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Dognition : the effect of pet ownership on cognition in older adults

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Abstract

The purpose of the present study was to investigate the effect of pet ownership on cognition in older adults. Previous research has indicated that interactions with pets are associated with improved mental and physical health in humans. We predicted that these benefits of human-pet interactions will extend to expose superior cognitive functioning in cat-owning or dog-owning older adults as compared to older adults who do not own pets. More specifically, we hypothesized that dog-owners would perform significantly better than cat-owners and non-pet owners on cognitive tasks as owning a dog requires exceeding attention, training, and exercise. We tested this effect using data collected from a recognition memory task. Older adults (N=52; 65-85 years old) were individually tested on their memory for words in recognition memory tasks. These data were analyzed, along with participant responses on questionnaires measuring human-pet relationships, loneliness, and mood. We found that cat owners performed significantly worse on the recognition memory test than both the dog owners and the non-pet owners.

Dognition: The Effect of Pet Ownership on Cognition in Older Adults

In our everyday life experiences, we can see the positive impacts on people interacting with dogs. When we see a dog sticking his head out of a car window, or walking by us on the street, we naturally smile. If we get the chance to pet them, we may feel warm, relaxed, and happy. These feelings that we experience in relation to dogs can be explained by our physiological reactions that have been documented in various scientific studies. Studies have shown that interacting with dogs lowers blood pressure, slows heart rate, regularizes breathing, and relaxes muscle tension (Beck & Katcher, 1996). Allen et al. (2002) measured cardiovascular reactivity in married couples, half of whom owned pets and half of whom did not. Participants were randomly assigned to one of 4 social support conditions: alone, with pet or friend (with friend if they did not own a pet), with spouse, or with spouse and pet/friend. In these social support conditions, participants underwent mental arithmetic tasks and the Cold Pressor Task, in which the participant places his/her hand in a bucket of ice water for one minute. In this study, pet owners had significantly lower heart rate and blood pressure levels at baseline compared to non-pet owners. Additionally, during both the mental arithmetic and Cold Pressor Tasks, pet owners demonstrated significantly smaller increases in heart rate and blood pressure from baseline as well as quicker recovery of these physiological reactions as compared to non-pet owners. Among pet owners, those participants with the lowest reactivity and quickest recovery were those in the pet-present conditions. The results of Allen et al.'s (2002) study suggest that pets help reduce our stress and keep us relaxed particularly when they are present, but that our interactions with them may have long lasting effects on our stress levels as well.

Anderson, Reid, and Jennings (1992) further investigated the long-term effects of pet ownership on our health by comparing risk for cardiovascular disease in pet owners and non-pet owners. These researchers examined accepted risk factors of cardiovascular disease such as

systolic blood pressure, plasma triglycerides, body mass index (BMI), smoking habits, meat consumption, and exercise levels. Pet owners in this study had significantly lower systolic blood pressure and plasma triglycerides than non-pet owners, and these differences were not explained by BMI, smoking habits, diet, or socioeconomic status as these factors did not differ between groups. These findings suggest that the difference in systolic blood pressure and plasma triglycerides between groups could be explained by exercise level as pet owners reported significantly more exercise than non-pet owners. Consequently, owning a pet may decrease owner risk for cardiovascular disease, with increased physical activity levels as a possible mechanism. These physiological benefits demonstrated by Allen et al. (2002) and Anderson, Reid, and Jennings (1992) point to the therapeutic potential of dog interactions.

The idea of dogs or other animals as co-therapists, emotional mediators, or otherwise beneficial to our mental well-being dates back to the 1960's, when psychiatrist Boris Levinson first introduced the concept, (Moretti et al., 2011). Presently, dogs are used as service animals for individuals with both physical and mental disabilities, and even as emotional support animals that do not require any specific training, as their presence alone provides therapeutic benefit to the people they interact with. Several studies of dog ownership and dog interaction demonstrate that beyond the physiological and physical health benefits of such interactions are mental health advantages. In a study that examined behavior of Medicare enrollees for a year, when sex, age, education, income, employment status, social network involvement, and chronic health problems were controlled for, individuals who owned pets reported fewer doctor contacts than non-pet owning individuals during that year (Siegel, 1990). For non-pet owning participants, accumulating stressful life events was associated with increased doctor contacts, however, this effect was not found for pet owners. Particularly, this data showed that owning a dog rather than

a cat provided a stress buffer, which may have been mediated by the finding that dog owners felt more attached to their pets than owners of other animals. This study suggests that owning a pet, especially a dog, may decrease owner stress level and consequently decrease owner request for doctor contacts. Dog owners felt less of a need to visit a doctor even when they experienced stressful life events, thus suggesting that dogs may help reduce our stress levels, helping us cope with difficult situations.

