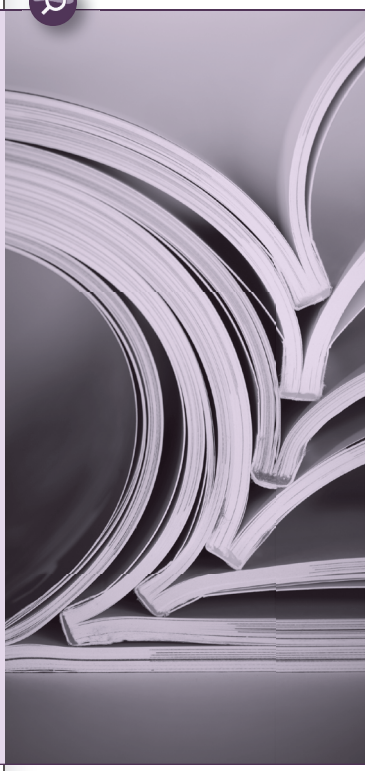
Focus on Canine Noise-Induced Fear

Journal Club



Fear of thunderstorms, fireworks, loud noises, gunshots, and vacuum cleaners is a common behavioral problem of companion animals. Between 17% and 49% of dogs experience an aversion to noise,[1] and the resulting stress, anxiety, and exhibited behaviors may negatively affect animal health, life span, welfare, and the human–animal bond.

Noise fear is manifested in many different ways, including panting, pacing, shaking, urination, defecation, salivation, hiding, escape attempts, and attention seeking. Professional treatment of noise fear is often delayed, and signs may progress with exposure and age.

Current treatment interventions involve behavioral and environmental modification and, when necessary, psychotropic medications or natural products. Pharmacotherapy has historically been limited to sedatives and tranquilizers, such as benzodiazepines and acepromazine. More efficacious anxiolytic medications are currently available, such as tricyclic antidepressants, selective serotonin reuptake inhibitors, alpha-2 agonists, and serotonin 2A antagonist/reuptake inhibitors.

However, owners often seek alternative treatment modalities for behavioral problems because they perceive natural products as being safer and having a lower risk for side effects, despite the lack of comparison studies. The recent literature aims to determine efficacy of natural therapeutic options, such as nutraceuticals and pheromones, as well as to identify risk factors for behavioral problems.

We hope that this information helps clinicians recognize passive and active behavioral signs of fear and the importance of preventing further sensitization by initiating a treatment plan without delay as soon as early signs of fear are detected.

—Carlo Siracusa, DVM, MS, PhD, Diplomate ACVB & ECAWBM
University of Pennsylvania

Overview of Selected Literature

Landsberg, Beck, and colleagues compared the effects of a pheromone collar versus a placebo collar to treat dogs with noise-induced fear in a laboratory model using an audio thunderstorm simulation. The pheromone collar reduced active behavioral signs associated with anxiety and increased the frequency with which dogs chose to enter a hide box, suggesting the development of a coping mechanism. Therefore, a pheromone collar may be a useful adjunctive treatment of noise-induced fear.

Pike and colleagues conducted an open-label clinical trial to determine the efficacy of L-theanine (Anxitane, virbacvet.com) to treat thunderstorm fear by using owner questionnaires. Daily L-theanine reduced several common behavioral signs associated with thunderstorm fear and had a high level of owner satisfaction. L-theanine may be a suitable first-line treatment of thunderstorm fear, especially for owners reluctant to try psychotropic medication.

Storengen and Lingaas examined correlations between noise fears and influence of breed, age, and sex by using web-based owner questionnaires. These results may help clinicians identify patients at risk for noise fear and provide an opportunity to discuss intervention strategies with owners.

Landsberg, Mougeout, and colleagues tested the efficacy of a novel gamma-aminobutyric acid (GABA)-ergic hydrolysate fish derivative on noise-induced fear in a laboratory model. The product may help decrease sensitization by reducing cortisol response and may help decrease active fear behaviors.

