

Effects of a synthetic facial pheromone on behavior of cats

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Objective—To evaluate the effects of a synthetic feline facial pheromone (FFP) on behavior and food intake of healthy versus clinically ill cats.

Design—Original study.

Animals—20 cats were used in each of 2 studies. In each study, 7 cats were considered healthy, and 13 cats were determined to be clinically ill.

Procedure—In study 1, cats were assigned either to exposure to FFP (treated group; 4 healthy, 6 ill cats) or to exposure to the vehicle (70% ethanol solution; control group; 3 healthy, 7 ill cats). Cats were placed in a cage containing a small cotton towel that had been sprayed with FFP or vehicle 30 minutes previously. Cats were then videotaped for 125 minutes, and food intake was measured during this period. Videotapes were scored at 5-minute intervals for various behaviors. In study 2, cats were categorized in 1 of 2 groups; group 1 (2 healthy, 8 ill cats) had a cat carrier placed in their cages, and group 2 (5 healthy, 5 ill cats) did not. All cats were exposed to FFP, and 24-hour food intake was measured.

Results—Differences between behaviors of healthy versus clinically ill cats were not identified. In the first study, significant increases in grooming and interest in food were found in cats exposed to FFP compared with vehicle. For all cats, significant positive correlations were detected between grooming and facial rubbing, walking and facial rubbing, interest in food and facial rubbing, eating and facial rubbing, grooming and interest in food, and grooming and eating. In the second study, 24-hour food intake was significantly greater in cats exposed to FFP and the cat carrier, compared with cats exposed to FFP alone.

Conclusions and Clinical Relevance—Results suggest that exposure to FFP may be useful to increase food intake of hospitalized cats. (*J Am Vet Med Assoc* 2000;217:1154–1156)

The sensitivity of cats to their surroundings and their responses to threatening stimuli have been studied for decades¹; Cannon's² description of the fight or flight response resulted from studies of cats. The autonomic responses to threatening stimuli that are essential for survival may become detrimental to the individual if sustained for prolonged periods.³ Cats are a relatively solitary species, often choosing population densities of less than 50/km².⁴ Although free-ranging

male and female cats occupy overlapping home ranges of approximately 100 meters in diameter, they avoid meeting each other by keeping to a sort of time schedule.⁵

Carlstead et al⁶ recently reported the effects of caging and stress on physiologic parameters and behavior of healthy domestic cats. They found that daily unpredictable manipulations such as unfamiliar caretakers or altered feeding schedules resulted in increased urine cortisol concentrations, enhanced adrenal sensitivity to adrenocorticotropic hormone, and decreased pituitary sensitivity to luteinizing hormone-releasing hormone. Active explorative and play behaviors were suppressed, and cats considered to be stressed spent more time being vigilant and attempting to hide.

The sensitivity of cats to their environment has potentially important implications for veterinarians. Some of the detrimental responses to environmental circumstances described by Masserman³ are health problems commonly encountered in practice, suggesting that the patient's environment could contribute to the initial illness. Additionally, the hospital environment might exacerbate the severity of the stress response, which might influence the patient's clinical condition or response to treatment.⁷ Unfortunately, the behavioral responses of hospitalized cats have not been well-documented. Thus, although adverse effects of unpredictable manipulations occurring in clinical settings similar to those reported by Carlstead⁶ might be predicted, the magnitude and severity of these effects is not known. Such basic information also is necessary to permit evaluation of the efficacy of efforts to decrease the stress that may be induced in hospitalized patients. A synthetic analogue of a naturally occurring feline facial pheromone (FFP)^a has been developed to decrease anxiety-related behaviors of cats. Cats release pheromones during facial rubbing when they feel comfortable with their environment. It has been reported that this pheromone reduces the amount of anxiety cats may have when they are placed in unfamiliar surroundings.^{8,9} The purposes of the study reported here were to determine the most common behaviors observed in cats housed in cages in a veterinary hospital and to determine the effects of exposure to FFP on these behaviors and food intake.

Materials and Methods

A list of behaviors of cats housed in cages was compiled from previous observational studies (Appendix).¹⁰⁻¹² Effects of hospital caging and exposure to FFP on these behaviors was observed during 2 separate studies. All cats in our study were > 1 year of age and consisted of various breeds. The cats studied were admitted to the Ohio State University Veterinary Hospital (OSUVH). All cats were housed individually in

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cages arranged identically; each cage included a litter pan, food bowl, water bowl, and a clean towel. A space was left between the litter box and the back of the cage to allow the cat to hide in this area. No toys, blankets, or other items belonging to the cat were placed in the cage. Cats were provided a commercially available dry food.^b Cats were housed in a ward that sometimes also housed other cats and dogs in nearby or adjacent cages; therefore, in both studies, cats were exposed to the typical noises, odors, sights, and disturbances expected in a hospital ward. Any disturbances considered unusual in the immediate environment were recorded.