Pet therapy among the elderly is particularly prominent as these individuals most frequently experience the co-occurrence of cognitive and mood disorders (Moretti et al., 2011). Studies of cognitive aging support certain actions that individuals can take to promote their cognitive health: being physically active, reducing high blood pressure, and being socially and intellectually active (Blazer, Yaffe, & Karlawish, 2015). These promoters of cognitive health are akin to the products of interacting with dogs as demonstrated by the aforementioned studies. Unlike in previous generations, people nowadays all across the world can expect to live well into their 60's and beyond (World Health Organization, 2015). As the elderly population is growing, these individuals may require increasing aid from health and social care. As the previous studies suggest, dog-ownership could keep these individuals physically and mentally healthier than their non-pet-owning peers and consequently reduce this population's reliance on our health care system.

Several studies have evaluated the effects of pet ownership and pet therapy on older adults' cognitive and emotional well-being. Krause-Parello (2012) investigated loneliness, pet attachment support, human social support, and depressed mood among dog and cat owning older women. She found that pets enhanced emotional stability and increased social support mechanisms of her participants and concluded that pet attachment is a greater form of social

support against loneliness and depression that human social support. Additionally, Moretti et al. (2011) investigated the effect of pet therapy on individuals 65 and older affected by dementia, depression, and psychosis. In this study, individuals in the test group interacted with dogs for 90 minutes, once a week for six weeks, while those in the control group were allowed to see the dogs enter the facility but were not allowed to interact with them. Test group members were required to hold, stroke, walk, talk to, and play with the dogs. The researchers found that after six weeks of pet therapy, individuals in the pet group showed a 50% decrease in depressive symptoms (Moretti et al., 2011). The findings of both Krause-Parello (2012) and Moretti et al. (2011) point to the therapeutic effects of dog interactions, which could decrease this growing population's dependence on therapists, counselors, and other health practitioners provided by our health care system.

Beyond improvements in depression, Moretti et al. (2011) found marginally significant cognitive improvements in participants who received pet therapy. Cognitive function was measured by the Mini Mental State Examination (MMSE), and those who interacted with dogs gained on average 4.5 points after six weeks of pet therapy, which was twice as large as the mean increase for the control group on this measure. Walsh et al. (1995) investigated the effect of therapy dogs on individuals with dementia in a psychiatric ward. Compared to individuals in the ward who did not receive pet therapy, individuals who received pet therapy demonstrated decreased heart rates as well as a substantial drop in noise levels in the ward when the dogs were present. Similarly, a study investigating the efficacy of animal assisted therapy (AAT) for elderly individuals with senile dementia found that compared to baseline scores, those who received AAT showed greater increases in mean MMSE scores, and in a measurement of daily living functioning (Kanarmori et al., 2001). Additional the AAT group showed a greater decrease in

Alzheimer' symptoms compared to those who did not receive AAT. This study also measured salivary cortisol levels, which revealed that the AAT group showed a decreasing tendency in these levels and thus decreasing levels of mental stress. As the studies completed by Walsh et al. (1995) and Kanarmori et al. (2001) evaluated short-term effects of AAT on individuals with dementia, Kawamura, Niiyama, and Niiyama (2007) evaluated the psychological and behavioral effects of AAT on this population on a long-term basis. After 6 months of participation in AAT, participants experienced improvements in mental functions, although their physical functions decreased. The researchers found a tendency for scores of impaired emotional function, particularly suitability of emotional expression and impaired stability of emotional expression to decrease during the 12 months of AAT.

Barak et al. (2001) demonstrated that these findings generalize to elderly patients with schizophrenia. Compared to individuals who did not receive AAT, those who did scored higher after the treatment on two separate measures of social functioning. The researchers found that AAT encouraged mobility, interpersonal contact, and communication as well as reinforced activities of daily living. These findings suggest that dogs may have a positive impact not only on the physical and emotional well-being of older adults, but also on their cognitive abilities.

Nonetheless, not all studies in this area yield such positive results of dog and other pet interactions. Thodberg et al. (2015) examined the effects of biweekly dog visits in elderly nursing homes and found that while sleep duration increased for individuals who interacted with the dogs, participants in this condition demonstrated no differences in weight, BMI, depression, daily life functions, or cognitive abilities. Similarly, a study investigating weekly dog visits to elderly individuals living in a nursing home found that these visits did not improve depression scores, mood, or levels of social interaction in this population (Phelps et al., 2008). The

discrepancy in results of the cognitive effects of dogs on older adults calls for further investigation of this concept.

The current study aimed to evaluate the effects of pet ownership on performance on recognition memory tasks in older adults. The researchers considered the research suggesting that the effects of cognitive aging, such as worsening performance on recognition memory tasks, can be reduced with physical exercise, lowered blood pressure, and increased social and intellectual activities (Blazer, Yaffe, & Karlawish, 2015), and the research demonstrating that pet ownership and interactions, particularly with dogs can lead to such improvements (Beck and Katcher, 1996; Krause-Parello, 2012; but see Phelps et al., 2008). While some studies found that pet ownership/interaction has a positive impact on cognitive abilities such as the MMSE (Moretti, et al., 2011; Kanarmori et al., 2001) others found no effect (Thodberg et al., 2015). The current study used a measure that has yet to be utilized in the assessment of the effect of pet ownership on cognition in older adults: recognition memory tasks. We predicted that pet ownership would enhance performance on these tasks, and that dog owners in particular would perform significantly better on these tasks than non-dog owners. We theorized that this effect would be mediated by the superior physical and mental health of dog owners as compared to cat owners and non-pet owners as owning a dog requires patience, hard work, physical activity, and social connections. We expected dog owners would be significantly less lonely, and have higher positive mood scores and lower negative mood scores than the other two groups. Finally, we hypothesized that dog owners would be more attached to their pets as compared to cat owners.

