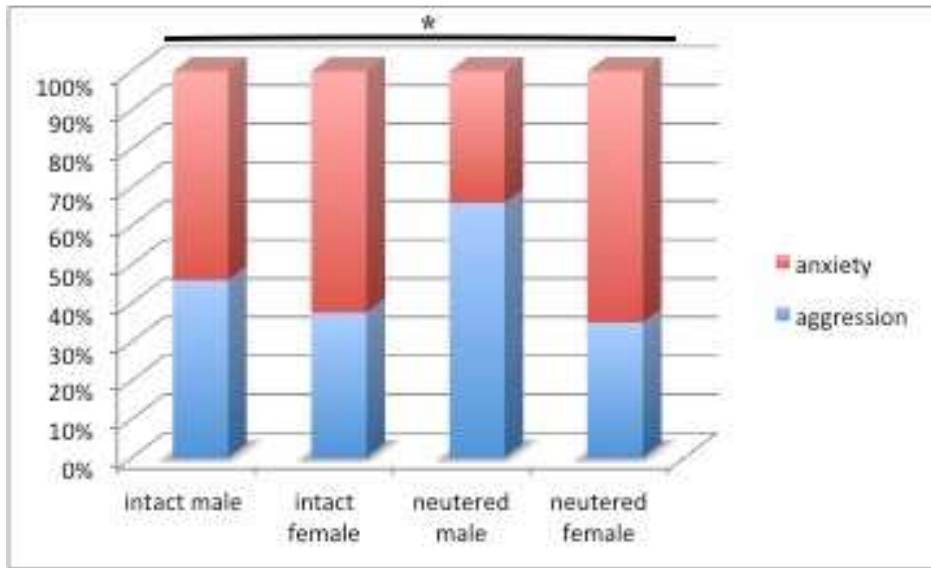
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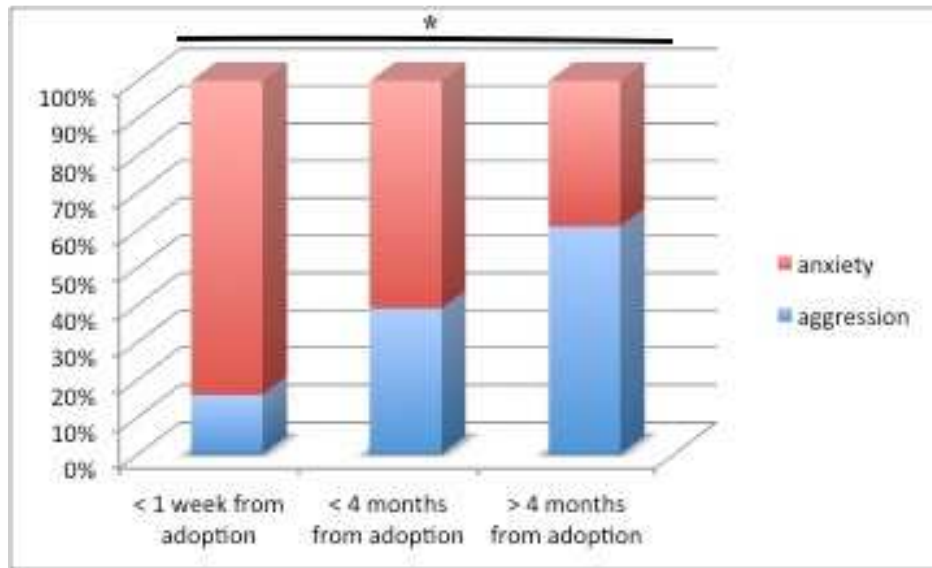
1 Table 1. Distribution of the breeds in the two groups of diagnosis.

