

ORIGINAL ARTICLE

Changes in Dogs' Social Behavior Toward Humans

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Abstract

The purpose of this study is to evaluate dogs' sociality toward human strangers in the absence of an owner by analyzing changes in dogs' behavior during a task of making eye contact with an experimenter to obtain snacks. A total of 17 dogs were divided into groups of high sociality (HS; n = 10, 4.4 ± 3.87 years) and low-sociality (LS; n = 7, 3.71 ± 2.06 years). A comparison of the average frequency of five behavioral types-fear-appeasement behaviors (P<0.001), sociability-related behaviors (P<0.001), stress-related behaviors (P<0.05), destruction (P < 0.001), and vocalization (P < 0.001)-between the groups showed a significant difference in all five categories. Together, these results suggest that dogs with high sociality are less exposed to various stresses and have a higher ability to adapt to new environments than dogs with low sociality. This can predict dogs' adaptability to a new environment and positive outcomes in their daily life with the owner.

Key words : Destruction, Fear-appeasement behaviors, Social evaluation, Sociability-related behaviors, Stress-related behaviors, Vocalizations

1. Introduction

Sociality is an essential factor in maintaining a successful and comfortable life for both dogs and humans (Taylor and Mills, 2006). Sociality that is displayed when a dog responds positively to a stranger or a strange situation refers to its positive reactions to unfamiliar situations (Jakovcevic et al., 2012). Past studies have made various social assessments to determine whether dogs adapt successfully when they meet new families or adjust to new surroundings (Palma et al., 2005; Valsecchi et al., 2011).

Sociality is identified as one of the most important characteristics for successful adaptation to a strange or unfamiliar environment. In particular, because the level of dogs' sociality can have negative

consequences for their ties with a new family (Salman et al., 2000), not only is sociality to be considered as the priority in the adoption process, but it can also affect the long-term welfare of a dog due to various stresses. In dogs, high sociality refers to their ability to adapt well to new situations or environments (Jones and Gosling, 2005); Therefore, there is little or no difficulty in coexisting with humans (Jakovcevic, 2012). This is an essential element for dogs to live with owners as their companions (Jones and Gosling, 2005). Dogs in an unknown or new environment may feel anxious or threatened, and this exposure to excessive stress may cause problematic behaviors intended to relieve anxiety (Bradshaw et al., 2002).

Researchers have evaluated the sociality of dogs using various methods (Palma et al., 2005;

Received 4 January, 2022; **Revised** 14 January, 2022;

Accepted 28 February, 2022

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Parthasarathy and Crowell-Davis, 2006; Nagasawa et al., 2009; Barrera et al., 2010). The strange situation procedure test, which confirms human attachment, has been modified and used to assess the sociality of dogs as the attachment relationship between infants and parents in human life has been shown to be very similar to the attachment relationship between dogs and owners (Nagasawa et al., 2009). Jakovcevic et al. (2012) found that dogs with high social abilities looked into human eyes longer than dogs with low sociability. A dog's tendency to look directly at a person is an important signal in their interaction (Ethofer et al., 2011) and is used as a means of communication. In particular, when dogs are faced with a situation that they cannot resolve by themselves, they tend to look at the owner's face as a signal for help (Marshall-Pescini et al., 2009).

Bentosela et al. (2008) reported that the time dogs spent looking at an experimenter increased significantly when snacks were visible but out of reach. However, not all dogs responded in the same manner. Jakovcevic et al. (2010) found that outcomes differed depending on breed, with retrievers staring at humans for longer than shepherds and poodles. In addition, family dogs gazed longer than shelter dogs (Barrera et al., 2011), and trained dogs gazed longer than untrained dogs (Bentosela et al., 2008). Dogs' eye contact with humans enables interaction and is related to sociality (Wieser et al., 2009; Schneier et al., 2011). Therefore, this study had two goals: to evaluate, first, the sociality of dogs according to their reaction to a stranger in the absence of the owner and, second, their behavioral changes during a task requiring them to focus on the experimenter's gaze to obtain a snack.