Method

Design and Participants

Fifty-two older adults participated in the study. There were 26 dog owners, 9 cat owners, and 17 non-pet owners. The participants ranged in age from 57 to 88 (M =71.51). Participants were recruited from a research pool of participants from previous unrelated studies, and through a newspaper ad in the Richmond Times Dispatch. Participants were compensated $10 for their participation in the experiment.

Years education, self-reported health, vision, and hearing ratings, vocabulary scores, and speed of processing scores are presented in Table 1. There were no significant differences between the dog group (*M*=16.20, *SD*=2.72), the cat group (*M*=17.83, *SD*=2.14), and the non-pet group (*M*=17.00, *SD*=3.06) in years of education, p=.391. Dog owners (*M*=8.02, *SD*=1.66), cat owners (*M*=8.67, *SD*=1.86), and non-pet owners (*M*=8.21, *SD*=1.19) also demonstrated no significant difference in their self reported measurements of overall health, p=.658. Vocabulary scores did not significantly differ between the dog group (*M*=14.33, *SD*=2.00), the cat group (*M*=14.50, *SD*=1.00), and the non-pet group (*M*=14.79, *SD*=1.48), p=.745). Additionally, dog owners (*M*=49.08, *SD*=11.76), cat owners (*M*=49.83, *SD*=7.96), and non-pet owners (*M*=52.07, *SD*=12.54) showed no significant differences in speed or processing as measured by the DSST, p=.746.

Materials

The background information form assessed demographics, health, vision, and hearing rating and activity levels. It asked participants their age, marital status, and level of education, and asked them to rate their overall health, hearing, and eyesight on a scale of 1 (very poor) to 10 (excellent). Dog and cat owners received the human-pet relationship questionnaires asking information about their dog or cat, respectively. This questionnaire asked participants their pets' age, breed, whether they were the primary caretaker, whether they personally trained the pet, and

how long they have had the pet. Additionally, the questionnaire included 26 statements regarding the interactions between the participant and their pet and their feelings toward their pet, and participants were asked to rate their level of agreement with each statement on a scale of 1-6. Non-pet owners received a shorter questionnaire that addressed their feelings towards both dogs and cats. Similarly to the dog and cat questionnaires, the non-pet questionnaire asked participants to rate their level of agreement on a scale of 1-6 of 10 statements about dogs and cats.

Stimuli for the recognition memory task were words (common nouns) chosen from the English Lexicon Project database. Using these words, we created a total of 60 word pairs, and additional words were chosen for use in practice tests, as well as lures during normal testing. These lures were comparable for the test stimuli in word length, and number of syllables. The construction of said pairs was done in a way to avoid both integrative relations (Badham, Estes, & Maylor, 2012) and basic associations (e.g., “cup-drink”). The experimental stimuli were divided to form two separate lists of 30 word pairs, one for each of two blocks. The word lists were comprised in such a way that measures of length and frequency were equivalent across both blocks.

Each block consisted of a study phase followed by an item test, and an associative test. The order in which participants were presented with each test type was counterbalanced across test versions. We used E-Prime software to program and run the study phase, and the test phase. As a distracter task, participants completed the Salthouse (1991) pattern comparison task to separate the study phase and the recognitions tasks within each block.

The Positive and Negative Affect Schedule (PANAS-X) was used as the mood measurement (Watson & Clark, 1994). The PANAS-X asks participants to indicate to what extent they have felt the way described by each item in the last few weeks. The form includes 60

words and phrases that describe different feelings and emotions. Participants rate each item on a scale of 1 (“very slightly or not at all”) to 5 (“extremely”). The Revised UCLA Loneliness Scale was used to measure loneliness (Russell, Peplau & Cutrona, 1980). This scale asks participants to indicate how often they feel the way described in each of the 20 statements by circling a number 1 (“never”) to 4 (“often”).

Procedure

The procedure consisted of two phases: Phase 1 occurred in participants’ homes and Phase 2 occurred in the psychology lab on campus. For phase one, participants were mailed a packet of questionnaires to complete at their homes including the background information form, the human-pet relationship questionnaire, the mood measurement, and the loneliness measurement. For phase two, participants were asked to come into the psychology lab on campus to complete the Digit Symbol Substitution Task (DSST, Weschler, 1981), the Pattern Comparison Questionnaire (Satlhouse, 1991), the vocabulary test (Ekstrom et al., 1976), and the recognition memory tasks.

