Examining the Effects on Salivary Cortisol Levels of Shelter Volunteers Interacting with Familiar Dogs

by
Holly Kyoko Duvall

A THESIS

submitted to

Oregon State University

Honors College

in partial fulfillment of
the requirements for the
degree of

Honors Baccalaureate of Science in Animal Science
(Honors Scholar)

Presented May 30, 2019
Commencement June 2019

AN ABSTRACT OF THE THESIS OF

Holly Kyoko Duvall for the degree of Honors Baccalaureate of Science in Animal Science presented on May 30, 2019. Title: Examining the Effects on Salivary Cortisol Levels of Shelter Volunteers Interacting with Familiar Dogs.

Abstract approved:_____

Monique Udell

Heightened cortisol levels are a typical physiological response to stress. The many responsibilities of animal shelter workers can lead to increased stress levels and negative effects on their job satisfaction and overall wellness. As a result, workers are subject to burnout and compassion fatigue. While working in shelter environments may be stressful, interactions with dogs have been found to help people manage their mental as well as physical health. The purpose of this study was to evaluate the physiologic stress response of shelter volunteers following interactions with dogs that they work with. Saliva samples were taken from seventeen participating shelter volunteers before and after interacting with a chosen familiar shelter dog from Willamette Humane Society through a 12 minute testing session consisting of a Secure Base Test and a Paired Attachment Test. Lexington Attachment to Pets Scale survey scores were also analyzed for the purpose of this study. No significant correlations were found with respect to cortisol levels and results of the behavioral tests or survey scores. In conclusion, the shelter volunteers of Willamette Humane Society were found to be stable in this environment and do not necessarily have a change in stress levels after interacting with a familiar dog.

Key Words: Stress, cortisol, animal shelter, compassion fatigue, dogs, attachment

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I understand that my project will become part of the permanent collection of Oregon State University, Honors College. My signature below authorizes release of my project to any reader upon request.

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Holly Kyoko Duvall, Author

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Introduction

Humans are subject to normal physiologic responses to environmental stressors. In the short term, such physiological stress reactions are typical bodily responses. However, extended periods of high stress levels have become a common problem that afflicts working people and students alike and heightened cortisol levels are a physiological response to stress (Kalman & Grahn, 2004). Prolonged heightened cortisol levels lead to a deterioration in physical and mental health (Friedmann & Son, 2009), including the development of several different physical chronic diseases and can degrade the form and function of a human's immune system, metabolism, central nervous system, and cardiovascular system (Juster, McEwen, & Lupien, 2010). Humans are also greatly exposed to developing psychologic diseases such as anxiety, depression, and social isolation or loneliness. Long term depression, anxiety, and loneliness were found to increase the risk of hyperactivity of the sympatho-adrenal-medulla system and hypothalamic-pituitary-adrenal axis (releases corticosteroids, which includes cortisol, into the blood) and abnormal platelet reactivity, among many other health problems (Friedmann & Son, 2009).

Most workers and volunteers that choose to work in an animal welfare setting do so because they have a love for animals and an affinity to care for them. They are generally very caring people that want to help improve animal welfare. Based on human-animal bond research demonstrating benefits of positive animal interactions, there is potential for these individuals to benefit from these relationships. However, many are hardly aware of the possible negative health implications that can come with working in an animal-care setting. It is a job that requires such high levels of care and regular observations of animals who have been relinquished, are sometimes in poor health and may fail to be adopted into new homes. These are some of the experiences of the job that can lead to heightened levels of stress in the animal caretakers

(Lowry, 2014). Several responsibilities that have led to increased stress levels and negative effects on their job satisfaction and overall wellness include making decisions on and performing euthanasia, physical labor, role ambiguity or insufficiency, rational coping, high demands of their job, overcrowding of the shelter, financial status of the shelter or the surrendering owners, and encounters of animal abuse (Scotney, McLaughlin, & Keates, 2015).

High levels of animal shelter worker stress are often discussed in the context of compassion fatigue, which can be defined as the psychologic and physiologic aftermath following a tragic end of the relationship between the worker and the patient or animal. Symptoms of compassion fatigue have been found to be synonymous to symptoms of Posttraumatic Stress Disorder (PTSD) which may include physiologic distress and can compromise a worker's ability to effectively care for other animals in the shelter and perform other daily tasks (Gallagher, 2013). Other symptoms of compassion fatigue include diminished sense of enjoyment with work, reduction in the ability to feel sympathy or empathy, exhaustion, negative coping behaviors, and hindered ability to make decisions (Cocker & Joss, 2016). The symptoms of compassion fatigue seem to overlap with general work burnout, but the main point that defines the two is that compassion fatigue is a result of exposure to a traumatic event or high distress (Cocker & Joss, 2016). One study suggested that there are four elements to compassion fatigue. These include primary traumatic stress, secondary traumatic stress, burnout, and unresolved grief. Unresolved grief was said to be a result of the fact that people rarely focus on finding ways to cope with the aftermath of the deaths that some workers are exposed to on a daily basis (Verdon, 2006).

Most noted compassion fatigue as a direct effect of performing euthanasia. Euthanasia-related strain has a large impact on a shelter worker's overall wellbeing and job satisfaction as it

leads to higher levels of stress in the workplace since the workers must cope with varying and possibly unknown outcomes for the animal (Lowry, 2014). Making this decision between keeping an animal alive or not can be personally morally conflicting and mentally devastating (Lowry, 2014). Many workers are susceptible to experiencing posttraumatic incidences. Higher euthanasia rates typically led to higher employee turnover rates. Interestingly though, these turnover rates more likely increase when the number of dog euthanasia rates increase and not so much when cat euthanasia rates increase. Scotney (2015) concluded that this was probably due to a greater perceived level of attachment of shelter workers to dogs than cats.

Shelter workers are often primarily responsible for making these life or death decisions, sometimes then followed by the performance of the euthanasia. They are aware that euthanasia is an undesired outcome, but understandably, oftentimes a necessary one. These conflicting feelings of wanting to provide the best care for their animals yet having to kill animals they may have potentially become attached to is known as the "Caring-Killing Paradox" which has comparable symptoms to those diagnosed with Posttraumatic Stress Disorder (Lowry, 2014). The Caring-Killing Paradox is a moral stress that can commonly occur to workers in a field like this, where their main goals are to provide care and promote well-being in the animals but they more often find themselves ending the lives of those they wish to care for (Shearer, 2018). While exposure to euthanasia has been identified as a common trigger for heightened stress levels in shelter workers, euthanasia rates vary between shelters and not all shelter workers or animal caretakers experience this aspect of shelter work directly. However, even when exposure to this aspect of shelter work is limited, other factors that could contribute to increased stress levels as noted, remain.