In the first study, 20 client-owned cats housed at OSUVH were studied during the summer of 1998. Thirteen of the cats were admitted for evaluation of signs of lower urinary tract disease, and 7 were cats owned by hospital staff and students that were presumed to be healthy based on absence of observable physical or behavioral abnormalities. A prospective double-blind placebo-controlled study was performed in which FFP or vehicle (70% ethanol) solution was used. An equal amount of either FFP or vehicle solution was applied to a towel 30 minutes before it was placed in the cage (this allowed the alcohol to evaporate). To ensure that odor from treated towels was not transferred to untreated towels, only freshly laundered towels were used, and FFP or vehicle solutions were applied in different rooms. Cats were alternately assigned to the FFP ($n = 10$; 4 healthy, 6 ill) or vehicle (control; 10; 3 healthy, 7 ill) group and placed in the cage. The pretreated towel was then placed into the cage, and the cat was videotaped for 125 minutes. Videotapes were viewed at a later time by 1 investigator (CAG), and each behavior was recorded for 18 5-minute intervals that began 35 minutes after the cat was placed into the cage with the pretreated towel (Appendix). The 90-minute interval was chosen on the basis of viewing the videotapes and previous reports^c that responses to FFP began only after approximately 30 minutes of exposure, and because few changes in behavior were observed after 125 minutes in either group of cats. Frequency of behaviors were recorded during 5-minute intervals to determine whether some behaviors were more prominent during different periods of the taping; the low frequency of behaviors observed during each interval precluded such an analysis; therefore, data for the entire 125-minute period were pooled. The number of grams of food offered and consumed during each 125-minute session also was recorded.

Effects of treatment and time were analyzed by 2-way nonparametric ANOVA, using commercially available software.^d Differences in frequency of observed behaviors that were stable over time were compared by χ^2 analysis. Correlations between behaviors were examined by use of a Pearson 2-tailed correlation test, using commercially available software.^d Food intake was compared by use of a t -test. Results are expressed as mean \pm SD.

In the second study, 20 cats housed at OSUVH were studied during the summer of 1999. These also were client-owned cats that were patients housed in the OSUVH, as described. Thirteen of the cats were admitted for evaluation of signs of endocrine ($n = 6$), gastrointestinal (4), lower urinary tract (2), and renal (3) disease, and 7 were cats owned by hospital staff and students that were presumed to be healthy based on absence of observable physical or behavioral abnormalities. No cat was included in both studies. In this study, all cats were exposed to FFP, using the protocol described for the first study, and alternately assigned to 1 of 2 groups. One group ($n = 10$; 2 healthy, 8 ill) was provided with a clean plastic cat carrier placed in the back of the cage that the cat could hide in and lay on; the other group (control; 10; 5 healthy, 5 ill) was not provided a carrier. Twenty-four-hour food intake was measured to the nearest gram and compared between groups by use of a t -test; results are

expressed as mean \pm SD. Values of $P < 0.05$ were considered significant.

Results

In the first study, during the period of videotaping, differences between behavior of healthy versus sick cats were not identified. No more than 2 episodes per cat of drinking, startle, pacing, trembling, kneading, playing, rubbing, or litter use were observed in either group; therefore, these behaviors were not evaluated further. Differences in behavior of cats exposed to FFP or vehicle were not detected during the first 30 minutes of observation.

Exposure to FFP resulted in significantly more episodes of lying (121 vs 95 episodes; $\chi^2 = 6.7$) and sitting (135 vs 109 episodes; $\chi^2 = 7.2$) and significantly fewer episodes of sleeping (18 vs 38 episodes; $\chi^2 = 7.6$). Significant increases in episodes of grooming (15 vs 3 episodes), interest in food (11 vs 1 episodes), and eating (10 vs 0 episodes) were detected. Additionally, significant positive correlations (r) were detected between grooming and facial rubbing (0.8), walking and facial rubbing (0.6), interest in food and facial rubbing (0.8), and eating and facial rubbing (0.8). Moreover, highly significant positive correlations were detected between grooming and interest in food (0.94) and grooming and eating (0.96).

In the first study, no difference was identified in mean food intake in cats exposed to FFP (9.8 ± 17.6 g), compared with those exposed to vehicle (0.2 ± 0.6 g). Three of the 10 cats exposed to FFP consumed food, whereas only 1 of the cats exposed to the vehicle consumed food. In the second study, 24-hour food intake was significantly greater in cats exposed to FFP and the cat carrier (26.0 ± 8.7 g), compared with cats exposed to FFP alone (8.9 ± 7.8 g). One cat in the FFP-only group consumed 50 g of food during the 24-hour period. This amount was > 2 SD above the mean of the other cats in this group; therefore, data from this cat was excluded from further statistical analysis. In the second study, all 10 cats exposed to FFP and the cat carrier consumed food (range, 8 to 48 g), whereas 7 of the 10 cats exposed to FFP alone consumed food (range, 0 to 50 g).