Tiira and Loh investigated the effects of early life experiences on fears and anxieties by using a validated survey. Sex, reproductive status, exercise, and off-leash exercise may have a significant effect on anxiety and fear.

Dog-Appeasing Pheromone Collars Reduce Sound-Induced Fear and Anxiety in Beagle Dogs: A Placebo-Controlled Study

Landsberg GM, Beck A, Lopez A, et al. *Vet Rec* 2015; 177(10):260.

Thunderstorms are complex stimuli accompanied by changes in barometric pressure and characterized by variable intensities and frequencies of thunder, lightning, wind, and rain. This blinded, longitudinal, placebo-controlled study evaluated the effect of dog-appeasing pheromone (DAP) collars on noise-induced fear and anxiety in a laboratory model of beagles by using an audio thunderstorm simulation.

STUDY METHODS

Twenty-four beagle dogs, age 7 to 12 years, naive to thunderstorm testing and with no history of noise phobia, were included in this study. Over 10 study days, the dogs were individually exposed to a baseline thunderstorm test (test 0; TT0). Then they were equally divided into a control or DAP collar group and well matched for age, sex, and global fear and anxiety scores at TT0.

Five days later, placebo collars were placed on dogs in the placebo group. Twenty-four hours after collar placement, the placebo group was individually exposed to thunderstorm test 1 (TT1) and then thunderstorm test 2 (TT2) the next day. Twenty-four hours after the placebo group completed TT2, DAP collars were placed on dogs in the DAP group. Approximately 24 hours after collar placement, dogs in the DAP group were individually exposed to TT1, followed by TT2 on the next day.

Behavioral measurements for TT0, TT1, and TT2 occurred over 9 minutes, split into three 3-minute phases: pre-thunder (PrTh), thunder (Th), and post-thunder (PoTh). The PrTh and PoTh phases were silent. Thunder was simulated by playing an audio recording (*Sounds Scary! Thunder Therapy CD*, soundtherapy4pets.co.uk) over a stereo system at approximately 84 dB.

The intensity and frequency of passive and active fear and anxiety behavioral responses were scored on a 6-point scale (1, no fear; 6, marked fear) for each phase. Active fear and anxiety signs included running, scanning, startling, digging, and jumping. Passive fear and anxiety signs included freezing, cowering, lip licking, and trembling. A global fear and anxiety score was calculated by summing individual passive and active scores.

A hide box was provided during each thunderstorm exposure, and frequency of entrance was recorded. Efficacy was determined on the basis of mean differences of active, passive, and global fear and anxiety scores between PrTh and Th, and between PrTh and PoTh, using a repeated-measures analysis.

STUDY RESULTS

- Compared with TT0, fear and anxiety scores for the PrTh phase for TT1 and TT2 were higher in both groups, which suggests a conditioned anxiety response (sensitization).
- Fear and anxiety scores were higher during the Th phase compared with the PoTh phase, and scores for these phases were higher than in the PrTh phase, confirming validity of the model.
- The DAP group showed significantly lower active and global fear and anxiety scores than the placebo group for both Th and PoTh phases of TT1 and TT2.
- There were relative increases in passive fear and anxiety scores for both groups; however, when the DAP group was compared to the placebo group, passive scores were marginally lower at TT2 during Th and PoTh, which suggests a less robust anxiolytic effect on passive fear and anxiety measures.
- Compared with the placebo group, the DAP group used the hide box significantly more frequently at TT2, which may suggest an adaptive response.

CONCLUSIONS

Dogs in the DAP treatment group exhibited decreased active behavioral responses associated with fear and anxiety. In addition, dogs in the treatment group frequented the hide box significantly more than the control group, which suggests an adaptive coping mechanism. However, this finding should be studied further. This study indicates that DAP may reduce active signs of anxiety when used as an adjunctive treatment.