While working in shelter environments may sometimes be stressful, interactions with dogs have also been found to help people manage their mental as well as physical health (Friedmann & Son, 2009; "Pet Ownership and Cardiovascular Risk | Circulation,"). For example, ownership of a dog has been shown to reduce cardiovascular disease, increase mood, reduce the feelings of depression, anxiety, and other mental health disorders (Friedmann & Son, 2009; Halm, 2008). Because of this, many people own dogs as a therapeutic assistant in their daily lives. As surveys have shown, these people feel that having a four-legged companion by their side has indeed helped them manage their stress (Friedmann & Son, 2009).

For example, those that enjoyed having a dog present demonstrated significantly lowered cardiovascular responses (Friedmann & Son, 2009) and significant improvements in psychological health after owning a pet for one month (Halm, 2008). Pet ownership not only affected physiologic responses but also helped to lead to better physical health as it was found that dog owners engaged in a significantly increased amount of physical activity per week compared to before they owning a pet. This increase in physical activity resulted in better levels in lipid profiles, lower systemic blood pressure and autonomic tone of these participants ("Pet Ownership and Cardiovascular Risk | Circulation,"). But previous studies have also demonstrated that simply being in the presence of a pet can also have positive effects on one's overall health (Friedmann & Son, 2009).

One research study concluded that owning a pet led to reductions in feelings of distress, anxiety, loneliness, depression in those that enjoyed these pets (Friedmann & Son, 2009). One reason that was reported for this is that pets, specifically dogs, helped encourage social interaction between people and strangers as the dog helped present a neutral topic for the two to converse over, thus alleviating feelings of social stress and loneliness. Those in wheelchairs

reported an increase in the frequency of social acknowledgement from passersby when a service dog was present with them (Hart, 2001). Among patients with HIV/AIDS, it was found that those that owned pets felt less depressed than those that did not own any pets. Having a companion animal also helped reduce distress in humans by helping the owner perceive some situations as less stressful (Friedmann & Son, 2009). Another study discovered that hypertensive patients that volunteered to become a pet owner had diminished increases in systolic blood pressure and heart rate when exposed to mental stress after 6 months of owning a pet. This was found to help these patient-pet owners have greater cardiac adaptability to stressors ("Pet Ownership and Cardiovascular Risk | Circulation," n.d.).

While many studies on the benefits of human-dog interactions have focused on pets, some have reported that just being in the presence of a dog, even a dog not owned by the human subject, helped to moderate stress levels. In one study, patients with psychiatric disorder, mood disorder, or other related disorders reported feeling less anxious following a session of animal assisted therapy (Barker & Dawson, 1998). In another study where 18 healthy individuals engaged in a positive interaction with a dog, it was discovered that β-endorphin, oxytocin, prolactin, phenylacetic acid, and dopamine significantly increased while cortisol levels significantly decreased (Odendaal, 2000). In cases involving animal-assisted therapy or animal assistance in activities, participants reported improvements in their mood and decreased feelings of distress, depression, and loneliness (Friedmann & Son, 2009). Patients that attended pet-therapy visits reported reduced levels of anxiety including a reduction in breathing rates, pain, temperature, and respiratory rate which are all signs of a state of relaxation. Adults, children, and nurses all felt as though the presence of pets in the work environment increased their feelings of happiness and helped them feel more calm and relaxed (Halm, 2008).

While pet ownership and pet presence have been found to be effective in helping people cope with mental and physical stressors, this can be quite dependent on the human's perception of pets and animals. Not all cultures view animals in a similar way and some even perceive them with negative associations which would instead lead to more feelings of distress rather than a reduction in distress. If the pet is perceived as a disruption to task completion, this could also lead to increased stress in the human (Friedmann & Son, 2009). Meanwhile, the way a dog is viewed and perceived can lead to a variety of human feelings and behaviors toward these dogs including, but not limited to, love, hate, fear, tenderness, and cruelty (Katcher, Beck, & International Conference on the Human-Companion Animal Bond, 1983). With this being said though, perceptions of dogs in a study conducted in Hennepin Country, Minnesota found that dogs were most highly ranked to have the advantages of companionship, love and affection, and pleasure, all positive perceptions (Katcher et al., 1983). However, it is still quite possible for a person to have negative experiences with a dog, such as through an aggressive or destructive dog, which can result in negative perceptions toward other dogs (Houpt, Honig, & Reisner, 1996).

The purpose of this study is to evaluate the physiologic stress response of individuals that volunteer in a shelter following their interactions with the dogs that they work with. Since cortisol is a biomarker of stress, this study will examined how interacting with dogs affects human cortisol levels in shelter volunteers from Willamette Humane Society in order to help determine how dogs may affect the physiological responses of people caring for animals that have been found as stray or relinquished to a shelter. These interactions include caring for the dog in feeding them, walking them, cleaning up after them, playing with them, interacting with

them in their kennels, and other general interactions the volunteer may have had with their chosen shelter dog.

Shelter animal caretakers likely have a mixture of positive and negative experiences with the animals they work with, and see both successes and difficult cases, which could contribute both to possible beneficial outcomes of human-animal interactions as well as compassion fatigue. Therefore attachment quality and strength between volunteer and dog were also evaluated to see if this would impact a volunteer's stress levels. Evaluating the volunteers' salivary cortisol levels may lend insight into some of the effects that working in a shelter have on a volunteer that works with the shelter's dogs.

We predicted that cortisol levels would be lower in shelter volunteers with higher scores on the Lexington Attachment to Pets Scale (LAPS), a measure of human-reported attachment compared to volunteers with lower LAPS scores. We expected that dogs with secure attachments to shelter volunteers, as measured by a Secure Base Test (Thielke, Rosenlicht, Saturn, & Udell, 2017; Wanser & Udell, 2019), would be paired with shelter volunteers with lower cortisol levels compared to dogs with insecure attachments to volunteers.

Methodology

Participants

Seventeen shelter volunteers (including dog walkers, kennel buddies, and volunteers involved with training and behavior modification) and 17 dogs from the Willamette Humane Society participated in this study (See Table 1).