Upon coming into the lab, participants were greeted by a trained experimenter, who explained the details to the participants, and remained in the test room during the entire procedure to guide participants through each of the tasks. Directions were both read aloud by the experimenter and provided on the computer screen in front of the participants. First, the experimenter ran through the instructions and provided examples for the full procedure. Next, participants completed a practice trial of the recognition memory task in which they were shown six word pairs for five seconds each, completed a three-item version of the Pattern Comparison Questionnaire, and then were asked to complete a shortened version of both the item test and the associative test. In the practice item test, six individual words were presented on the computer

screen one at a time, and participants were asked to press either ‘yes’ if they remember the word from the study list, or ‘no’ if they did not remember the word from the study list. In the practice associative test, six word pairs were presented on the computer screen one pair at a time, and participants were asked to press either ‘yes’ if they remembered the word pair from the study list or ‘no’ if they did not remember the word pair from the study list.

Upon completion of the practice trials, participants advanced to the recognition memory task. First, participants were presented with a study list of 30 word pairs shown for five seconds each on the computer screen. Next, participants were given 20 seconds to complete as much of the Pattern Comparison Questionnaire as they could. Next participants completed both the associative test and the item test. In the associative test, 30 word pairs were presented on the screen one at a time and participants were asked to press ‘yes’ if they remembered that pair from the study list or ‘no’ if they did not remember that word pair from the study list. In the item test, 30 individual words were presented on the screen one at a time and participants were asked to press ‘yes’ if they remembered that word from the study list or ‘no’ if they did not remember that word from the study list. After this first session was completed, participants moved on to session two in which they were once again shown a study list, completed the Pattern Comparison Questionnaire, and performed both the item and the associative tests. In the second session, a new set of words was used, however the Pattern Comparison Questionnaire did not change between sessions.

After the two sessions of the recognition memory task, the experimenter read the instructions for the DSST aloud, and the participants were given 90 seconds to complete as much of it as they could. Next, the experimenter read the instructions for the vocabulary test aloud, and

the participants were given two minutes to complete it. After the two minutes expired, participants were debriefed, thanked, and paid $10 for their participation.

Results

The primary methods of statistical analyses were univariate (ANOVA) and multivariate (MANOVA) analyses of variance with pet group as the independent variable and memory scores, mood scories, and pet attachment scores as dependent variables. Means, standard deviations, and p-values are reported in Table 2.

Memory

A MANOVA for item hit rate, associative hit rate, item false alarm rate, and associative false alarm rate examined the effect of pet group on memory. There was a significant overall pet group effect, F (1, 49) = 137.66, p = .001. Between group differences were most notable in associative false alarm rates (p = .007) and item false alarm rates were marginally significant (p = .082). A pairwise comparison revealed cat owners (M = .467, SD = .157) to have the highest associative false alarm rate compared to dog owners (M = .238, SD = .160, p = .002) and non-pet owners (M = .262, SD = .157, p = .008). Dog owners and non-pet owners did not differ. The memory results are presented in Table 2 and Figures 1-4.

Mood

Performance on the Revised UCLA Loneliness Scale was analyzed using a one-way ANOVA with pet group as the independent variable and score on the scale as the dependent variable. There was no significant effect, F (2,49)= .502, p=.608, see Table 2. Performance on the PANAS-X was measured using a one-way ANOVA with pet group as the independent variable and positive and negative subscale scores as the dependent variables. There was no

significant effect of pet group on positive scores, F (2,49)=.350, p=.706 or negative scores, F (2,49)=.096, p=.909, see Table 2.

Pet Attachment

A MANOVA for the pet attachment items yielded significant effects for three items (12, 16, 17), and marginally significant effects for two items (34, 35), see Table 2. Dog owners had higher scores than cat owners on item 12 ("I often engage in activities and behaviors with my dog/cat other than basic necessities (feeding, giving water, letting outside)"), item 16 ("I like my dog/cat because he/she accepts me no matter what I do"), and item 17 ("My dog/cat gives me something to talk about with others").

Discussion

This study provides an innovative investigation of the effect of pet ownership on cognition in older adults by assessing the performance of dog owners, cat owners, and non-pet owners on recognition memory tasks. Our hypothesis that dog owners would perform best on the memory tasks was partially supported as dog owners performed better than cat owners, however, their performance was not significantly different than that of non-pet owners. Our preliminary explanation for these findings is that while owning a cat may not worsen cognitive abilities, dog ownership may combat cognitive decline, preserving performance on recognition memory tasks.

Contrary to our expectations, there were no differences between groups on positive and negative mood as measured by the PANAS-X or on loneliness, as measured by the Revised UCLA Loneliness Scale. Both loneliness and mood can be affected by a wide array of variables such as favorable or unfavorable events that day, weather, current relationships, and stressful events such as the loss of a loved one. As pet-ownership is not the only factor that plays a role in

loneliness and mood, it is possible that factors other than pet-ownership affected these measures more strongly.

As predicted, dog owners scored higher on measures of pet attachment than cat owners. Dog owners rated the statement "I often engage in activities and behaviors with my dog/cat other than basic necessities (feeding, giving water, letting outside)" significantly higher than cat owners. This finding was in line with our prediction that owning a dog requires more attention and work than owning a cat. We believe that this finding is indicative of pet attachment because more attached owners are likely to spend more time with their pets beyond what is necessary to the pet's survival. Therefore, the finding that dog owners rated this statement more highly suggests that the dog owners in this study were more attached to their pets than were cat owners.