—Lena Provoost, DVM, University of Pennsylvania

An Open-Label Prospective Study of the Use of L-theanine (Anxitane) in Storm-Sensitive Client-Owned Dogs

Pike AL, Horwitz DF, Lobprise H. *J Vet Behav* 2015; 10(4):324-331.

L-theanine, an amino acid found in green tea, increases GABA, serotonin, and dopamine levels in the brain. This study tested whether intervention with a nutraceutical containing L-theanine (Anxitane) safely and effectively relieved signs of anxiety for client-owned, storm-sensitive dogs.

STUDY METHODS

A single-group, multicenter, open-label, prospective clinical trial enrolled client-owned dogs. Inclusion

and exclusion criteria were related to age, existing health status, and behavioral signs. Eighteen dogs completed the trial: 12 spayed females and 6 castrated males, ages 2 to 8 years. The population represented purebred dogs or mixes from the following groups: sporting (n = 7), hound (n = 5), terrier (n = 4), toy (n = 3), herding (n = 2), and nonsporting (n = 1).

Owners completed a questionnaire for 6 storms. After the initial storm, owners began administering the test product for at least 4 weeks or 5 storms. For each storm, owners rated 13 behavioral manifestations and storm severity on a 0 to 5 Likert scale. After each storm, owners evaluated the time it took the dog to return to normal behavior. In addition, owners assigned the dog a global storm sensitivity score on a 0 to 5 Likert scale before and after the trial. At the end of the trial, owners assessed improvement of behavioral signs, overall satisfaction with the product, and likelihood of using the product in the future.

Behavioral signs from the initial and fifth storm were compared individually to determine success by using a simple ratio; success was improvement in the individual behavior score after the fifth storm. A sign test was used to evaluate the significance between the initial and exit global storm sensitivity scores, as well as the time for a dog to return to baseline behavior by comparing the initial and final storms.

Treatment effects were calculated by using a 2-sided test after dichotomizing the data into success or failure; success was indicated when 50% of the behavioral manifestations reported for the initial storm improved by at least 1 rating and none of the behavioral manifestations worsened. A paired t-test assessed the summed behavior scores from the baseline to final storm by using a global correction score to determine effects of storm severity. Univariate analysis of end-of-study outcomes determined owners' assessment of overall improvement, satisfaction, and likelihood of continuing the product.

STUDY RESULTS

- Owners reported a high rate of improvement for the following behavioral signs: drooling (83.3%), following people (75%), panting (76.5%), pacing (78.6%), and hiding (78.6%).
- Reported global storm sensitivity scores significantly decreased by 2 points on the Likert scale.
- The time for a dog to return to its normal behavioral state after a storm also significantly decreased.
- Storm intensity and/or quality did not affect the results.
- Treatment was successful in 12 of 18 dogs.
- Seventeen owners felt overall improvement occurred, were satisfied with the product, and would continue using it.

CONCLUSIONS

Daily L-theanine reduced owner-reported intensity of common behavioral signs of anxiety during naturally occurring storms. Owner satisfaction was high, but the authors warn that the placebo effect is a limitation of this study.

—Lena Provoost, DVM, University of Pennsylvania

Noise Sensitivity in 17 Dog Breeds: Prevalence, Breed Risk and Correlation with Fear in Other Situations

Storengen LM, Lingaas F. *Appl Animal Behav Sci* 2015; 171:152-160.

Age, breed, traumatic experiences, and social transmission (eg, behavior learned from other dogs) may contribute to noise aversion in dogs. This study described the distribution of noise sensitivity in 17 dog breeds and investigated the influence of sex, age, neuter status, and comorbidity of fear responses.

STUDY METHODS

Members from 17 breed clubs voluntarily completed a web-based survey regarding their dogs' general health and behavior. Owners rated signs of fear toward loud noises/gunshots, fireworks, thunderstorms, and traffic on a scale of 1 to 5. Dogs were determined to be fearful if they had a minimum score of 4 in at least 1 category. The sum of scores across all 4 categories was used for the fearfulness score. Using the same 1 to 5 scale, owners also reported signs of separation anxiety and fear in novel situations and how quickly their dogs calmed after a stressful event.