Table 1: *Demographic information on the dogs and participants. Due to the anonymous nature of the study, participants were given an ID number as a form of identification.*

Dog Name	Dog Breed	Dog Sex	Participant ID #	Participation	Gender
Chico	Shepard	Male	046	first	Female
Mari	Pointer mix	Female	047	first	Female
Lincoln	Mixed breed	Male	048	first	Female
Brownie	American Staffordshire terrier mix	Female	050	first	Female
Daisy Thriller	Boxer mix	Female	051	second	Female
Bandit	American Staffordshire terrier mix	Male	052	first	Female
Biscay	Mixed breed	Male	053	first	Male
Charlie	American Staffordshire terrier mix	Male	054	first	Female
Maizie	Unknown	Female	055	first	Female
Floki	Lab mix	Male	056	first	Female
Jordy	Labrador retriever mix	Male	058	first	Female
Dakota	American Staffordshire terrier mix	Female	059	first	Male
Gemma	American Staffordshire terrier mix	Female	060	first	Female
Smallz	Pug/Chihuahua mix	Male	062	first	Male
Hoagie	Retriever mix	Male	063	first	Female
Numair	Dachshund mix	Female	064	first	Female
Jacob	Cocker Spaniel mix	Male	101	first	Female

Measurement

Assessment of human-dog pairs consisted of conducting Secure Base Tests (SBT), Paired Attachment Tests, and analyzing a modified Lexington Attachment to Pets Scale (LAPS) Survey Scores and Attachment scores. This shortened SBT test was used as a method to evaluate the behaviors performed by the dog and to measure attachment formation of the dog to the human. It was previously developed to evaluate attachment formation and measure these behaviors associated with the secure base effect in non-human animals (Harlow, 1958). The PT test was meant for evaluation of social partner preference in the dog between a familiar or unfamiliar person (Frank & Frank, 1982). The LAPS was utilized as a psychometric measurement for the person's emotional attachment to their chosen familiar dog (Johnson, Garrity, & Stallones, 1992).

Prior to each testing session, volunteers were asked to choose a dog that they had interacted with for at least three separate 10-minute session prior to this test. This could include petting and talking to the dog in the kennel, walking the dog, training the dog, or playing with the dog in any of the shelter's exercise yards. This criteria was chosen because previous research has found that shelter dogs form attachment bonds to unfamiliar people after only three separate 10-minute interaction periods (Gácsi, Topál, Miklósi, Dóka, & Csányi, 2001).

The testing room was a small room that was 2.5m x 3m and would have been an unfamiliar room to the dog being tested. Two chairs were set up facing each other and against the walls directly across from each other in the room. A 1 meter radius perimeter was set up around each chair and marked with tape on the floor and 2 cameras were set up in two corners of the room to see as much of the floor of the room as possible. One tennis ball, one stuffed dog toy,

and one rope toy was placed on the floor in the center of the room outside of the 1 meter radius perimeter.

Following consent, participants were provided with 2 mL plastic screw-top vials for saliva sample collection. They were instructed to provide their assigned ID number as well as the time and date of the collection on each cup. The minimum amount of saliva needed was 130 microliters. We asked participants to provide saliva samples in two separate vials at the following time points:

1. Prior to beginning the Secure Base Attachment Test
2. Immediately following the completion of the Secure Base Attachment Test (12 minutes total)

Samples were frozen within a few hours of collection and later sent off to Iowa State University's Stress Physiology Investigative Team's (SPIT) Lab for analysis of the saliva samples once all samples were collected. The samples were each labeled with participant number, time, pre or post, and date. Each sample was secured numerically in a vial box and was stored in a styrofoam shipping box surrounded by dry ice pellets to keep the samples frozen for the entirety of the shipping process. Iowa State University's SPIT Lab used a Salimetrics Salivary Cortisol Enzyme Immunoassay Kit to find the salivary cortisol levels. Instructions from the kit indicated that average reported salivary cortisol levels for healthy adults are 0.094-1.551 μg/dL in the morning and <0.007-0.359 μg/dL in the evening ("Salivary Cortisol ELISA Kit,"). Any saliva remaining from the sample after processing was appropriately discarded.

The Secure Base Test (SBT) consisted of three two-minute phases. The dog was allowed to explore the room freely during all phases of testing. In phase one (baseline phase), the shelter volunteer sat neutrally and silently in one of the chairs for two minutes. The human was

instructed to freely interact with the dog anytime it entered the 1-meter radius circle, including talking to the dog, petting the dog, or playing with the dog if the dog brought a toy to the human. When the dog was outside of the circle, the human was asked to sit neutrally and refrain from interacting with or calling to the dog. In phase 2 (alone phase), the human was instructed to exit the testing room to leave the dog alone in the room for two minutes. In phase three (return phase), the human re-entered the testing room and sat back into the same chair they first sat in during phase 1 for another two minutes. The instructions were identical to those from phase 1. After this phase, the human was asked to re-exit the testing room for another two minutes, which led to the transition into the Paired Attachment Test (PT).

After the second two-minute alone phase, the familiar person and unfamiliar person the dog had not previously interacted with entered the testing room with the familiar human entering the testing room first. The familiar human sat in the same chair that he or she sat in during the SBT, while the unfamiliar person sat in the chair on the opposite side of the room to begin the passive phase. For two minutes, both the familiar person and unfamiliar person sat neutrally for two minutes with similar instructions from phase 1 of the SBT. During the next two minute phase, the active phase, both humans were asked to gain the dog's attention with the best of their ability. If the dog entered their circle with at least two paws the humans were allowed to provide continuous petting and attention. Results from the PT were not evaluated as a part of this analysis as another human was involved in this session. Volunteers also filled out a series of surveys following the SBT, including the LAPS.

Video Analysis of the Secure Base Test

Two independent coders reviewed the return phase videos for each dog's SBT and categorized dogs' attachment styles based on patterns of the dog's behavior seen in the return phase. Inter-rater reliability was assessed based on the percentage of agreement after this initial round of coding. After the two coders reviewed each video independently, they watched any videos for which they disagreed on attachment style categorization together and reached an agreement. If the coders could not agree on an attachment style for a particular dog, the dog would be categorized as "Unclassifiable" and removed from analysis. A description of all attachment style classifications can be found in Table 2.

Table 2: *Holistic coding attachment style definitions (adapted from Schöberl et al., 2016)*

Attachment Style	Definition
Secure	Little or no resistance to contact or interaction. Greeting behavior is active, open and positive. Seeks proximity and is comforted upon reunion, returning to exploration or play.
Insecure ambivalent	Shows exaggerated proximity-seeking and clinging behavior, but may struggle if held by owner. Mixed persistent distress with efforts to maintain physical contact and/or physically intrusive behavior directed toward the owner. (Dogs who the judges agreed seemed essentially secure but with ambivalent tendencies, were included in the secure group).
Insecure avoidant	May show little/no distress on departure. Little/no visible response to return, ignores/turns away but may not resist interaction altogether (e.g. rests or stands without bodily contact, out of reach or at a distance).
Insecure disorganized	Evidence of strong approach avoidance conflict or fear on reunion, for example, circling owner, hiding from sight, rapidly dashing away on reunion, "aimless" wandering around the room. May show stereotypies on return (e.g. freezing or compulsive grooming). Lack of coherent strategy shown by contradictory behavior. "Dissociation" may be observed, that is, staring into space without apparent cause; still or frozen posture for at least 20 seconds (in the nonresting, nonsleeping dog).
Unclassifiable	Classifiers were unable to reach consensus on group placement for dogs from this classification category. Unclassifiable dogs were excluded from further analysis on dog attachment.