Dog owners also rated the statement "I like my dog/cat because he/she accepts me no matter what I do" significantly higher than cat owners. We found this result to be telling of the essence of the relationship between pet owners and their pets as it suggests pet-owner comfort level and a mechanism for pet attachment. The result that dog owners rated this statement more highly than cat owners suggests that our dog-owning participants may have had greater levels of comfort with their pets than our cat-owning participants and this points to an explanation of why dog owners may be more attached to their pets than cat owners.

Additionally, dog owners rated the statement "My dog/cat gives me something to talk about with others" significantly higher than cat owners. This finding sheds light on the social aspect of dog ownership previously demonstrated by Krause-Parello (2012), and Barak et al. (2001). This result suggests that owning a dog enhances individuals' social relationships with others, likely through the mechanisms of giving dog-owners something to talk about with others, and getting these individuals out walking around the neighborhood.

The statements “Having a dog/cat makes my life more difficult” and “Having a dog/cat makes me more active” were rated marginally higher by dog owners than by cat owners. The finding that dog owners believe their pets make their lives more difficult follows our prediction that owning a dog requires more attention and work than owning a cat. The concept that dogs require more from their owners than cats do may make life more difficult for dog-owners; however, it may also lead to stronger attachment between pet and owner. If dog-owners need to spend exceeding time training and caring for their pets, they may develop stronger bonds for their pets than cat owners. On the other hand, additional time spent with their pets may make owners more physically active. While dogs need to be walked on a leash everyday, cats do not require owner-facilitated exercise. Consequently, the finding that dog owners feel that their pets make them more physically active than cat owners is in line with our prediction of increased physical exercise as a mechanism for enhanced cognitive abilities in dog owners.

The current study aimed to demonstrate in a novel way that dog ownership enhances cognition in older adults. While our hypothesis was partially supported, our findings did not support dog ownership as superior to non-pet ownership in effect on performance on recognition memory tasks. We also found support for our hypothesis that dog owners would be more attached to their pets than cat owners. One limitation of our research was that it was unfeasible to have participants’ pets with them in the lab during the memory test. It is possible that having the pet with the participants during the experiment would yield stronger between group differences as the effect of pets on cognition in older adults may be more prominent in short-term measurements. Future research should compare performance of older adults on memory tasks both when their pet is physically present in the room during the experiment and when it is absent. The value of owning a dog on older adults’ cognition and well-being merits further research.

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Table 1

Means, Standard Deviations, and Significance Levels for Pet Owner Groups and Demographics

Variable	Non-pet	Cat	Dog	p-value
Age	70.65 (1.47)	76.00 (1.47)	70.52 (1.26)	.682
Sex	M (8), F (9)	M (3), F (7)	M (11), F (14)	
Health	8.21 (1.19)	8.67 (1.86)	8.02 (1.66)	.658
Vision	8.41 (.337)	8.33 (.464)	8.70 (.290)	.732
Hearing	8.71 (.402)	9.00 (.553)	8.70 (.290)	.194
Years of Education	17.00 (3.06)	17.83 (2.14)	16.21 (2.72)	.391
Vocabulary Scores	14.79 (1.48)	14.50 (1.00)	14.33 (2.00)	.745
Speed of Processing (DSST) Scores	52.07 (12.54)	49.83 (7.96)	49.08 (11.76)	.746

Table 2

Means, Standard Deviations, and Significance Levels for Pet Owner Groups and Outcome Variables

Variable	Non-pet	Cat	Dog	p-value
Items Hit Rate	.782 (.182)	.742 (.192)	.753 (.146)	.799
Items False Alarm Rate	.197 (.142)	.306 (.155)	.185 (.127)	.082
Associates Hit Rate	.797 (.148)	.728 (.150)	.690 (.171)	.116
Associates False Alarm Rate	.262 (.157)	.467 (.157)	.238 (.160)	.007
[a]Positive mood	3.36 (.681)	3.35 (.550)	3.50 (.589)	.706
[a]Negative mood	1.47 (.440)	1.42 (.339)	1.51 (.624)	.909
[b]Loneliness	37.24 (13.55)	32.50 (11.58)	34.44 (10.69)	.608
[c]Engage		4.80 (1.14)	5.50 (.834)	.054
[c]Accept		4.70 (1.36)	5.58 (.654)	.014
[c]Social		4.50 (.850)	5.16 (.761)	.031
[c]Difficult		1.80 (.919)	2.71 (1.46)	.079
[c]Active		3.90 (1.20)	4.75 (1.19)	.067

Note. [a] PANAS-X Positive and Negative Mood Scales, [b] UCLA Loneliness Scales, [c] Pet Attachment Scale