Analysis of variance (ANOVA) was performed to determine the effect of breed on each of the 4 noise aversions, followed by a Tukey post hoc test. An ordinal logistic regression model measured the association between noise sensitivity (dependent variable), breed, sex, and age. Co-occurrence was evaluated among the 4 noise aversions with a Spearman correlation test; co-occurrence between noise aversion and fear responses in other situations was evaluated with odds ratios.

STUDY RESULTS

Data for 5257 dogs were available. The population consisted of 54.8% female and 45.2% male dogs, of which 13.43% were neutered. The mean age was 4.93 years. Results were as follows:

- Dogs determined to be fearful reacted to fireworks, loud noises/gunshots, thunderstorms, and heavy traffic, in descending order of frequency; 10.5% and 12.7% of dogs exhibited

strong and very strong fear, respectively, across all 4 categories.
- *For fireworks,* intensity of fear in the Norwegian buhund, Shiba Inu, Irish soft-coated wheaten terrier, Lagotto Romagnolo, Cairn terrier, and collie was significantly greater than fear intensity in the boxer, Chinese crested, miniature schnauzer, Great Dane, giant schnauzer, and pointer.
- *For loud noises/gunshots,* intensity of fear in the Norwegian buhund, Shiba Inu, Irish soft-coated wheaten terrier, Lagotto Romagnolo, Nova Scotia duck tolling retriever, and collie was significantly greater than fear intensity in the boxer, Great Dane, and pointer. Nonhunting breeds were 1.4 times more likely to be fearful of gunshots.
- *For thunderstorms,* intensity of fear in the Norwegian buhund, Irish soft-coated wheaten terrier, Lagotto Romagnolo, and Nova Scotia duck tolling retriever was significantly greater than fear intensity in the boxer, Chinese crested, Great Dane, and Bouvier des Flandres.
- *For traffic,* intensity of fear in the Norwegian buhund and Nova Scotia duck tolling retriever was significantly greater than fear intensity in the boxer, Great Dane, and Bouvier des Flandres.
- Dogs fearful of fireworks were more likely to be fearful of loud noises/gunshots and thunderstorms.
- For each additional year of age, the odds of being fearful of loud noise increased 3.4%.
- Female dogs were 1.3 times more likely to demonstrate fear compared with male dogs.
- Neutered dogs were 1.7 times more likely to demonstrate fear, suggesting that reproductive hormones may play a role in noise aversion or that owners may have decided to neuter the dog to reduce an existing behavioral problem within this specific population of dogs.
- Dogs fearful in any of the 4 categories were at increased odds of separation-related fear, were more likely to be fearful in novel situations, and took longer to calm after stressful events.

CONCLUSIONS

Breed, sex, neuter status, and age influence noise fear, which may aid in screening at-risk patients. Limitations of this study included the narrow focus of noise aversions, absence of information on specific behavioral responses, and questions about interpretation of the impact of neutering given the breeding population studied, all of which warrant further investigation.

—Lena Provoost, DVM, University of Pennsylvania

Assessment of Noise-Induced Fear and Anxiety in Dogs: Modification by a Novel Fish Hydrolysate Supplemented Diet

Landsberg GM, Mougeout I, Kelly S, Milgram NW. *J Vet Behav* 2015; 10(5):391-398.

Treatment of noise aversions often includes GABA-ergic therapies, such as benzodiazepines or alpha-casozepine. A novel compound has benzodiazepine-like effects on the hypothalamic pituitary adrenal axis in humans and rats. This study compared the effectiveness of 2 doses of Gabocean 3D PTP55 novel fish hydrolysate on simulated thunderstorm exposure in a laboratory.