Discussion

Although many definitions of stress exist,¹³⁻¹⁵ responses to stress are the result of at least 3 components: the stressor, whether physical (environmental) or social (territorial); genetic make-up of the animal; and previous experiences of the animal. Results of the present study suggested that placement into a cage in a veterinary hospital may result in signs of stress in some cats. This response may be caused by a combination of fear, confinement, and novelty of the environment.¹⁶ Responses to such stressors include signs of aggression or fear, hiding, anorexia, self-mutilation, weight gain, and weight loss.¹⁷

The significant increases detected in grooming, interest in food, and food intake suggest that FFP induced an anxiolytic effect on some cats. It was expected that cats would respond to FFP by increased episodes of facial rubbing, which would deposit their own FFP onto objects in the cage. The significant posi-

tive correlation found between facial rubbing and grooming, walking, interest in food, and eating suggests that FFP stimulated these behaviors. The high correlation between grooming and food-related behaviors suggests that exposure to FFP might cause an increase in food intake of hospitalized cats, and increased grooming activity may be an indication that there will be an increase in food intake. In the first study, the mean intake of nearly 10 g of food during the period of observation of cats exposed to FFP was greater than that of cats exposed to vehicle, although food intake was not consistent among all cats exposed to FFP. This observation was confirmed (and the period of food intake was measured and extended) in the second study. In the second study, food intake in the FFP-only group was similar to that observed in the first study, although only 7 of the 10 cats exposed to FFP alone consumed food. Addition of the cat carrier to cages of the FFP-exposed cats resulted in a further significant increase in food intake, suggesting that other features of the environment may affect the response to FFP.

Exposure to FFP resulted in more lying and sitting and less sleeping. The increased number of times cats lied down and sat suggests that exposure to FFP may have made cats more at ease in the cage, although anxious cats also may engage in more lying behavior. Licking behaviors were not observed in any cats nor was any cat aggressive to the observer. Furthermore, significant effects of FFP on interactions between cats and the observer were not identified. This lack of significance may be attributable to the small sample size or to a lack of inflicting a stressor onto the cat that was unexpected, unpredictable, and concentrated (as opposed to the uniform and unchanging environmental stressor of the cage). Further study is required to more accurately assess the reaction of hospitalized cats to unfamiliar caretakers.

^aFeliway, Abbott Laboratories, North Chicago, Ill.

^bScience Diet Feline Maintenance dry, Hill's Pet Nutrition Inc, Topeka, Kan.

^cCozzi EM, Abbott Laboratories, North Chicago, Ill: Personal communication, 1999.

^dSPSS, version 8, SPSS Inc, Chicago, Ill.

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Appendix

Commonly observed behaviors of cats

| Behavior | Description |
|-----------------------------------|---|
| Consumption | |
| Food interest | Sniffing, pawing, or licking the food bowl or area immediately around the food |
| Eating | Intake of food |
| Water interest | Sniffing, pawing, or licking the water bowl or area immediately around the water |
| Drinking | Intake of water |
| Emotion | |
| Hiding | Attempts to be concealed under the blanket or behind the litter box |
| Startle | Sudden flinch or freeze in response to a visual, tactile, or auditory stimulus |
| Pacing | Repeatedly walking back and forth across the floor of the cage |
| Crouching | Crouching in a protective position with cautious attention to its environment |
| Trembling | Fine muscle tremor or spasm of body or limb |
| Resting | |
| Lying | Lateral or ventral recumbence |
| Sleeping | Lying quietly in 1 area of the cage with its eyes closed |
| Sitting | Alert with hind limbs on the ground, forelimbs extended, and the back inclined at approximately a 45° angle |
| Activity | |
| Climbing | Climbing up the walls of the cage |
| Grooming | Cleaning or smoothing of fur, using the tongue or paws |
| Kneading | Rhythmic pushing of the paws into a substrate such as the floor as if to form or shape an object |
| Playing | Chasing, pouncing, biting, or wrestling with an object in a playful manner |
| Facial rubbing | Pushing face against the observer |
| Vocalizing | Production of sound noted as a purr, cry, hiss, or growl |
| Elimination | |
| Litter box interest | Sniffing or pawing the litter box or area immediately around the litter box but not immediately using it for eliminative behavior |
| Eliminative behaviors | Urination or defecation |
| Interactions with observer | |
| Watching | Watching the motions of the observer |
| Sniffing | Investigating an object or person distinguished by the proximity of, and movements of, the nose and muzzle |
| Avoidance | Withdraw when moving or being approached |
| Licking | Attempts to lick the observer or object |
| Aggression | Growling, hissing, piloerection, or striking at the observer |
| Walking | Randomly moving away from a stationary position |