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## Perception of dogs' stress by their owners

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**Abstract** Questionnaires potentially have a broad applicability in measuring stress levels in dogs, as owners know their dogs' behavior and personality better than anyone else. The aim of this research was to evaluate how owners perceive stress in their dogs through understanding of displayed behaviors.

The survey was carried out using 1,190 questionnaires completed by dog owners. More than half of respondents were able to correctly identify stress as a short- or long-term alteration of the psychophysical equilibrium that can develop into illness. This ability was higher with higher educational levels. The behavioral indicators of stress most frequently identified by owners were trembling and whining, followed by aggressiveness, excessive barking, and panting. More subtle behaviors such as looking elsewhere, turning head, yawning, and nose licking were more rarely reported, suggesting that few owners are able to correctly interpret and intervene in early stages of stress. The vast majority of respondents indicated that dogs were stressed seldom or only in specific situations. Men generally considered their dogs as experiencing low stress more often than did women, whereas women considered their dogs as being moderately stressed more often than did men.

An owner's ability to recognize behavioral signs of stress is important, as it enables the owner to help the animal to avoid welfare problems, such as stressful situations, and favors a rapid recovery of psychophysical homeostasis by interrupting the progression to overstress and distress. The results show that some owners can help in protecting the welfare of their dogs, but that many owners would benefit from educational efforts to improve their ability to interpret their dogs' behavior.

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### Introduction

As early as 1936, Selye used the word stress to describe the nonspecific response of the organism to a noxious stimulus. Previously, the term "stress" had only been used in engineering to indicate the strain put on materials.

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Subsequently, various definitions of stress were formulated (Selye, 1952; Perry, 1975; Broom, 1988; Moberg et al., 2000), most of which describe stress as a response of the organism to an internal or external threat where it concentrates its effort to cope with it.

Normally, stress tends to be associated with negative factors (Nagel and Reinhardt, 2003), although it is an ambivalent phenomenon. Selye (1974) separated stress into eustress (a form of positive or physiological stress) and 2 forms of negative stress: overstress and distress.

The term eustress indicates the effort the animal makes to adapt to the environment within the limits of normality.

The terms overstress and distress signify an adapting effort that requires a large amount of energy to the detriment of other important biological functions (e.g., growth and reproduction) of which the animal may (distress) or may not (overstress) be aware. In the case of distress, the perception of the effort necessary to attempt to reestablish psychophysical homeostasis modified by the stressor is often accompanied by the animal suffering.

Stress levels can be measured by using various parameters, with physiological and behavioral indicators being the more often used for pets. To establish stress and subsequent welfare problems in dogs, behavioral parameters are of special interest because they may be measured easily and noninvasively (Beerda et al., 1997, 1998).

The evaluation of behavioral responses is usually conducted by experts, mainly by administering specific stimuli to the dogs in experimental conditions (Beerda et al., 1998). Serpell and Hsu (2001) suggested that questionnaire methodologies have a potentially broad applicability for measuring dogs' behavior in situations where other conventional means are not easy to use, based on the fact that owners know their dogs' behavior better than anyone else. In fact, this method has been used in many other studies on dog behavior (Hiby et al., 2004; Rooney and Bradshaw, 2004; Marinelli et al., 2007; Gazzano et al., 2008a, 2008b), also when related to emotional state (Kerswell et al., 2009).

Differences in stressor properties and in individual characteristics of dogs introduce variability in stress responses (Beerda et al., 1997; Rooney et al., 2009). Besides, dog behavior varies significantly according to the time of day, and dogs behave very differently when people are present compared with when they are absent (Gaines et al., 2007). Thus, the more time people spend observing their dogs and the more varied the contexts in which those observations take place, the more accurate the assessment of their welfare will be (Rooney et al., 2009). Moreover, owners are the people most familiar with their dog's personality, behavior, and daily routine (Wojciechowska and Hewson, 2005). These findings seem to suggest that owners may be accurate in assessing stress in their dogs, and their reports could be used as individual behavioral observations of indicators of animal feelings (Wojciechowska and Hewson, 2005).