Results

After receiving results from Iowa State University's SPIT Lab, the data was compiled in the following figures (See Table 3 and Figure 1). As part of analysis of the difference in salivary cortisol levels, a paired t test was run on the pre salivary cortisol levels and post salivary cortisol levels. The two-tailed P value equaled 0.9935, which indicated that the difference between the two testing times was not statistically significant.

Table 3: *"Pre" refers to the salivary cortisol levels of the corresponding participant immediately before the attachment tests were run. "Post" refers to the salivary cortisol levels of the participant immediately after the attachment tests were run. "Cortisol level difference" refers to the difference of the Pre levels minus the Post levels.*

Participant ID #	Pre (µg/dL)	Post (µg/dL)	Cortisol level difference (µg/dL)
046	2.528	1.358	-1.17
047	0.2	0.131	-0.069
048	0.116	0.079	-0.037
050	0.112	0.307	0.195
051	0.191	0.185	-0.006
052	2.1045	3.149	1.0445
053	0.039	0.077	0.038
054	0.097	0.096	-0.001
055	0.042	0.019	-0.023
056	0.114	0.051	-0.063
058	0.052	0.053	0.001
059	0.118	0.083	-0.035
060	0.175	0.154	-0.021
062	0.064	0.094	0.03
063	0.078	0.172	0.643
064	0.127	0.094	-0.033
101	0.077	0.119	0.042
Average:	0.36673529	0.36594118	0.0315

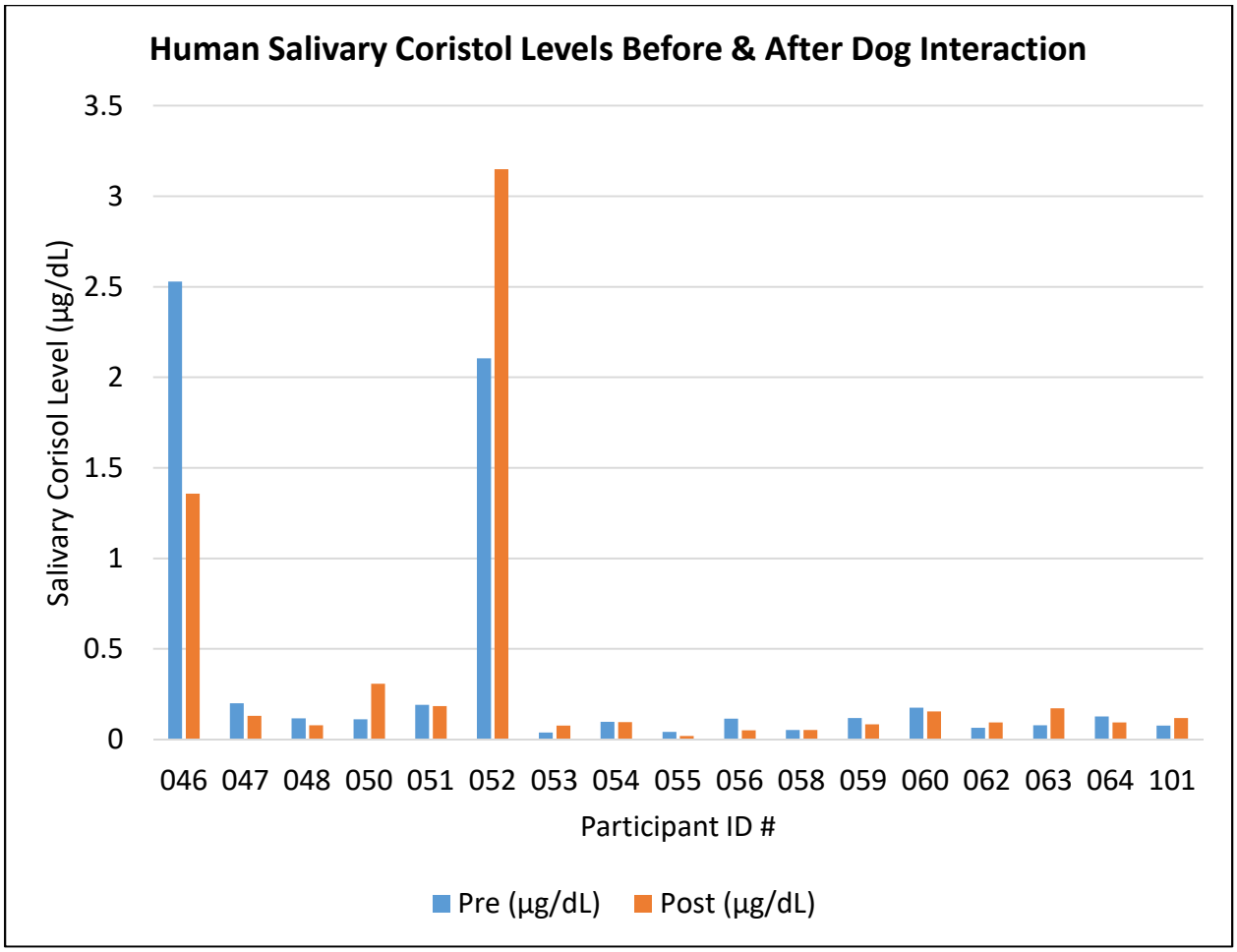

Figure 1

Attachment styles of each dog were coded according to the attachment style categorization descriptions (see Table 2) and compiled in Table 4.

Table 4: *Attachment styles and attachment categories of each dog*

Dog Name	Participant ID #	Attachment style	Attachment category
Chico	046	secure	secure
Mari	047	ambivalent	insecure
Lincoln	048	secure	secure
Brownie	050	secure	secure
Daisy Thriller	051	ambivalent	insecure
Bandit	052	secure	secure
Biscay	053	ambivalent	insecure
Charlie	054	ambivalent	insecure
Maizie	055	ambivalent	insecure
Floki	056	ambivalent	insecure
Jordy	058	ambivalent	insecure
Dakota	059	secure	secure
Gemma	060	ambivalent	insecure
Smallz	062	ambivalent	insecure
Hoagie	063	secure	secure
Numair	064	secure	secure
Jacob	101	secure	secure

For the purposes of analysis, all ambivalent dogs were placed as insecurely attached dogs since there were no avoidant or disorganized shelter dogs in the first round. A Shapiro-Wilk test was used to test for normality. Pre, Post, and cortisol level difference data were all non-normally distributed, $p < 0.05$. Thus, nonparametric Mann-Whitney U tests were used for pairwise comparisons. The median change in cortisol level for volunteers who interacted with dogs with secure attachment styles was -0.01, and the median change in cortisol level for volunteers who interacted with insecure dogs was <0.01. No significant differences were found with respect to attachment style and change in cortisol level, $U(7.04) = 30$, $p = 0.24$. (See Tables 5 & 6 and Figures 2 & 3). After running an Asymptotic Wilcoxon-Mann-Whitney Test, a statistically significant relationship between baseline cortisol levels and attachment categories was not found ($Z = -1.25$, $p = 0.21$).