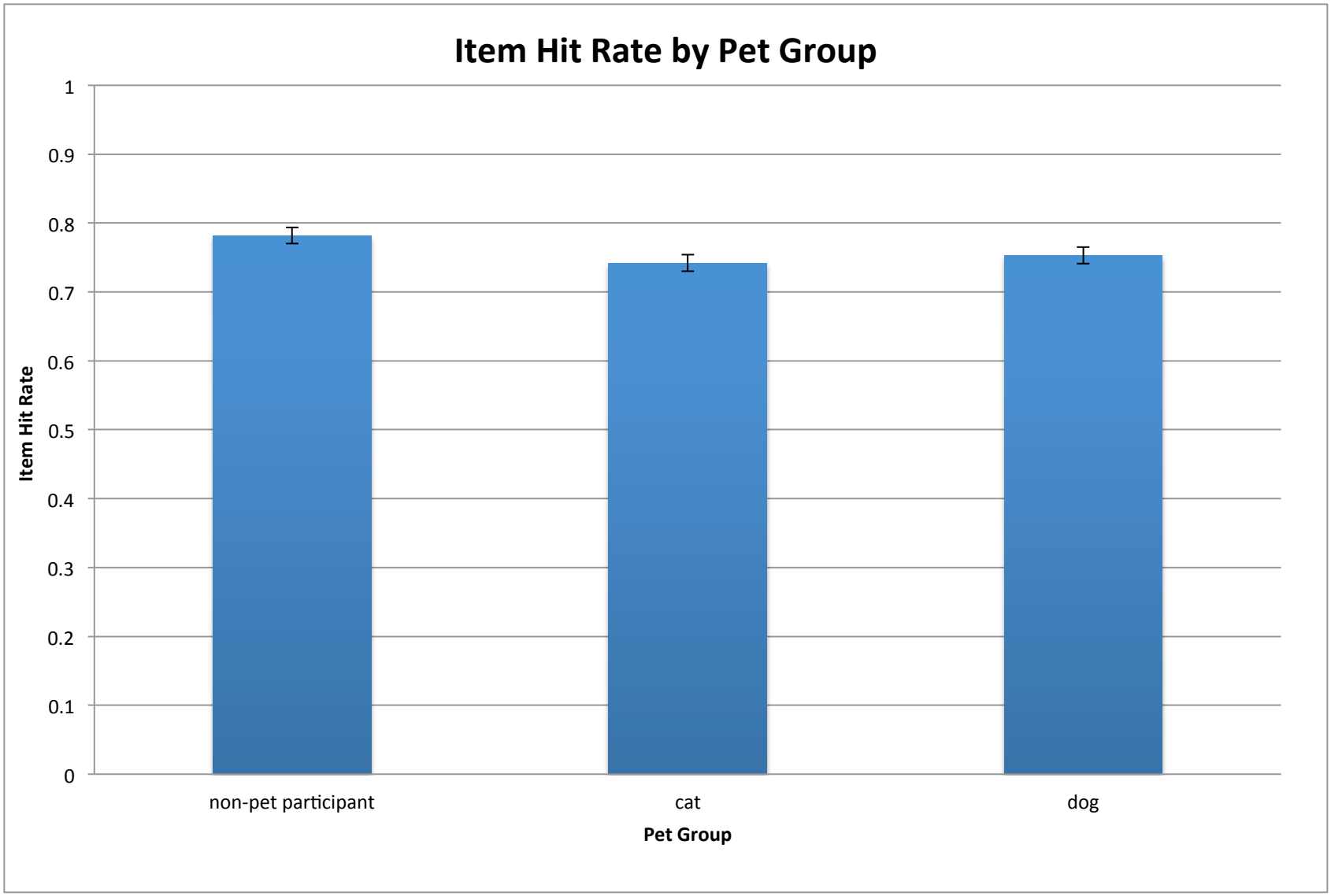

Figure 1. Mean item hit rate (with standard error bars) by pet group.