The aim of this study was to evaluate how owners perceive stress in their dogs through the understanding of displayed behaviors.

## Materials and methods

The survey was carried out using a purposely prepared questionnaire. A sample of 1,190 dog owners completed the questionnaire anonymously between July 2007 and April 2008. Respondents were recruited through an in-person interview in 20 veterinary clinics (located in central Italy)

and by personal contacts. A trained person filled in the questionnaire based on the answers provided by people who agreed to participate. Each questionnaire corresponded to an individual dog, for which a single questionnaire was filled in.

Only dogs that were regarded as pets and that lived with the respondents were included.

The questionnaire was composed of 2 sections. The first addressed owners' personal data: sex, educational level (elementary/middle school, high school, or university degree), and age (as suggested by Kubinyi et al., 2009: 18-30 years, 31-60 years, and >60 years).

The second section was focused on stress in dogs and consisted of 3 questions. A multiple-choice question aimed at understanding what owners intended by the term stress (see Results for the possible answers provided). Then, owners were asked to indicate which of the behaviors listed in Table 1 could indicate stress in dogs. The final question aimed at identifying the owners' opinion regarding the level of stress of their dogs: low (the dog is seldom stressed), medium (the dog is stressed only in specific situations), high (the dog is often stressed), or very high (the dog is always stressed).

Data obtained were analyzed through SPSS Statistics 17.0 for Windows (Chicago, IL) by using a  $\chi^2$  test ( $P < 0.05$ ) for the comparisons between sexes, educational levels, and ranges of age of respondents.

## Results

Almost half of the dogs (45.0%) were mixed breeds, the rest belonging to 51 breeds of different Fédération Cynologique Internationale groups. Dogs' age was  $72.4 \pm 46.1$  months (mean  $\pm$  standard deviation).

The population of owners was relatively balanced for sex, although there were more females than males (56.1%,  $n = 667$  vs. 43.9%,  $n = 523$ ).

More than half the respondents had a high school diploma (65.6%), 17.1% had attended elementary/middle school, and 16.4% had a university degree.

Respondents were stratified by age: 18-30 years (47.4%), 31-60 years (44.6%), and >60 years (8.0%).

More than half of the respondents (59.6%,  $n = 709$ ) correctly considered that stress is a short- or long-term alteration of the psychophysical equilibrium of the animal that can develop into an illness, whereas 19.7% ( $n = 234$ ) believed that it is a short-term alteration of the psychophysical equilibrium that does not have consequences for the dog. Seventeen percent ( $n = 203$ ) of owners considered stress to be exclusively an alteration of the psychological equilibrium, whereas 3.7% ( $n = 44$ ) considered it to be only an alteration of the physical equilibrium of the dog.

With respect to the ability of the respondents to identify the correct definition of stress, there was a statistically significant difference for sex (55.6% of males vs. 62.7% of