2. Materials and Methods

2.1. Participating animals

All procedures in the present study were performed in accordance with the IACUC (Institutional Animal

Care and Use Committee) of Jeju National University, South Korea. In this study, 17 dogs living at home as companion dogs were selected as participants, after explaining the purpose of the study to their owners at a local dog park (Table 1). The dogs were not aggressive, as dogs at the park were required to behave in such a manner that anyone could spend time with them or behave appropriately when they were brought out of the park to meet other dogs. The participating dogs were a mix of several breeds. They were classified into two groups: the high sociality group (HS) group ($n = 10$, 4.4 ± 3.87 years; Male Castrated (4), Male (3), Female Spayed (3); 2 Shin Tzu, 1 Shiba, 1 beagle, 1 Welsh corgi, 2 greyhounds, 1 golden retriever, 2 mixed) and low sociality (LS) group ($n = 7$, 3.71 ± 2.06 years; Male Castrated (4), Female Spayed (3); 2 Shih Tzu, 3 poodles, 1 Chihuahua, 1 mixed). None of the dogs had any training experience.

2.2. Experimental procedure

2.2.1. Sociability test

The first test evaluated the dog's behavior when the experimenter (E) and the dog were together in the absence of an owner (Batt et al., 2008; Barrera et al., 2010; Jakovcevic et al., 2012). The second test evaluated changes in the dog's behavior when eye contact with the E was required to earn snacks (Jakovcevic et al., 2012). Before the experiment, the owner and the dog walked for 10 minutes together and then returned to the experimental site (where they usually stayed). At this time, the E came in and sat down and the owner left. The experiment was initiated at this point. The steps were as follows (Fig. 1): Stage 1 (experimenter unconcerned [EUC], 2 min): For 2 min, the E read a book and appeared completely indifferent to the dog. However, when the dog approached, the E silently stroked the dog on the head or under the chin; Stage 2 (experimenter concerned [EC], 2 min): For 2 min, the E called out the dog's name or clapped his hands, attempting to attract the dog's attention and




Step 1	Step 2	Step 3
<p>Experimenter unconcerned</p> <p>Experimenter shows no interest in dogs (2 min)</p>	<p>Experimenter concerned</p> <p>Experimenter shows an interest in dogs (actions such as calling its name, clapping hands, etc.) (2 min)</p>	<p>Eye contact</p> <p>Section 1: Snacks provided when the dog approached the experimenter, and then when the dog was sitting (2 min)</p> <p>Section 2: Snacks when the dog made eye contact with the experimenter (2 min)</p> <p>Section 3: Snacks provided for prolonged eye contact (more than 3 seconds) with the experimenter (2 min)</p> <p>-Record behaviors in the three sections.</p>
 <p>EUC</p>	 <p>EC</p>	 <p>Eye contact</p>

Fig. 1. Experimental design.

invite it to approach. When the dog approached, the E spoke to it and showed a more active interest than in the first stage.

Step 3 (eye contact, 6 min): This step was divided into three sections (2 min each). In section 1, the E rewarded the dog by showing snacks and throwing them away as the dog approached; this was repeated three to five times. In Section 2, snacks were given continuously when the dog sat and made eye contact with E. In section 3, the dog was given a snack each time it looked into E's eyes and maintained eye contact for more than three seconds. All three steps were video-recorded for measurement purposes. All tests were conducted in a place familiar to the dog.

2.2.2. Evaluation items

Behaviors (19 behaviors) were divided into five categories for analysis (Barrera et al., 2010; Palestrini et al., 2010)-fear-appeasement behaviors (two behaviors), sociability-related behaviors (nine behaviors), stress-related behaviors (three behaviors), destruction (three behaviors), and vocalizations (two behaviors; Table 1).

2.3. Data analysis

Data were recorded by observing the video and analyzing the behaviors in five categories. SPSS

software version 24.0 was used for the analysis. Comparisons between the groups were performed by K-means cluster analysis; one-way analysis of variance was used for comparisons by stage, and Duncan's test was used as a post hoc test. The significance level was set at $P < .05$. SPSS 18.0 statistical program (ver. 21.0, SPSS, USA) was used for the data analysis. One-way ANOVA was used to verify differences in the dependent variables over time. Duncan's method was used for the post-test analysis. The significance level for all data analyses was set at $p < .05$.