STUDY METHODS

Forty-five beagles with normal complete blood count/biochemistry panels were split into 2 cohorts for testing days. Thunderstorm tests consisted of 3 minutes of the *Sounds Scary! Thunder Therapy CD*, at peaks of around 90 dB.

Cohort 1 started 1 day before cohort 2. Dogs were exposed to the open field in which testing would occur without thunderstorm sounds 8 and 7 days before treatment (day 1). Five and 6 days prior to initiation of treatment, the dogs were again placed in the open field but this time with a thunder test. Baseline and post-thunderstorm cortisol levels were measured. Responsive dogs were defined as having a 25% or greater cortisol response over baseline after the first simulated thunderstorm.

Dogs were allocated to control (maltodextrin capsule), low-dose treatment (750-mg capsule), or high-dose treatment (1500-mg capsule), matched for sex and serum cortisol response. Thunderstorm test 1 occurred on days 14/15 and test 2 on days 26/27, with serum cortisol sampled at 5 minutes and 1 hour after testing. Dogs were exposed to the testing area without thunderstorm for 9 minutes on days 7/8 and 21/22.
- *Active (positive) responses* to thunder were distance traveled; startle; scanning/orienting; bolting; aimless, repetitive, or stereotypic running; circling; digging; climbing; jumping; or barking.
- *Inactive (negative) responses* were also scored and included freezing against a wall or at a door, lowered body posture, crouching/cowering, tail between legs, or ears back.
- *Autonomic markers* or *conflict markers* were panting, shaking/trembling, alert/tense/vigilant, salivating, yawning, lip licking, foreleg lifting, and whining.
- Active and inactive behaviors were ranked on a 6-point Likert scale for frequency. Severity was ranked as none, mild, moderate, or severe on a 4-point Likert scale.
- Global scores were based on combined intensity and frequency of either type of behavior.

STUDY RESULTS

- All results were analyzed by using repeated-measure ANOVAs.
- Main effect of trial and time interval was seen for global behavior (frequency and intensity), inactive behavior, and active behavior, with an overall increase in scores over sessions and higher scores during thunder than the post-thunder intervals.
- Global behavior scores increased during and after thunder versus pre-thunder in all groups (no treatment effect).
- Inactive behavior scores increased during thunder compared with pre-thunder in all groups (no treatment effect).
- Active fear behavior scores increased at test 1 in control dogs, but decreased in animals receiving either supplement dose.
- Across all groups, cortisol levels were lower 1 hour after thunder than 5 minutes after thunder.
- In low-dose and high-dose treatment groups, post-thunder cortisol levels were lower than initial thunder-exposure level; these differences were greater at the second test.

CONCLUSIONS

Gabocean 3D PTP55 may reduce active anxiety responses and cortisol responses. Specifically, it may help subvert sensitization when used early, a scenario that would more closely mimic this laboratory setting.

—M. Leanne Lilly, DVM, University of Pennsylvania

Early Life Experiences and Exercise Associated with Canine Anxieties

Tiira K, Loh H. *PLoS One* 2015; 10(11):e0141907.

A tendency toward fear, anxiety, and sensitivities results from genetic, epigenetic, and environmental factors. The specific environmental factors have not been well evaluated, nor have early life experiences, such as maternal care, as they pertain to fears and anxieties.

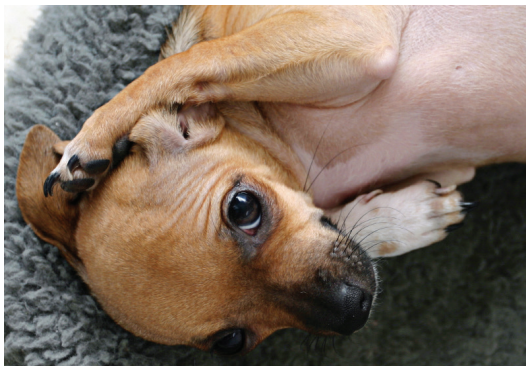
STUDY METHODS

The family owners of 3264 dogs in Finland were surveyed about the following factors: maternal rearing, birthplace, age of separation from mother, type of food, extra nutrients, time spent alone per day, daily amount and type of exercise, types and number of family members living with dog, indoor/outdoor living, and number of dogs owned previously. A validated survey was used to assess fear, noise sensitivity, and anxieties.