**Table 1** List of surveyed behaviors as possible indicators of stress in dogs and relative scientific literature

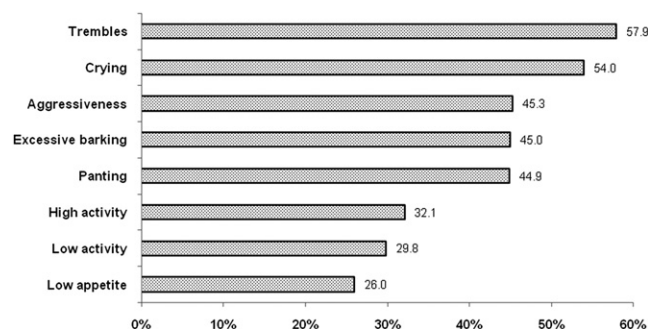
| Behaviors                       | References   |
|---------------------------------|--|
| Urination and/or defecation     | Beerda et al., 1998, 1999; Casey, 2002; Tod et al., 2005   |
| Yawn                            | Beerda et al., 1998; Hennessy et al., 1998; Schildler and van der Borg, 2004; Dreschel and Granger, 2005; Tod et al., 2005; Rooney et al., 2007  |
| Low activity                    | Beerda et al., 1997, 1999  |
| High activity                   | Beerda et al., 1997, 1998; Casey, 2002; Rooney et al., 2007  |
| Looking elsewhere               | Rooney et al., 2009  |
| Turning head                    | Schildler and van der Borg, 2004; Rooney et al., 2007  |
| Crying (yelp, whining, whimper) | Schildler and van der Borg, 2004; Beerda et al., 1997; Rooney et al., 2007; Rooney et al., 2009  |
| Hypersalivation                 | Beerda et al., 1997; Casey, 2002; Dreschel and Granger, 2005   |
| Aggressiveness                  | Beerda et al., 1999; Casey, 2002; Schildler and van der Borg, 2004; Tod et al., 2005; Rooney et al., 2009  |
| Trembles                        | Beerda et al., 1999; Dreschel and Granger, 2005; Tod et al., 2005; Rooney et al., 2009   |
| Panting                         | Beerda et al., 1997, 1999; Hennessy et al., 1998; Casey, 2002; Schildler and van der Borg, 2004; Dreschel and Granger, 2005; Rooney et al., 2009 |
| Nose licking                    | Beerda et al., 1997, 1998; Schildler and van der Borg, 2004; Tod et al., 2005; Rooney et al., 2007; Rooney et al., 2009                          |
| Paw lifting                     | Beerda et al., 1997, 1998, 1999; Schildler and van der Borg, 2004; Rooney et al., 2007; Rooney et al., 2009                                      |
| Low appetite                    | Casey, 2002  |
| Turning around/circling         | Beerda et al., 1997, 1998, 1999; Casey, 2002; Schildler and van der Borg, 2004; Dreschel and Granger, 2005; Rooney et al., 2007                  |
| Excessive barking               | Beerda et al., 1998; Schildler and van der Borg, 2004; Tod et al., 2005; Rooney et al., 2009   |
| Eating and/or drinking much     | Beerda et al., 1998; Tod et al., 2005  |
| Autogrooming                    | Beerda et al., 1998, 1999; Rooney et al., 2007; Rooney et al., 2009  |
| Other repetitive activities     | Beerda et al., 1997, 1999; Rooney et al., 2009   |

females;  $\chi^2 = 5.724$ ;  $P = 0.017$ ), age (18-30 years, 72.0%; 31-60 years, 49.3%; >60 years, 43.2%;  $\chi^2 = 69.799$ ;  $P = 0.000$ ), and educational level (degree, 61.0%; high school, 63.3%; middle school, 45.8%; elementary, 27.3%;  $\chi^2 = 25.287$ ;  $P = 0.000$ ). Specifically, people with a university degree were more likely to answer this question correctly than people who only attended middle ( $\chi^2 = 8.646$ ;  $P = 0.003$ ) and elementary school ( $\chi^2 = 3.614$ ;  $P = 0.057$ ), but there was no difference between those with a university degree and those with a high school diploma ( $\chi^2 = 0.243$ ;  $P = 0.622$ ). Furthermore, people with high school diplomas provided the correct answer statistically more frequently than those with a middle school ( $\chi^2 = 19.642$ ;  $P = 0.000$ ) and an elementary school diploma ( $\chi^2 = 4.567$ ;  $P = 0.033$ ).