3. Results

3.1. Fear-appeasement behaviors

In the fear-appeasement category, the overall frequency was significantly lower in the HS group (2.93 ± 4.52) than in the LS group (10.29 ± 7.70) ($p < 0.001$; Fig. 2A). In the stepwise comparison, during the EUC stage, the HS group (2.20 ± 3.91) exhibited significantly fewer fear-appeasement behaviors than the LS group (8.86 ± 6.62) ($p < 0.05$). Similarly, the frequency of such behaviors during the EC stage was significantly lower in the HS group (3.70 ± 5.25) than in the LS group (8.71 ± 6.95); in the eye contact stage

Table 1. Definitions of behaviors

Behavioral category	Behavior	Definition
Fear-appeasement behaviors	Tail down	The dog's tail is between its hind legs.
	Ears down	The dog's ears are tilted back and down.
Sociability-related behaviors	Gaze at the E	The dog looks at the experimenter.
	Proximity to E	The dog approaches the experimenter (within 1 m).
	Close to door	The dog is located near the door.
	Contact the E	The dog touches the experimenter.
	Look at the door	The dog is looking at the door.
	Sniffing	The dog sniffs and smells.
	Passive behavior	The dog is lying down (the head on the ground) without a clear orientation.
	Sitting and standing	The dog is sitting or standing with a clear orientation.
Stress-related behaviors	Pacing	Pacing
	Lip licking	The dog licks its lips with its tongue.
	Yawning	The dog is yawning
Destruction	Paw up	The dog raises one front leg
	Scratching	The dog scratches the floor or cage.
	Escape attempt	The dog chews or scratches the door and jumps to escape.
	Locomotion	The dog keeps walking around without searching.
Vocalizations	Barking	Barking
	Whining	Whining

as well, the HS group (2.90 ± 4.68) showed significantly fewer fear-appeasement behaviors than the LS group (13.29 ± 9.46) ($p < 0.01$). In terms of behavioral details, there were differences between the groups in EUC ears down ($p < 0.05$) and EC tail down ($p < 0.01$) (Table 2).

3.2. Sociability-related behaviors

With respect to sociability-related behaviors, the average overall frequency of sociability behaviors was significantly lower in the HS (20.00 ± 7.90) than in the LS group (35.29 ± 16.11 ; $p < 0.001$); Fig. 2B). In the step-by-step comparison, during the EUC stage, the frequency of sociability-related behaviors was significantly lower in the HS (17.40 ± 7.51) than in the LS group (36.43 ± 18.16 ; $p < 0.01$). The frequency of these behaviors during the EC stage was also significantly lower in the HS (15.70 ± 5.81) than in the

LS group (34.43 ± 17.49 ; $p < 0.001$). Two detailed behaviors also differed significantly ($p < 0.001$) between the groups: gazing at the E during the EUC stage ($p < 0.05$) and being close to the door. Significant differences were observed in their gazing at the E ($p < 0.05$), being close to the door ($p < 0.01$), looking at the door ($p < 0.001$), and sniffing ($p < 0.05$) during the EC stage. In addition, there was a significant difference between the groups in being close to the door ($p < 0.5$) during the eye-contact stage (Table 2).

3.3. Stress-related behaviors

In the stress-related category, the overall change in behavioral frequency was significantly greater in the HS group (1.17 ± 2.05) than in the LS group (0.14 ± 0.36) ($P < 0.05$; Fig. 2C). No significant differences were found in the stepwise comparison or in the detailed items (Table 2).

Table 2. Changes in the frequency of behaviors during sociality evaluation and eye contact (means \pm SE) in dogs