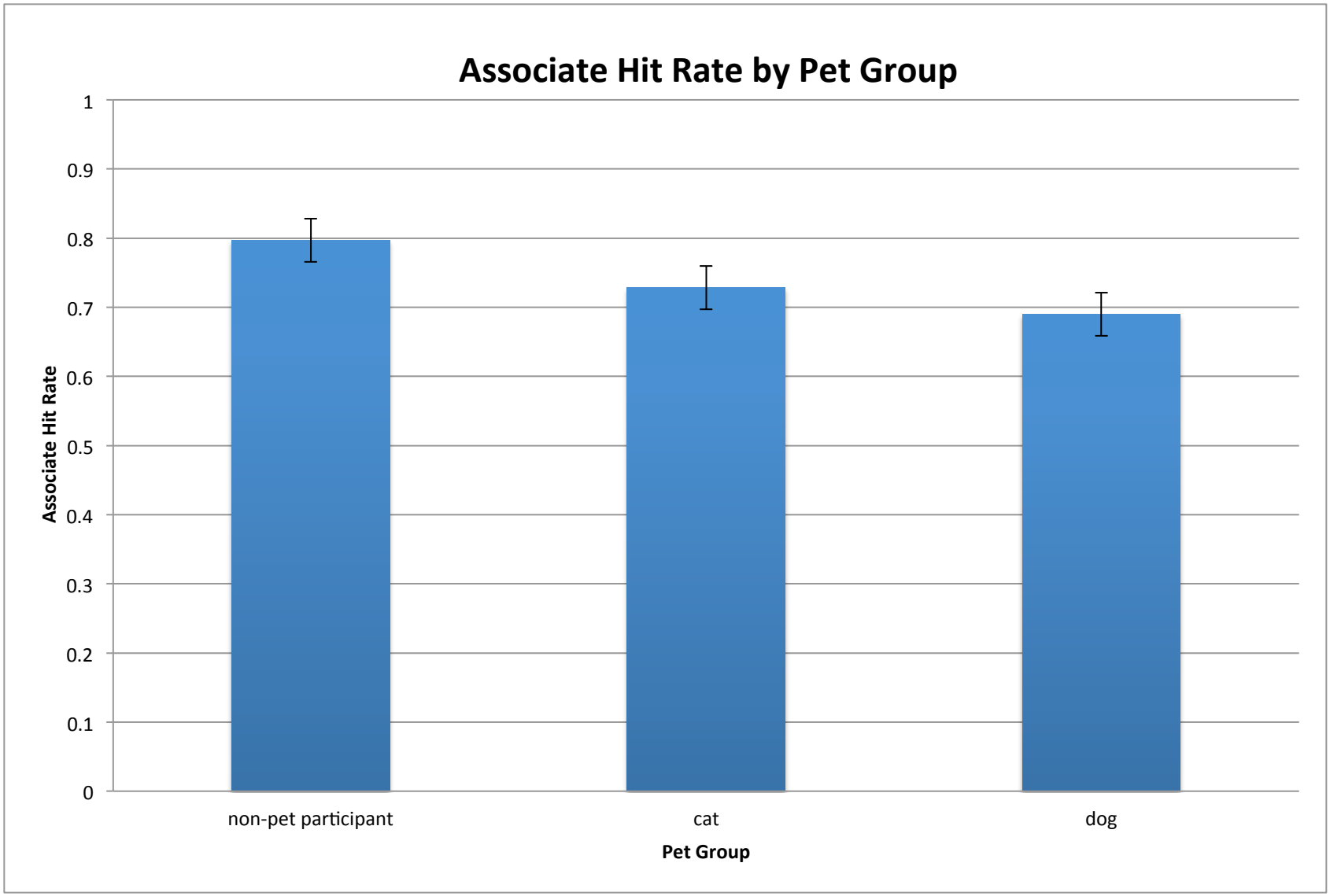

Figure 2. Mean associate hit rate (with standard error bars) by pet group.