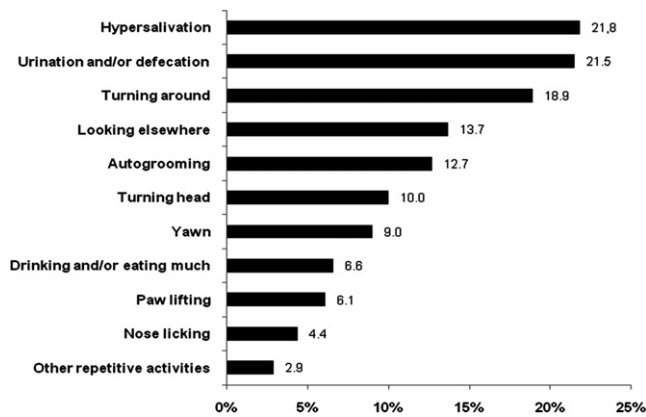
Figures 1 and 2 report behaviors that the owners believed were possible indicators of stress in dogs. Table 2 summarizes the differences in such identification between respondents who correctly or incorrectly defined stress; results of the comparison through statistical analysis are also reported.

In the list of behaviors reported in Table 1, some behaviors were more subtle (i.e., yawning, looking elsewhere, turning head, nose licking, and paw lifting). We asked whether people who were able to identify at least 1 of the subtle behaviors as a possible indicator of stress differently

assessed the level of stress of their dogs. No difference was found for the very high level of stress (2.7% vs. 1.4%;  $\chi^2 = 1.581$ ;  $P = 0.209$ ). Respondents who reported the more subtle signs, compared with those who did not, tended to more frequently assess the stress of their dogs as high or medium (10.7% vs. 7.3%;  $\chi^2 = 3.364$ ;  $P = 0.067$  and 44.3% vs. 38.8%;  $\chi^2 = 2.899$ ;  $P = 0.089$ , respectively). Owners who did not consider subtle behaviors as indicators of stress reported that their dogs were low stressed more than other owners (52.6% vs. 42.3%;  $\chi^2 = 9.853$ ;  $P = 0.002$ ).



**Figure 1** Behaviors that were correctly identified as possible indicators of stress in dogs by >25% of respondent owners.



**Figure 2** Behaviors that were correctly identified as possible indicators of stress in dogs by <25% of respondent owners.

Analyzing differences for sex, men were more able to identify low activity (33.8% vs. 26.7%;  $\chi^2 = 6.835$ ;  $P = 0.009$ ) and low appetite (29.8% vs. 22.9%;  $\chi^2 = 6.884$ ;  $P = 0.009$ ) as possible stress indicators. No sex differences were found for other behaviors.

With respect to the ability to correctly identify possible behavioral indicators of stress in dogs, educational level did not seem to make any statistically significant difference.

As for age, the only significant differences found about possible indicators of stress were that elderly people were less able to identify urination/defecation (18-30 years, 23.0%; 31-60 years, 21.7%; >60 years, 11.6%;  $\chi^2 = 6.348$ ;  $P = 0.042$ ) and low appetite (18-30 years, 33.2%; 31-60 years, 21.1%; >60 years, 10.5%;  $\chi^2 = 33.508$ ;  $P = 0.000$ ), whereas they were better at reporting

overgrooming (18-30 years, 11.9%; 31-60 years, 11.7%; >60 years, 23.2%;  $\chi^2 = 10.223$ ;  $P = 0.006$ ).

Most of the respondents considered the level of stress in their dogs as low (Figure 3), and the vast majority indicated that dogs were stressed seldom or only in specific situations. Dogs that were reported as being moderately stressed were more likely to display stress when kept in a veterinary clinic (73.1%) and in case of loud noises (65.2%) or thunderstorm (58.5%).

Answers to the question regarding stress levels showed significant statistical differences when analyzed by the respondent's sex: men were more likely to consider their dogs to be low stressed than were women (55.4% vs. 45.1%;  $\chi^2 = 12.084$ ;  $P = 0.000$ ), whereas women considered their dogs to be medium stressed more than did men (43.5% vs. 36.3%;  $\chi^2 = 5.933$ ;  $P = 0.015$ ).

No difference was found after comparing the different educational levels and the level of stress in dogs: for low stress,  $\chi^2 = 1.931$  and  $P = 0.803$ ; for medium stress,  $\chi^2 = 2.431$  and  $P = 0.666$ ; for high stress,  $\chi^2 = 3.185$  and  $P = 0.493$ ; for very high stress,  $\chi^2 = 2.518$  and  $P = 0.643$ .