Categories	Items	Group	EUC	EC	Eye contact	P
Fear-appeasement behaviors	Tail down	HS	0.50 \pm 1.58	0.80 \pm 2.53	0.40 ^B \pm 1.26	.636
		LS	2.85 \pm 4.88	3.57 \pm 5.09	5.00 ^A \pm 4.08	.405
	Ears down	HS	1.70 ^B \pm 2.83	2.90 \pm 4.18	2.50 \pm 4.25	.642
		LS	6.00 ^A \pm 4.47	5.14 \pm 3.63	8.29 \pm 7.50	.444
Sociability-related behaviors	Gaze at the E	HS	4.50 ^{Bbc} \pm 2.42	4.80 ^{Bb} \pm 2.82	11.30 ^a \pm 2.91	.000
		LS	8.29 ^A \pm 4.50	9.14 ^A \pm 4.98	10.43 \pm 4.58	.404
	Proximity to E	HS	1.60 ^{bc} \pm 1.78	1.80 ^b \pm 1.87	5.20 ^a \pm 4.21	.009
		LS	2.71 ^{ab} \pm 2.29	1.43 ^b \pm 0.98	5.00 ^a \pm 2.77	.006
	Close to door	HS	1.40 ^{Ba} \pm 0.96	0.50 ^{Bb} \pm 1.27	0.10 ^{Bc} \pm 0.32	.005
		LS	7.71 ^{Aa} \pm 2.06	5.29 ^{Aa} \pm 3.68	2.00 ^{Aab} \pm 2.24	.001
	Contact the E	HS	1.60 ^c \pm 1.78	2.70 ^b \pm 2.58	6.30 ^a \pm 3.59	.001
		LS	0.43 ^b \pm 0.53	1.43 ^a \pm 0.40	4.71 ^a \pm 3.25	.001
	Look at the door	HS	3.20 ^a \pm 2.82	1.60 ^{Bab} \pm 2.07	0.30 ^b \pm 0.67	.004
		LS	7.29 \pm 5.88	8.86 ^A \pm 7.27	2.86 \pm 4.88	.190
	Sniffing	HS	1.90 ^a \pm 1.66	1.50 ^{Aab} \pm 1.58	0.30 ^b \pm 0.95	.019
		LS	0.86 \pm 0.90	0.00 ^B \pm 0.00	0.57 \pm 0.96	.494
	Passive behavior	HS	0.20 \pm 0.42	0.10 \pm 0.32	0.60 \pm 0.97	.171
		LS	0.00 ^b \pm 0.00	0.00 ^b \pm 0.00	0.43 ^a \pm 0.53	.018
	Sitting and standing	HS	3.00 \pm 2.31	2.70 \pm 2.79	2.80 \pm 4.24	.891
		LS	7.14 \pm 8.30	6.29 \pm 5.59	7.29 \pm 5.59	.968
Stress-related behaviors	Lip licking	HS	1.20 \pm 1.99	0.70 \pm 1.89	0.60 \pm 1.07	.437
		LS	0.00 ^b \pm 0.00	0.00 ^b \pm 0.00	0.43 ^a \pm 0.53	.018
Destruction	Locomotion	HS	2.30 ^B \pm 1.64	1.60 ^B \pm 0.84	2.10 \pm 3.14	.833
		LS	6.57 ^A \pm 4.58	8.57 ^A \pm 2.44	4.29 \pm 3.90	.269
Vocalizations	Barking	HS	0.20 \pm 0.63	0.00 \pm 0.00	0.00 \pm 0.00	.231
		LS	1.71 \pm 2.93	0.00 \pm 0.00	0.00 \pm 0.00	.074
	Whining	HS	0.00 ^B \pm 0.00	0.00 ^B \pm 0.00	0.00 \pm 0.00	-
		LS	8.43 ^{Aa} \pm 5.91	6.57 ^{Aa} \pm 5.47	1.14 ^b \pm 1.95	.011

^{a-c} Least-square means with different superscripts in the same row differ significantly ($P < 0.05$). ^{A-B} Least-square means with different superscripts in the same column differ significantly ($P < 0.05$). EUC, Experimenter unconcerned; EC, Experimenter concerned; E, Experimenter.

3.4. Destruction

The change in the overall frequency of destructive behaviors was significantly lower in the HS (2.00 ± 2.05) than in the LS group (7.33 ± 4.93 ; $P < 0.001$; Fig. 2D). In the step-by-step comparison, during the EUC stage, the HS group (2.20 ± 1.64) showed significantly fewer destructive behaviors than the LS group ($6.86 \pm$

4.71 ; $p < 0.05$). The EC stage was significantly lower in the HS (1.60 ± 0.84) than in the LS group (9.71 ± 3.68 ; $p < 0.01$). There were no significant differences between the groups during the eye-contact stage. Regarding detailed behaviors, the LS group showed higher levels of locomotion during the EUC ($p < 0.05$) and EC stages ($p < 0.001$) than the HS group (Table 2).