Table 5: *Participants and their salivary cortisol levels with dogs categorized as Secure.*

Participant ID #	Attachment category	Pre (µg/dL)	Post (µg/dL)	Cortisol level difference (µg/dL)
046	secure	2.528	1.358	-1.17
048	secure	0.116	0.079	-0.037
050	secure	0.112	0.307	0.195
052	secure	2.1045	3.149	1.0445
059	secure	0.118	0.083	-0.035
063	secure	0.078	0.172	0.643
064	secure	0.127	0.094	-0.033
101	secure	0.077	0.119	0.042
Average:		0.6575625	0.670125	0.0811875

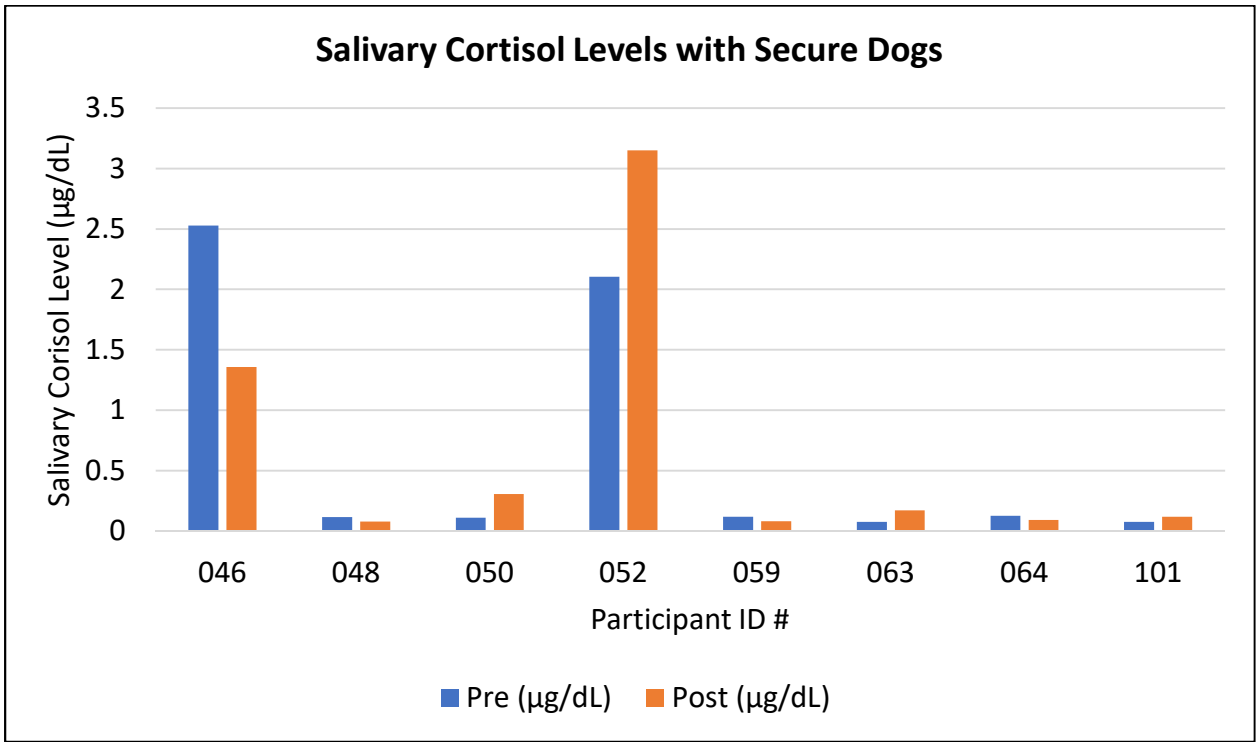

Figure 2: *Participants and their salivary cortisol levels with dogs categorized as Secure*

Table 6: *Participants and their salivary cortisol levels with dogs categorized as Insecure*

Participant ID #	Attachment category	Pre (µg/dL)	Post (µg/dL)	Cortisol level difference (µg/dL)
047	insecure	0.2	0.131	-0.069
051	insecure	0.191	0.185	-0.006
053	insecure	0.039	0.077	0.038
054	insecure	0.097	0.096	-0.001
055	insecure	0.042	0.019	-0.023
056	insecure	0.114	0.051	-0.063
058	insecure	0.052	0.053	0.001
060	insecure	0.175	0.154	-0.021
062	insecure	0.064	0.094	0.03
Average:		0.108222222	0.09555556	-0.012666667