People who were 18-30 and 31-60 years old responded similarly, whereas elderly owners were less likely to answer that their dogs were medium stressed (18-30 years, 43.4%; 31-60 years, 40.1%; >60 years, 23.2%;  $\chi^2 = 13.917$ ;  $P = 0.000$ ), and tended to indicate high and low levels of stress, compared with those in other age groups.

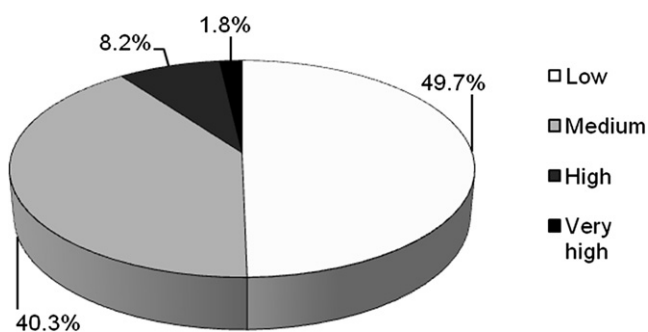
## Discussion

Stress is a common experience in everyday life, as all living beings need to adapt to instabilities in their environment to

**Table 2** Percentages of behaviors regarded as possible indicators of stress in dogs by respondents who gave the correct and incorrect definition of stress, and relative results of the statistical analysis

| Behaviors                      | % for correct definition of stress | % for incorrect definition of stress | Results of the statistical analysis |
|--------------------------------|------------------------------------|--------------------------------------|-------------------------------------|
| Urination/defecation           | 21.2%                              | 22.0%                                | $\chi^2 = 0.085$ ; $P = 0.771$      |
| Yawn                           | 8.5%                               | 10.0%                                | $\chi^2 = 0.626$ ; $P = 0.429$      |
| Low activity <sup>a</sup>      | 34.8%                              | 22.5%                                | $\chi^2 = 20.411$ ; $P = 0.000$     |
| High activity <sup>a</sup>     | 34.6%                              | 28.5%                                | $\chi^2 = 4.575$ ; $P = 0.032$      |
| Looking elsewhere <sup>a</sup> | 16.6%                              | 9.4%                                 | $\chi^2 = 64.862$ ; $P = 0.000$     |
| Turning head                   | 11.4%                              | 7.9%                                 | $\chi^2 = 3.573$ ; $P = 0.059$      |
| Crying <sup>a</sup>            | 56.7%                              | 50.1%                                | $\chi^2 = 4.757$ ; $P = 0.029$      |
| Hypersalivation <sup>a</sup>   | 26.1%                              | 15.6%                                | $\chi^2 = 17.896$ ; $P = 0.000$     |
| Aggressiveness                 | 46.8%                              | 43.0%                                | $\chi^2 = 1.513$ ; $P = 0.219$      |
| Tremble <sup>a</sup>           | 64.7%                              | 47.8%                                | $\chi^2 = 32.975$ ; $P = 0.000$     |
| Panting                        | 47.2%                              | 41.4%                                | $\chi^2 = 3.768$ ; $P = 0.052$      |
| Nose licking                   | 4.7%                               | 4.0%                                 | $\chi^2 = 0.193$ ; $P = 0.661$      |
| Paw lifting                    | 6.1%                               | 6.2%                                 | $\chi^2 = 0.000$ ; $P = 0.999$      |
| Low appetite <sup>a</sup>      | 32.6%                              | 16.2%                                | $\chi^2 = 39.077$ ; $P = 0.000$     |
| Turning around <sup>a</sup>    | 22.4%                              | 13.7%                                | $\chi^2 = 13.600$ ; $P = 0.000$     |
| Excessive barking              | 44.0%                              | 46.6%                                | $\chi^2 = 0.661$ ; $P = 0.416$      |
| Eating/drinking much           | 7.3%                               | 5.4%                                 | $\chi^2 = 1.440$ ; $P = 0.230$      |
| Autogrooming <sup>a</sup>      | 14.4%                              | 10.2%                                | $\chi^2 = 4.190$ ; $P = 0.041$      |

<sup>a</sup> $P < 0.05$ .