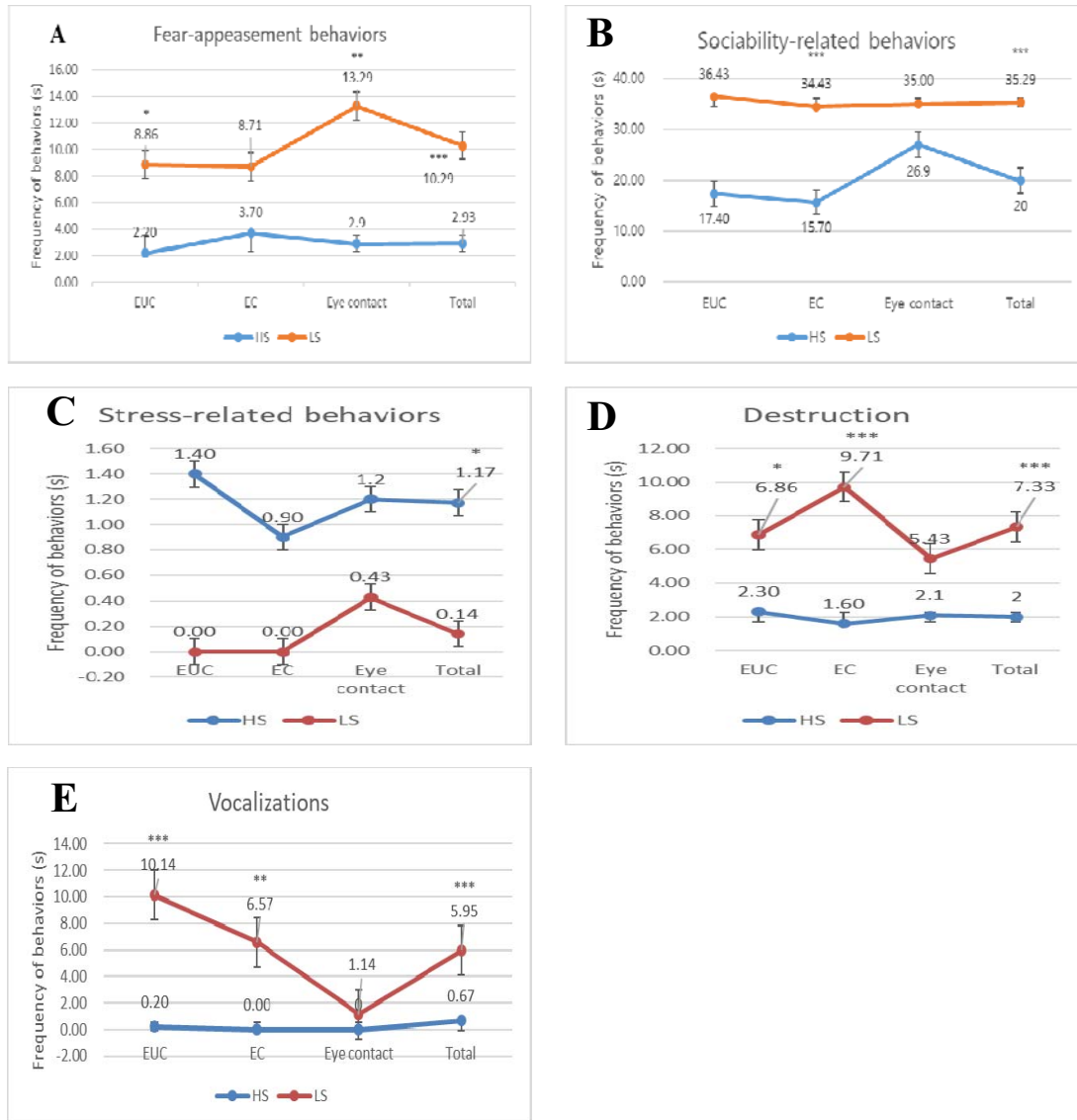


Fig. 2. Changes in frequency of social behaviors by stages in companion dogs. A, Fear-appeasement behaviors; B, Sociability-related behaviors; C, Stress-related behaviors; D, Destruction; E, Vocalizations.

3.5. Vocalizations

In terms of vocalizations, the overall change in frequency was significantly lower in the HS (0.67 ± 0.37) than in the LS group (5.95 ± 5.24 ; $P < 0.001$; Fig. 2E). In the stepwise comparison, during the EUC stage, vocalizations were significantly less frequent in

the HS group (0.20 ± 0.63) than in the LS group (10.14 ± 3.13 ; $p < 0.001$; Table 2). In contrast, during the EC stage, the level was significantly higher in the HS (0.00 ± 0.00) than in the LS group (6.57 ± 5.47 ; $p < 0.01$). Regarding detailed items, whining was significantly more common in the LS group than in the HS group

during the EUC ($p < 0.001$) and EC stages ($p < 0.01$).