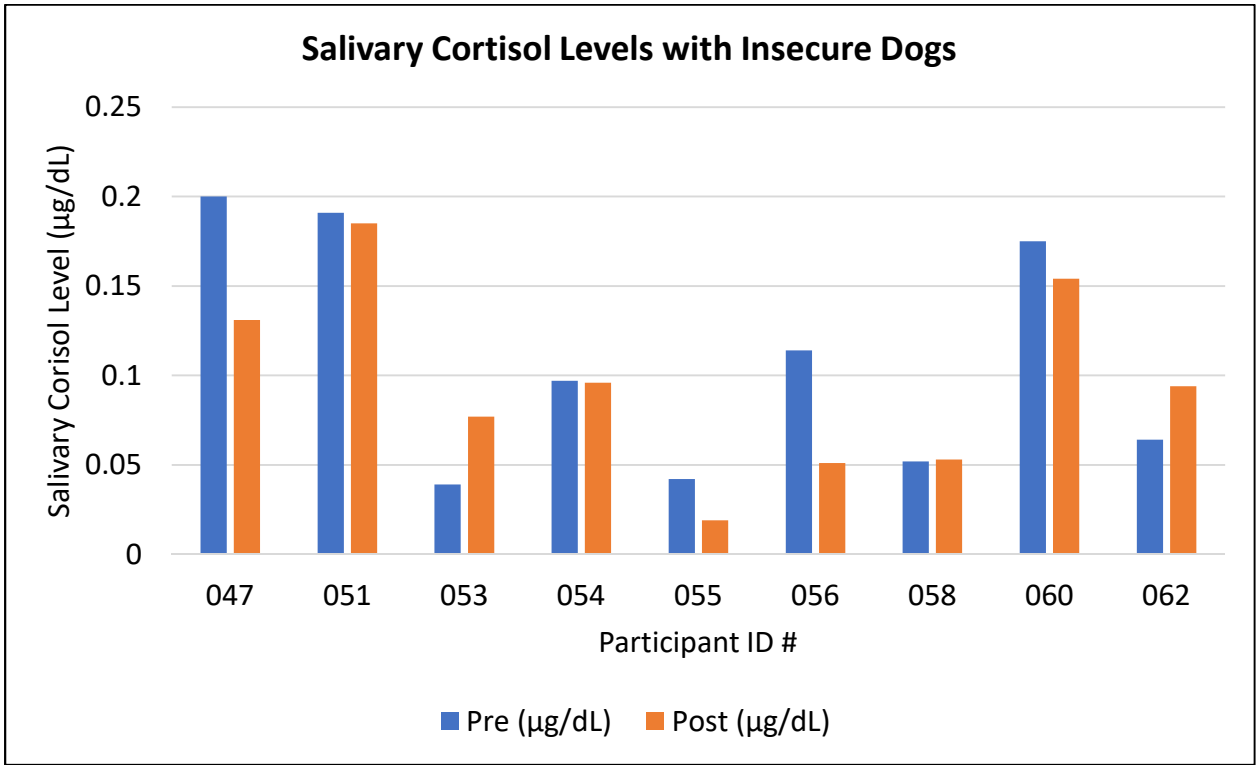

Figure 3: *Participants and their salivary cortisol levels with dogs categorized as Insecure*

A correlation analysis using Spearman's rank correlation was utilized to analyze the relationship between participant LAPS Scores and salivary cortisol levels (See Table 7 and Figures 4 & 5, $r = 0.30$, $p = 0.24$). The association between these two variables was not found to be statistically significant.

Table 7: *LAPS Scores of each participant for their familiar dog and salivary cortisol levels*

Name	Participant ID #	Attachment category	LAPS Score	Pre (µg/dL)	Post (µg/dL)	Cortisol level difference (µg/dL)
Chico	046	secure	5	2.528	1.358	-1.17
Mari	047	insecure	9	0.2	0.131	-0.069
Lincoln	048	secure	8	0.116	0.079	-0.037
Brownie	050	secure	24	0.112	0.307	0.195
Daisy Thriller	051	insecure	-17	0.191	0.185	-0.006
Bandit	052	secure	35	2.1045	3.149	1.0445
Biscay	053	insecure	36	0.039	0.077	0.038
Charlie	054	insecure	-1	0.097	0.096	-0.001
Maizie	055	insecure	-3	0.042	0.019	-0.023
Floki	056	insecure	33	0.114	0.051	-0.063
Jordy	058	insecure	14	0.052	0.053	0.001
Dakota	059	secure	7	0.118	0.083	-0.035
Gemma	060	insecure	13	0.175	0.154	-0.021
Smallz	062	insecure	21	0.064	0.094	0.03
Hoagie	063	secure	-3	0.078	0.172	0.643
Numair	064	secure	22	0.127	0.094	-0.033
Jacob	101	secure	30	0.077	0.119	0.042
Average:			13.70588235	0.36673529	0.365941176	0.0315

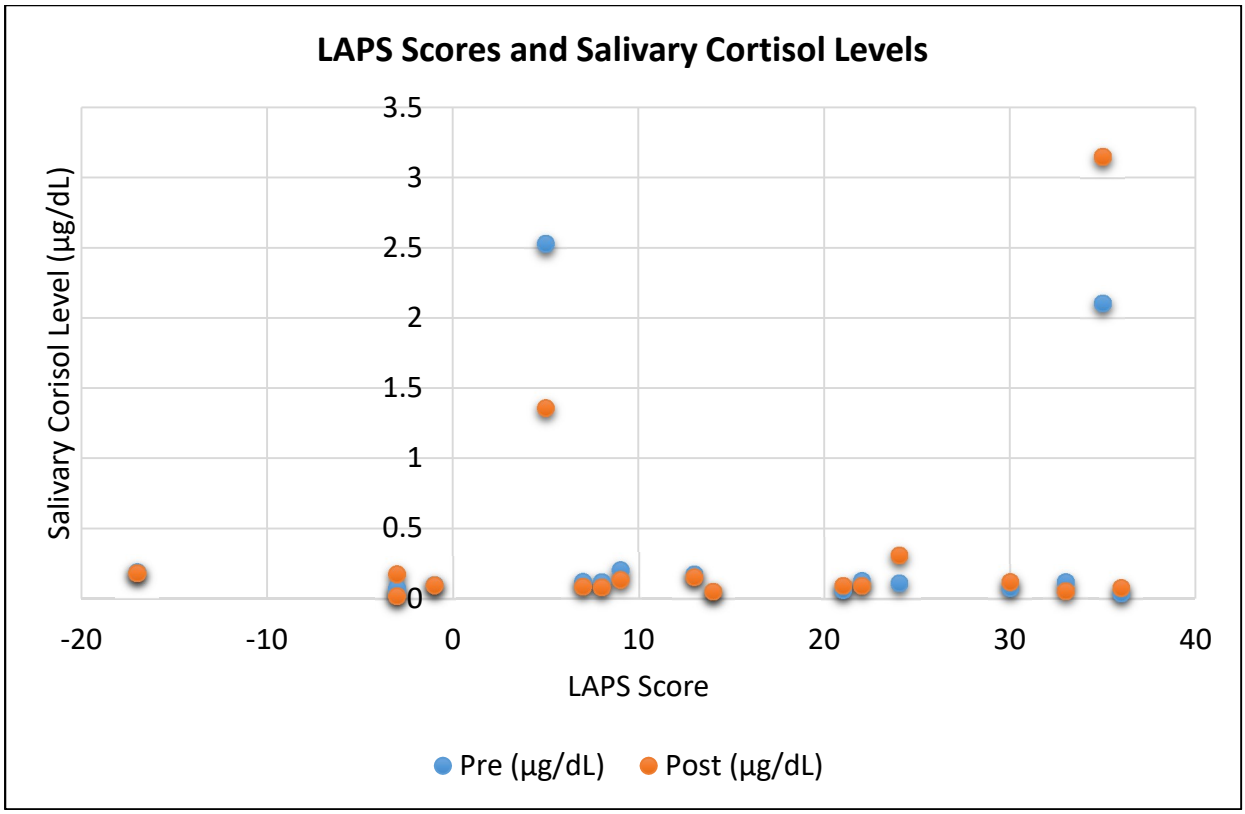

Figure 4: *LAPS Scores of each participant for their familiar dog and salivary cortisol levels*