**Figure 3** Stress levels in dogs as perceived by their owners. Percentages of dogs showing low, medium, high, and very high levels of stress according to their owners.

ensure survival and reproductive fitness. A behavioral response is often the most efficient option to resolve the stressful situation, permitting the organism to regain homeostasis. Behavior may also be the consequence of the rapid activation of the autonomic nervous system (piloerection, panting, and trembling) or is indicative of a state of stress that is by now chronic (e.g., stereotypies) (Moberg et al., 2000). Correspondence between behavioral and physiological measures of stress has not been well established (e.g., Rooney et al., 2007; Blackwell et al., 2010).

Dogs show a range of behaviors that reflect their emotional state (Beaver, 1981, 1982). The ability of owners to recognize the behavioral signs of stress is important, as it permits the animal to avoid related welfare problems (Kerswell et al., 2009) and it favors a rapid recovery of psychophysical homeostasis by interrupting the progression to overstress and distress.

Data obtained show that the majority of the respondent owners believe that there are stressful situations for their dogs. This means that owners regard themselves as being capable of judging whether their dogs are stressed. Only a small percentage of owners maintain that they are not able to answer or interpret the emotional state of their dogs. This finding could be secondary to the scarce attention paid to the animal's behavior and/or to the lack of knowledge of canine ethology.

The repercussions of this inability to interpret and understand dog language should not be underestimated, as it prevents the owner from acting correctly when the animal is stressed and represents a potential cause of behavior problems in the dog (Voith et al., 1992; McBride et al., 1995; O'Farrell, 1995; Jago and Serpell, 1996).

Price (1999) and McGreevy and Nicholas (1999) suggested that dog morphology affects owners' ability to understand their dogs and the canine behavioral messages. This is in contrast to results reported by Kerswell et al. (2009), probably because owners tend to focus their attention on vocalizations and gross body movements rather than on more subtle signals, which may be disguised by a dog's morphological traits (Kerswell et al., 2009).

In the current study, the majority of owners reported that the main behavior indicators of stress in the dog are

trembling and whining, behaviors that are easy to interpret because they conform to the general public's image of fear and anxiety. Stress is often a consequence of fear, which in turn depends on the lack of familiarity with a stimulus or its association with aversive events. A basic knowledge of learning theory, together with common sense, forms the basis for the prevention of stress in dogs in many situations.

Besides whining and trembling, respondents often reported aggression, excessive barking, and other quite obvious behaviors. It is important that owners of dogs displaying very common and behavioral problems such as aggression and excessive barking understand that these problems can be related to stress, the cause to focus on and treat, instead of relinquishing, abandoning, and euthanizing their dogs.

The more subtle signs were not considered as possible stress indicators. Kerswell et al. (2009) found that subtle behaviors are largely unreported and not recalled by owners. The current study confirmed that these subtle signs, displayed in the earlier stages of emotional arousal (Kerswell et al., 2009), often go unnoticed and can even be misinterpreted by owners. It is up to the veterinary surgeon, and other professionals from whom the owners may seek advice, to explain and, if necessary, point out the more subtle indicators of stress.

However, as suggested by Kerswell et al. (2009), it is unlikely that owners have an implicit understanding of their dogs' emotional state, as they do not recall most of the dog's behaviors, a result confirmed in this study. It is remarkable that owners able to recognize subtle signs as stress indicators reported higher levels of stress in their dogs. A better knowledge of canine behavior likely leads to a better understanding of dogs' emotional state, but the opposite is also likely to be true. In addition, it is not surprising that owners of highly stressed dogs answered similarly regarding subtle signs of stress, as their dogs probably display more evident behaviors.