4. Discussion

The purpose of this study was to evaluate the social behavior of dogs toward human strangers in the absence of owners, and their behavior changes during a task requiring them to maintain eye contact with the E to obtain a snack. Our analyses showed significant differences between the groups for all five behavioral categories. Compared with the LS group, the HS group exhibited significantly lower frequencies of actions in all categories, except stress-related behaviors. Barrera et al.(2010) found that dogs more frequently stayed near the door when they were with strangers in the absence of their owners. When comparing the HS and LS groups in this study, the frequency of being near the door was found to be high in all stages of the experiment ($P < 0.001$).

This means that in a situation with a stranger (and no owner), dogs' reactions are closely related to sociality. The HS group in this study exhibited significantly fewer behaviors suggesting problems than the LS group, including holding their tail down and ears back during fear-appeasement behaviors, gazing at the E, sniffing, sitting and standing, and pacing during sociability-related behaviors. In addition, there were differences between the groups in scratching, escape attempts, and locomotion, in the destructive and vocalization category. These results demonstrate that sociality is strongly associated with behavioral problems. Sociality is very important for companion dogs to enjoy a successful life with humans (Taylor and Mills, 2006). In general, dogs may be sensitive to unfamiliar situations or other animals and may be subject to extreme stress under such circumstances (Uzunova et al., 2010).

Jakovcevic et al.(2012) reported that during a test evaluating the level of sociality, in both the EUC and EC stages, the HS group was significantly more likely

to approach or touch the experimenter than the LS group. However, in our study, proximity to and contact with the E increased in both the HS and LS groups, with no difference between the groups. Nevertheless, we agree that dogs with HS display frequent proximity and contact with strangers. In the LS group in this study, some dogs exhibited proximity and contact, but these behaviors were accompanied by extreme fear. It is thought that proximity behavior reflects an act of judgment wherein a dog concludes that it must depend on the E in the absence of its owner. However, the expression of fear remained unchanged (approaching the body as low as possible, putting the tail between the hind legs, putting the ears back, and vomiting). These behaviors suggest that the dog's proximity to and contact with the E may not be pleasurable. Therefore, these results should be interpreted carefully.

Gaze is an important nonverbal behavior in human communications. The direction of the gaze is used as an important signal because it provides a range of information in everyday interactions (Ethofer et al., 2011). In the eye-contact stage of this study, eye contact with the E for more than three seconds was achieved in all dogs with HS. This resulted, according to Bentosela et al.(2008), from the increased time they spent gazing at E when the snack was visible but out of reach, which was increased through three reinforcement trials. In addition, these results support the argument that when dogs encounter problems that are difficult to solve directly, they tend to look to their owners for solutions (Marshall-Pescini et al., 2009).

In particular, HS dogs look at a person's face longer than LS dogs in the hope of solving problems (Jakovcevic et al., 2012). In the present study, dogs in the HS group maintained eye contact for three seconds and obtained five or more snacks with a 100% success rate, whereas the LS group had a success rate of about 71%. Such eye contact can be useful in dog training or communication with owners in social education. Dogs' tendency to gaze at their owners can be used as an

indicator that they are attending to the owner (Emery, 2000), and their concentration can maximize the effectiveness of training and communication. Therefore, the results of this study suggest that dogs with high sociality are less stressed and have a greater ability to adapt to various environments than dogs with low sociality. In addition, dogs with high sociality have no problems communicating with strangers through their gaze. Thus, they can contribute to positive interactions while living together with other dogs and humans. This indicator of dogs' behavioral tendencies can predict their adaptability to unfamiliar environments and make it possible to predict whether a dog can enjoy a happy life with its owner.

5. Conclusions

The results of this study show that the frequency of behavioral problems caused by separation anxiety in companion dogs significantly decreased after environmental reinforcement. This is proposed as a method for reducing the frequency of problem behaviors by increasing the diversity of positive actions. In addition, it can form a good bond for humans and dogs to live together, and it can be one of the ways to lead a healthy life. As a result, environmental enrichment can improve the well-being of dogs and reduce the pain and fear of separation anxiety.

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