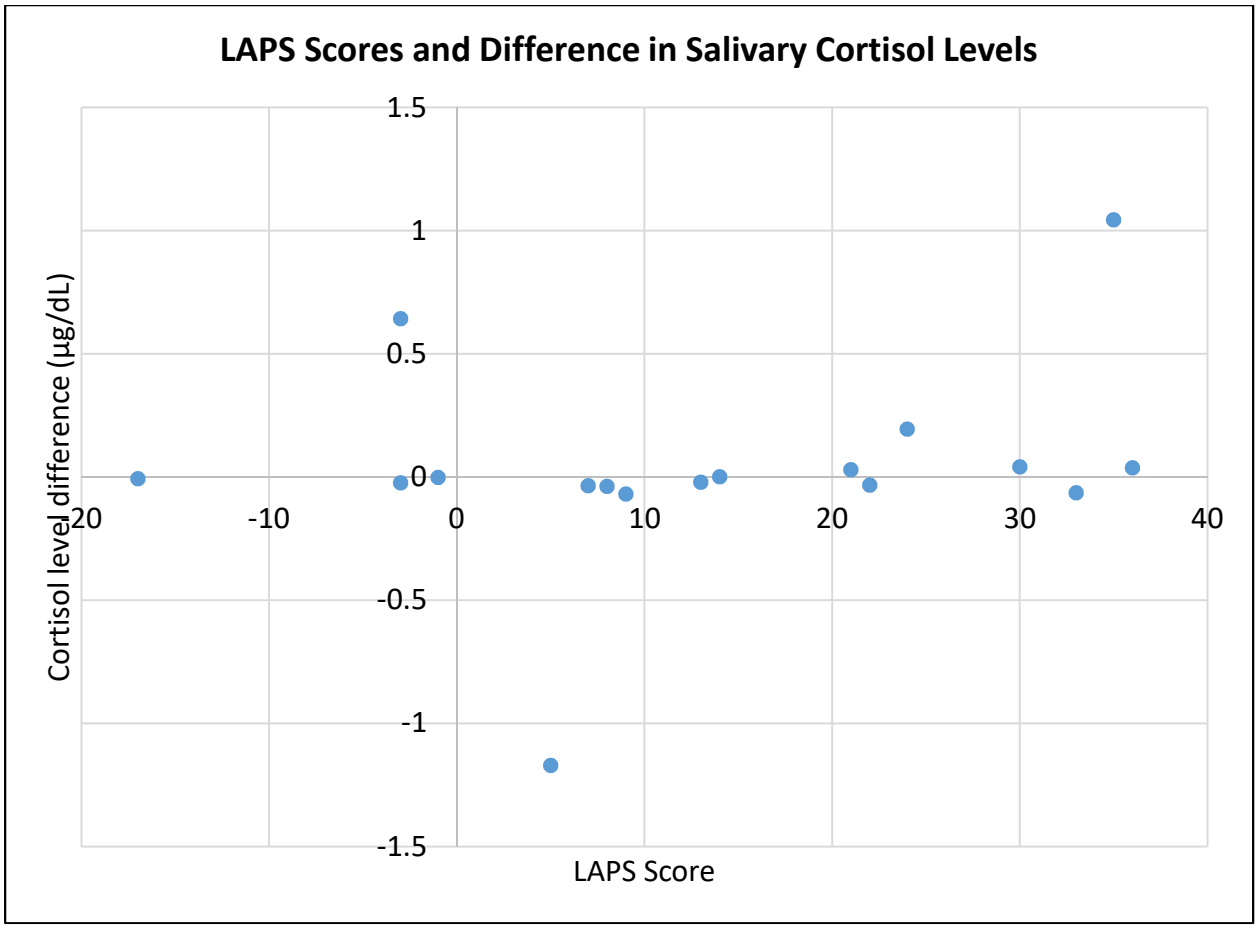

Figure 5: *LAPS Scores of each participant for their familiar dog and the difference in salivary cortisol levels*

A Mann-Whitney U Test was run according to gender of the human and cortisol level difference. No significant difference between male and female cortisol level difference was found with ($Z = -0.38$, p-value = 0.71) $p > 0.05$ (See Tables 8 & 9, and Figure 6).

Table 8: *Female participants and cortisol levels*

Participant ID #	Gender	Pre (µg/dL)	Post (µg/dL)	Cortisol level difference (µg/dL)
046	Female	2.528	1.358	-1.17
047	Female	2.528	0.131	-0.069
048	Female	2.528	0.079	-0.037
050	Female	2.528	0.307	0.195
051	Female	2.528	0.185	-0.006
052	Female	2.528	3.149	1.0445
054	Female	2.528	0.096	-0.001
055	Female	2.528	0.019	-0.023
056	Female	2.528	0.051	-0.063
058	Female	2.528	0.053	0.001
060	Female	2.528	0.154	-0.021
063	Female	2.528	0.172	0.643
064	Female	2.528	0.094	-0.033
101	Female	2.528	0.119	0.042
Average:		2.528	0.42621429	0.03589286

Table 9: *Male participants and cortisol levels*

Participant ID #	Gender	Pre (µg/dL)	Post (µg/dL)	Cortisol level difference (µg/dL)
053	Male	0.039	0.077	0.038
059	Male	0.118	0.083	-0.035
062	Male	0.064	0.094	0.03
Average:		0.07366667	0.08466667	0.011