- Noise sensitivity was defined by having a score greater than 0 in response to "thunder, fireworks, gunshots, vacuum cleaners, leaf blowers, sirens, alarm systems, etc" and included dogs with reactions to any of the noises at any frequency other than 0.
- Fear status was defined by showing fearful signs in more than 40% of situations.
- Separation anxiety status was self-reported by owners as "yes" or "no," with a description requested for all those who responded "yes" (none was requested for those responding "no").
- In analysis A, fearfulness, noise sensitivity, and separation anxiety were analyzed against the factors. Each group was then separately compared with dogs without other anxieties in analysis B. Dogs with all 3 anxieties were then compared with controls in analysis C.

STUDY RESULTS

Survey data were analyzed by using a generalized linear mixed model with binomial distribution.



Analysis A

- Noise-sensitive dogs got significantly less exercise than those without noise sensitivities; this held true for dogs with noise sensitivity and comorbidities.
- Neutered dogs had more noise sensitivities than intact dogs.
- Sex across intact and neutered dogs was not a significant factor for noise fear, but intact females were more sensitive than intact males.
- Noise-sensitive dogs were older and spent slightly less time alone than unaffected dogs.
- Daily exercise did not correlate with puppy socialization, aggressiveness toward strangers, or time spent alone across all dogs.
- Freely exercised dogs across all groups were more likely to have dog companions at home and not be the first dog.
- Among noise-sensitive dogs, noise fear started later in free-exercising dogs than those always on leash.

Analysis B

When dogs with other fears or anxieties were removed from the analysis, noise-sensitive dogs:

- Received less daily exercise, were older, were

less socialized, and spent less time alone on average; dogs born at breeders versus at a permanent home were less noise sensitive.
- Arrived at their homes earlier than others and tended to live with more children.
- Showed a negative correlation between daily exercise and aggressiveness toward dogs and owner, time spent alone, and more time in other activities with dogs; in these dogs, the more dogs the owner had previously owned, the later the noise fear was reported to start.

Analysis C

In this analysis, among dogs with all 3 comorbidities, the generalized chi-square was poor (0.66) and the results should be interpreted cautiously. These dogs:
- Had poorer maternal care and had been separated from their mothers.
- Spent less time alone or engaged in activities with their owners.

No significant environmental factors were identified in dogs with only separation anxiety. Significant environmental factors associated with fearful dogs without noise sensitivities were younger age, less socialization, and less exercise.

CONCLUSIONS

Amount and type of exercise may be an indicator of overall welfare or management as well as a stress buffer for noise fear. Maternal care and exercise early in life versus current amount of exercise should be studied. Direct measures of exercise duration and intensity, rather than owner-reported measures, may further elucidate associations. Intact females were more likely to have noise fear than intact males, but neutered dogs were more sensitive than intact dogs. The largest association was with the amount of exercise: noise fear started later in free-exercising dogs than those always on leash. Additionally, owner reporting of separation anxiety may underreport mildly affected, nondestructive, nonvocal dogs, so associations with this anxiety should be further evaluated.

—M. Leanne Lilly, DVM, University of Pennsylvania

ANOVA = analysis of variance; DAP = dog-appeasing pheromone; GABA = gamma-aminobutyric acid

Reference

1. Blackwell EJ, Bradshaw JW, Casey RA. Fear responses to noises in domestic dogs: Prevalence, risk factors and co-occurrence with other fear related behaviors. *Appl Anim Behav Sci* 2013; 145:15-25.