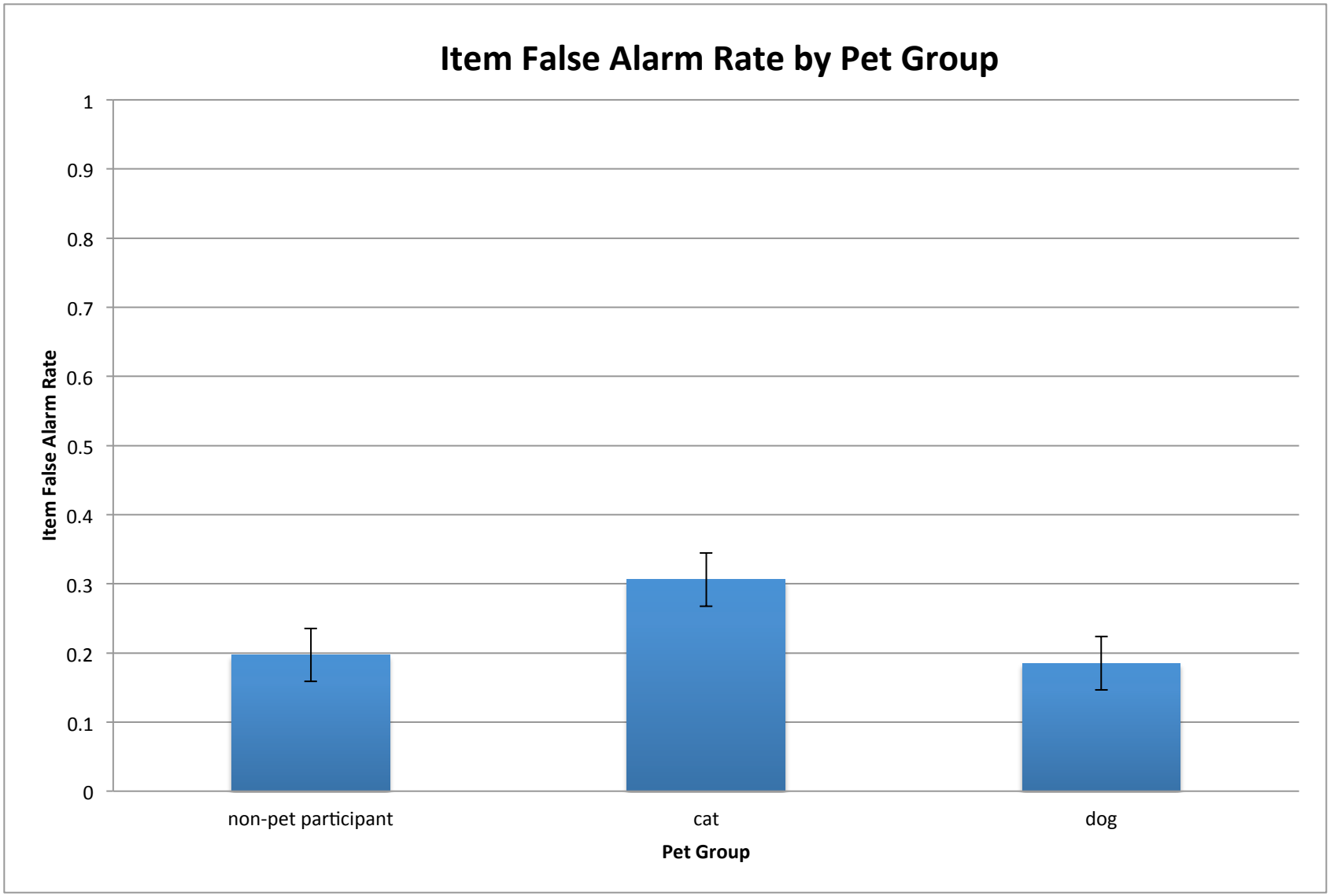

Figure 3. Mean item false alarm rate (with standard error bars) by pet group.

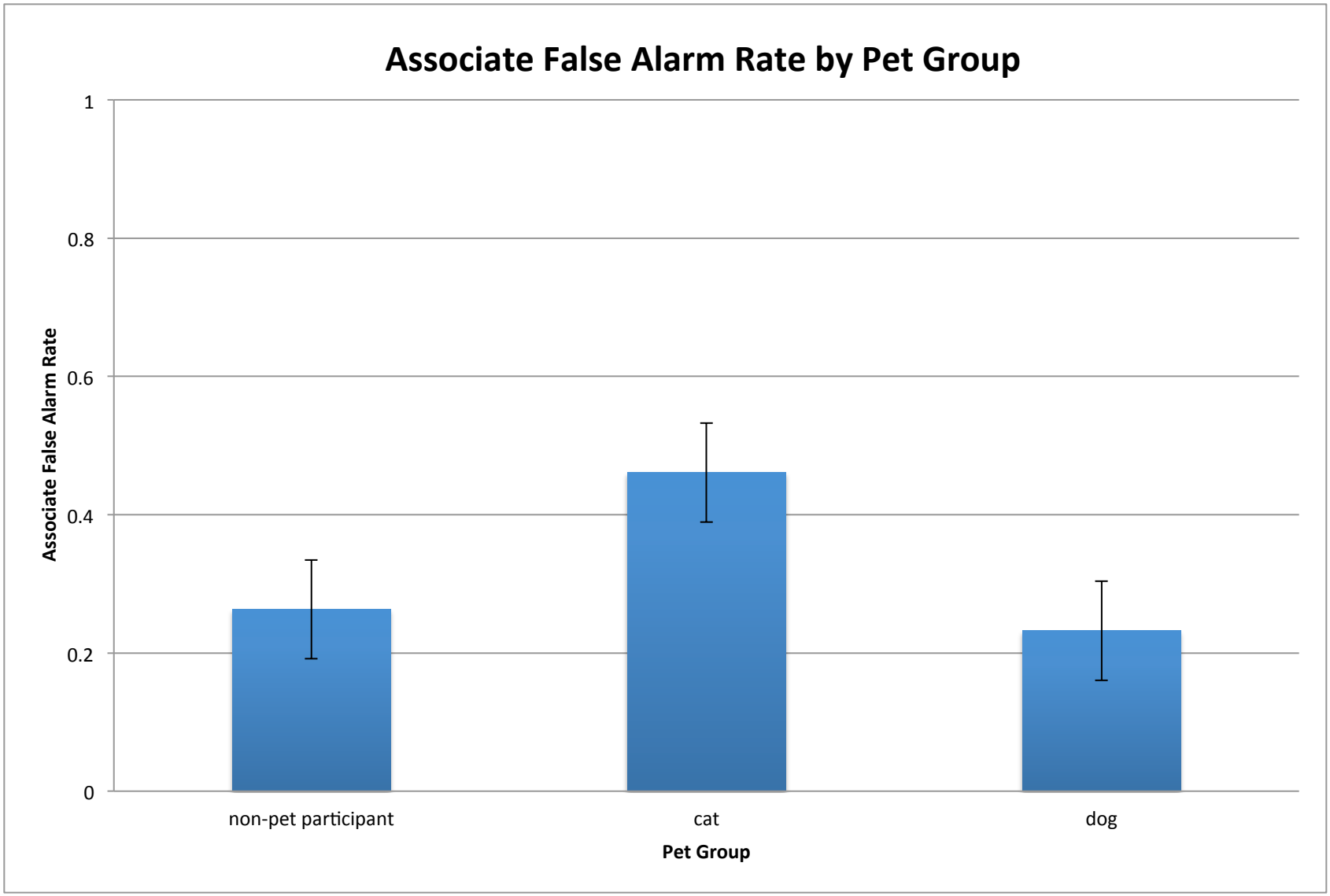

Figure 4. Mean associate false alarm rate (with standard error bars) by pet group.