This research showed that more than half of the respondents were able to identify an appropriate definition of stress. However, 1 of 5 owners considers that stress in dogs has no physical or psychological consequences. Such owners are not aware that they could intervene in any way to decrease the stress that may be present in their animal. Knowing how to define stress was related to a better identification of its behavioral signs. We do not know whether the understanding of the correct definition of stress leads to a higher sensitivity in assessment or vice versa.

Nearly all the respondents believe that their dog is rarely stressed, or is stressed only in particular situations where it displays a low-to-medium level of stress.

For owners who recognize the presence of some sources of stress for their dogs, those with dogs whose level of stress is high would benefit from a consultation with an animal behaviorist regarding possible remedial interventions. The situations most often reported by owners are also

those documented to be stressful for dogs: the veterinary clinic (Stanford, 1981; Pierantoni et al., 2010), loud noises, and thunderstorms (Tuber et al., 1982). This finding suggests that owner assessments may be a useful tool in preventing and treating cases of poor welfare.

Women were more able to identify the correct definition of stress and more frequently indicated that their dog's level of stress was medium. Conversely, a higher proportion of men considered their dog's level of stress as low, and more men reported that low activity and low appetite can be stress indicators in dogs. Women have been reported to be more knowledgeable about and empathic, nurturing, and positive toward animals than males (Kellert and Berry, 1987). Women score significantly higher on the Pain Assessment Instrument (Ellingsen et al., 2010). They are more likely to oppose animal research than men in many countries (Gallup and Beckstead, 1988; Herzog et al., 1991), including Italy (Pifer et al., 1994). Moreover, owners' sex and personality influence dyadic interaction styles, dog behavior, and dyadic practical functionality (Kotrschal et al., 2009). Owners' interaction style and sex affect situational stress levels in the dog (Hennessy et al., 1998; Schöberl et al., 2009). These findings may indicate that women have different perceptions of dog behavior, and/or that dogs behave differently while coping with a stressful situation depending on their owners' sex. Correspondingly, dogs with male owners may be less stressed, they may display it less often, and/or their owners may be less able to recognize and interpret stress-related behavior.

Male owners appear to pay more attention to the level of activity and appetite of their pets, reporting their decrease as possible indicators of stress. Male owners may manage dogs differently or share activities (e.g., hunting, sport) that lead men to pay more attention to those specific behaviors. Although women have been shown to provide a higher level of care (Kidd et al., 1992; Adamelli et al., 2005) and to give more attention and love to their pets (Eldridge and Gluck, 1996; Adamelli et al., 2005), dogs belonging to men tend to be in better physical condition (Marinelli et al., 2007).

The only statistically significant difference pertaining to owner education was that people with a university degree or a high school diploma were better at correctly identifying the definition of stress. A higher educational level may help in understanding what stress is and what it can lead to. High educational levels have been found to be predictive of knowledge of animal species (Randler et al., 2007) and have been related to an increased interest in animals (Kellert, 1996; Bjerke and Østdahl, 2004), but a university education may not lead to increased benefits for dogs (Lago et al., 1987; Marinelli et al., 2007).

No difference emerged between the 2 youngest groups of owners. Respondents aged >60 years were better at reporting overgrooming, which leaves permanent signs, but were less able to identify urination/defecation and low appetite as possible stress indicators. Older respondents

were more likely to report extreme (high or low) levels of stress for their dogs. Age may affect what one considers to be "normal" behavior.

Factors not considered here, such as dogs' daily routine, the time they are in contact with their owners, and the amount of time the owners observe their dogs' behavior, may be important to examine in future studies.

## Conclusions

Dog owners can provide valid help in the protection of the welfare of this species, and they should be aided by animal behaviorists in the task of interpreting the behavior of their dog, with the aim of assessing (and, if necessary, intervening in) dog welfare. It is important for veterinary surgeons to be well versed in veterinary behavioral medicine.

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