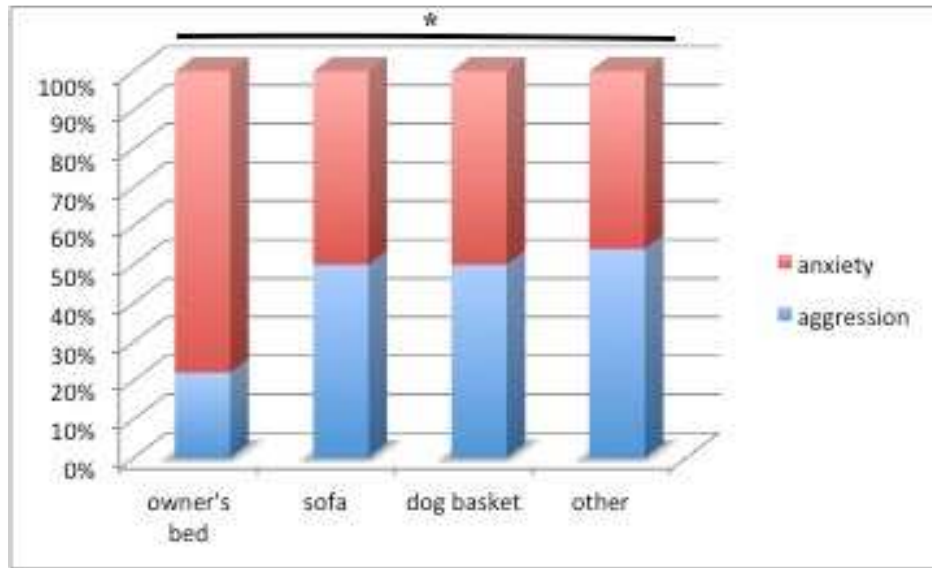
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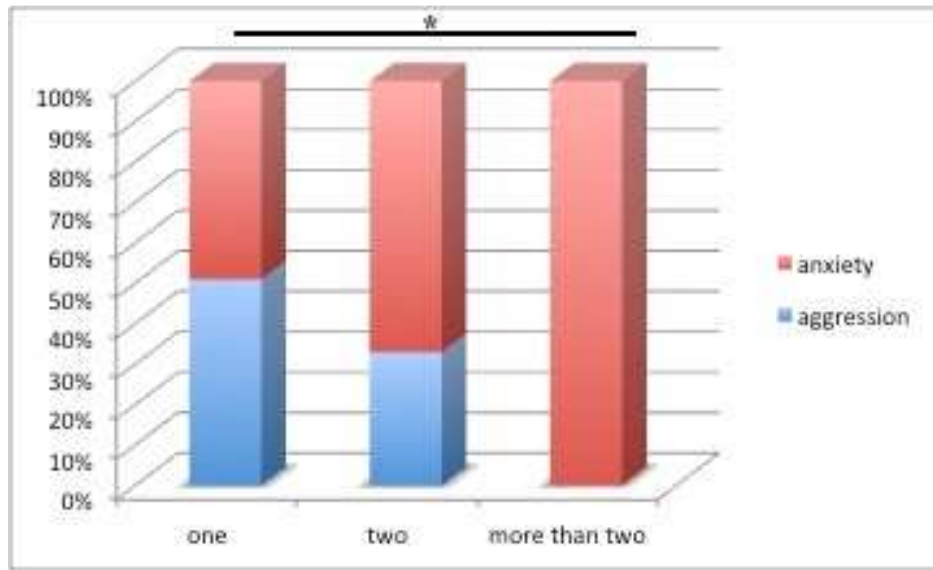
BREED	AGGRESSION	ANXIETY
1	14,0%	6,4%
2	11,3%	10,8%
3	8,0%	7,6%
4	5,3%	6,5%
5	2,0%	2,7%
6	0,7%	4,3%
7	1,3%	4,9%
8	3,3%	6,5%
9	6,7%	8,1%
10	0,0%	2,2%
11	4,7%	0,0%
12	42,7%	40,0%

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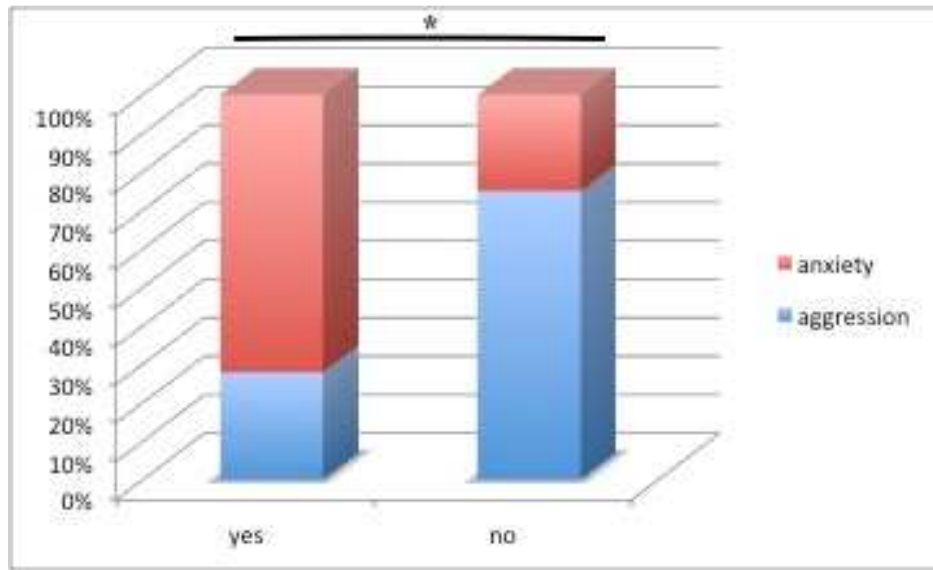












**Highlights**

- Dogs were diagnosed as primarily anxious or primarily aggressive
- Female dogs were mostly anxious and male dogs were mostly aggressive
- Small and medium sized dogs were mainly anxious
- Dogs adopted from pet shops were all anxious
- Dogs that improved with behavior therapy were more aggressive than anxious
- Anxious dogs' owners more often thought of surrendering their dog to a shelter or other people