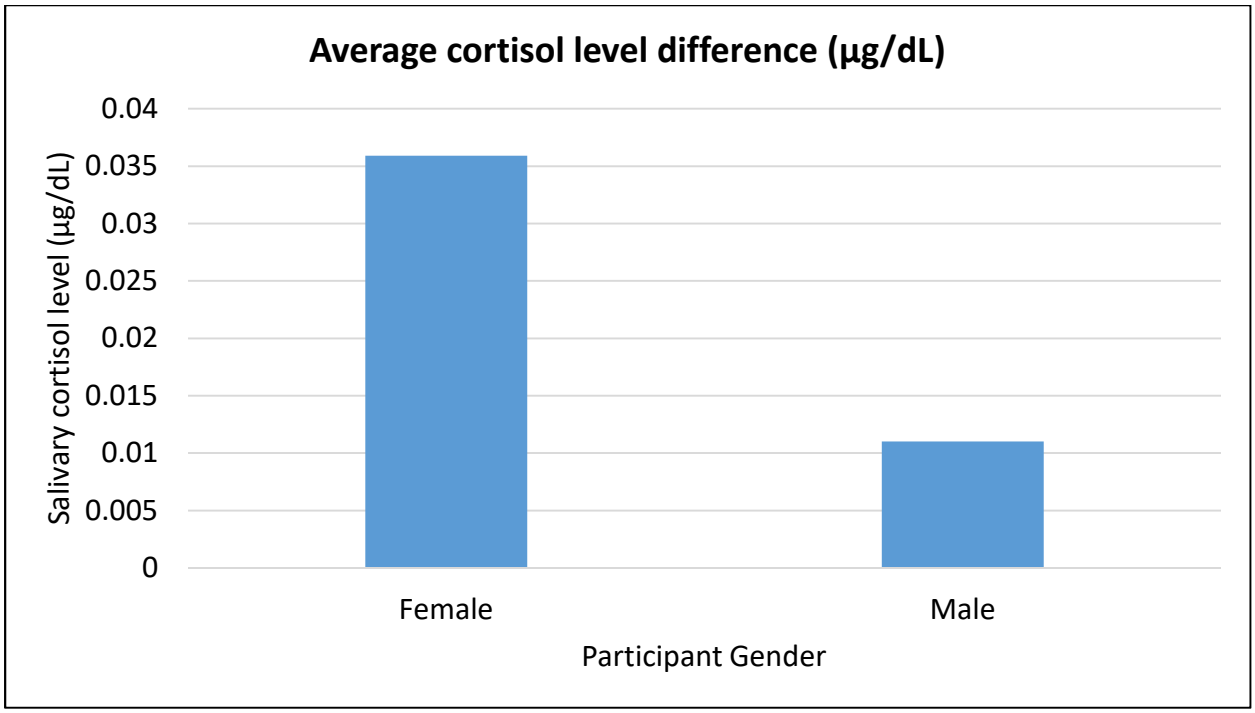

Figure 6: *Average difference between pre and post cortisol levels in male and female participants*

Discussion

In the current study it was found that shelter volunteers, responsible for caring for and walking dogs, were rather stable in terms of their salivary cortisol levels and therefore stress levels before and after a social interaction test with a familiar dog. Following this, no significant impact on the stress response of shelter volunteers depending on the attachment style of the dog or the level of human attachment to the dog was found. Most participants were also within the normal health range expected in human saliva.

One reasonable explanation for this outcome is that Willamette Humane Society has a rather positive culture and high save rate of about 95% compared to the national average euthanasia rate of approximately 14% (I. W. D. Team, 2017; M. Team, 2019) So in the case of this particular shelter, it is well known that there is quite a high likelihood for positive outcomes for the animals that come into this shelter potentially compared to other shelters across the United States. Therefore it is possible that the volunteers have less feelings of anxiety or stress related to their work in this environment as there may be less worry about the outcome of the shelter dog. Since positive outcomes are quite high for this shelter, this possibly also helps to retain volunteer satisfaction and retention (Davis, n.d.).

It may be important to note that many shelter workers may also have a communal understanding of why euthanasia may be necessary at times, which can help with their coping of such a loss in the cases where this does occur. Many workers reported that when euthanasia's were performed to help the animal end suffering and provide a better alternative to living, then the euthanasia was actually perceived as a gift to both the workers and the animal. This contrasts feelings of killing animals for convenience purposes such as overcrowding of the shelter, lack of funds, or other reasons This contrasts feelings of killing animals for convenience purposes

(Verdon, 2006). The culture of the shelter also was found to help newcomers ease into the idea of euthanasia's prior to their own exposure to it (Scotney et al., 2015). However, to our knowledge none of the volunteers in our current study had actively been involved in the act of euthanasia or other morally stressful tasks as a part of their volunteering routine which could mean that they are able to avoid this situation of dealing with the moral stress of euthanasia.

Another factor to consider from this study that may have had an influence on the results is that all shelter volunteer participants interacted with other people during the study too. During the alone phases of the Secure Base Test, each participant typically spent the two minute waiting periods talking with the researchers and research assistants. It has been reported that social interaction and social support can also have impacts on an individual's stress levels (Cobb, 1976) and it is possible that these participant interactions with the experimenters (unfamiliar people) could have had impacts on the results of the study. For example, one study concluded that children performed in situations better and with less stress when they were in the presence of a friend rather than a stranger (Winstead, Derlega, Lewis, Sanchez-Hucles, & Clarke, 1992). However, it was also found in another experiment on women that those in the presence of the experimenter had higher physiologic reactivity than if they were in the presence of a pet dog or another female friend (Allen, Blascovich, Tomaka, & Kelsey, 1991). So depending on how the participant perceived being in the presence of other humans or the experimenters, it is possible that the presence of other humans may have also increased or decreased stress levels of the participants.

Something else that may be interesting to consider is the fact that these participants may not have been stressed to begin with. Because of this, it may be possible that this interaction did not have much of an impact on the participants because they were already stable in their stress

levels prior to the experiment. It was also found that those with anxiety or mood disorders have a greater stress reactivity than healthy individuals (Brown). Since we did not gather information on the mental health status of the participants, it is possible that factors such as this could have also contributed to the observed results.

Future Directions

Given the relatively low and stable cortisol levels observed within the volunteer population at our chosen shelter, it may be beneficial to in future studies look at the shelter employees rather than the shelter volunteers, as compassion fatigue may be more prevalent in this population. While volunteers are also prone to being exposed to negative sights such as animals that were abused or the euthanasia process, they are not required by many shelters to perform euthanasia as this is typically a trained worker's duty (Davis). Additional research is also needed to examine a wide variety of shelter environments, including those with lower adoption rates, and possibly more environmental variables.

As mentioned above, this particular shelter has a high positive outcome rate compared to many shelters, so loss of one of the shelter dogs they personally cared for can be quite a rare experience for these particular volunteers. However, for future studies it could be valuable to study volunteers' levels of attachment to the dogs and potential for grief following a loss.

Time of day for this experiment was not controlled but could possibly have value for future studies. Cortisol levels naturally change throughout the course of the day ("Salivary Cortisol ELISA Kit,") and may have also impacted the cortisol levels. Future studies could

potentially control for the time of day by being consistent in the time of day that the experiment is run and the samples are taken.

Although the reviewed literature states that salivary cortisol levels can change within a matter of minutes (Kalman & Grahn, 2004) samples for this experiment may have been taken too quickly in order to observe a significant change. Saliva samples from the volunteers were taken immediately after dog interaction, so it may be possible that the levels of cortisol in participants' saliva were on a slight delay. For future studies, it may be beneficial to wait a few minutes after interaction or perhaps even lengthen the time of the testing session to see a greater impact on their salivary cortisol levels.

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