Dogs and blood pressure in non-dog owners

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Running Head: THE FUNCTION OF CANINE PRESENCE IN REDUCING BLOOD PRESSURE IN HUMANS

Dogs and blood pressure in non-dog owners

Natasha D. Adamson

Carroll College
This thesis for honors recognition has been approved for the Department of Psychology.

Dogs and blood pressure 2
Abstract

Several studies have shown that the presence of a dog can reduce blood pressure during a stressful situation. A study done in 2001 demonstrated that for blood pressure to be reduced during a stressor the subjects must be dog owners. The purpose of this experiment was to determine if four, one hour, exposures to a dog is sufficient for reducing blood pressure in non-dog owning subjects. Twenty-three volunteers from an undergraduate psychology class were shown three holocaust photographs, in the presence of a familiar dog, unfamiliar dog, or without a dog. The results of the study found that there was a significant difference in blood pressure rate changes as a function of the slightly familiar dog’s presence. The lower blood pressure was associated with the group that was previously exposed to the dog. These data suggest that non-dog owning subjects can experience lowered blood pressures if they are exposed for a short amount of time to a dog prior to testing.
Introduction

History of Animal therapy

The idea that animals have a healing quality reaches back to the dawn of civilization. The Mayans believed that each human being is given a soul animal to serve as a protective guide in his/her earthly life. The Soul animal, or Tona is related to the soul energy that is connected with the animal, and which becomes connected to the person. Whatever happens to one is the fate of the other, such as illness or death (Sahagun, 1969). In Egypt the deity Anubis, physician of the gods, bore a canine head (Aldred, 1998). Seen today in post-classical Greek art the dog represents loyalty and love often featured with Aphrodite and Venus (Hall, 1995). In more modern times, Florence Nightingale promoted pet ownership as a way to ease the suffering of the chronically ill (Beck & Katcher, 1983).

In 1972 the relationship of canine and human took on a psychological aspect, serving as a form of therapy. The York retreat in England was the first documented use of animals in therapy. York was a lunatic asylum founded by the Society of Friends. William Tuke, a Quaker merchant, believed that animals would enhance the humanity of the emotionally ill. The asylum used farm animals to better teach self-reform to the patients. The patients were taught self-control as they were charged with the routine care of the animals in the program. (Beck & Katcher, 1983).

Another program was located in Bielfeld Germany, and originated from the Bethel institute for epileptics. It has succeeded as being the longest running program since its founding in 1867. The program used a wide range of animals, encompassing domesticated farm animals and pets, to wild animals from a game park. The animals were used as aids in treatment of a wide range of mental disorders. Unfortunately, like the previous treatments, there was no systematic record by which the effects could be evaluated. (Bustad and Hines, 1984).

According to Levinson (1969) there was not another recorded use of pets in therapy until 1944. In 1944 The American Red Cross ran the Army Air Forces Convalescent Center, and used dogs by giving them to officers and enlisted patients. They then combined daily training session with their normal rehabilitation routine. The American Red Cross reported an increased sense of integrity and responsibility among
the patients. Unfortunately, no significant records were kept on the effects of the human-animal interactions and the program was discontinued after World War II. No further use of animals in therapy is revealed in the literature until Boris Levinson described his use of animals as adjuncts in his practice of psychology (Levinson, 1962; 1969; 1975).

The popularity of animal therapy grew in the late sixties when Boris Levinson, Ph.D started to use animals as a way of psychological assessment. Levinson’s research in the field grew from serendipitous circumstances. When a young boy, who showed strong signs of withdrawal, and his mother showed up for an initial assessment Dr. Levinson’s dog happened to answer the door. The dog showed immediate affection toward the boy. Dr. Levinson reported the initial introduction alone brought out interaction abilities in the boy, and created a bond that Dr. Levinson documented as enabling the communication process to begin. (Levinson, 1969). After this initial observation Levinson began to use animals in assisting him through the psychological assessment of children. He assessed their behaviors/interactions with the animal and determined what problems the child might be suffering. From the experiments with his clients he began writing journal articles documenting his success, as well as his theories as to why the process worked (Levinson, 1969). While Dr. Levinson showed intelligent reasoning in the area of animal therapy, his conclusions were based on observation and not experiential research or concrete data.

In the eighties systematic research was done on the theory that animals were a positive influence on the human beings. Most research is composed of studying those people who have lived with an animal for a long period of time, as well as assessing nursing homes that bring pets in as friendly companions for the elderly. In 1991 Karen Allan furthered the research when she investigated autonomic responses to stress under different circumstances. The researchers measured blood pressure and heart rate in forty-five adult women who were asked to perform an experimental stress task in the laboratory with only the experimenter present, and two weeks later at home in the presence of a female friend, a pet dog, or neither. The results suggested that autonomic reactivity was moderated by the presence of an animal companion. There was less physiological reactivity during stressful tasks performed in the presence of the dog than in any of the other situations (Allen, 1991).
The relationship was further scrutinized in 2001 when Kingwell, Lomdahl, and Anderson performed a study that intended to increase the accuracy of blood pressure and heart rate measures by using continuous monitors. Their study revealed an aspect not yet measured by previous scientists. A dog owner experienced a decrease in blood pressure in the presence of a dog during the mental stress, yet when a non-dog owner was introduced to the same mental stress in the presence of the same dog, his/her blood pressure rose significantly. These results suggest that a dog may be a positive influence on dog owners in situations of tension, such as therapy, but for non-dog owners there may be no benefit (Kingwell, 2001).

The study performed by Kingwell seems to suggest that only those who are dog owners can experience positive results. Regardless of Kingwell’s work using canines in therapy is gaining in popularity. To date therapists may register their dogs for use in therapy and use them during sessions. For a pet to become registered through the Delta Society there are four steps one must go through. The steps are: training, health screening, team evaluation, and registration. After registered the animal is a member of the Delta Society Pet Partners, and may be used in a therapy setting (Become a partner, 2004).

**Animal Assisted Therapy**

Pets have the ability to reduce anxiety and promote a feeling of safety, whether or not the threat is real (Cusack, 1980). According to the Delta Society, animal assisted therapy (AAT) “Is a goal-directed intervention in which an animal that meets specific criteria is an integral part of the treatment process. AAT is directed and/or delivered by a health/human service professional with specialized expertise, and within the scope of practice of his/her profession” (Delta Society, 2004). The purpose of AAT is to promote improvement in human physical, social, emotional and/or cognitive well-being. AAT comes in a variety of settings and is documented and evaluated by an overseeing therapist.

There are two main aspects of pet psychotherapy: the use of pets in the therapist’s office, and the assignment of pets to a home with continued therapy of the patient (Levinson, 1970). Pet therapy takes different forms for different clients. The goals and objectives of the sessions are unique to each individual, and are assigned by the therapist.
The most commonly used definition of pet therapy is, "a bridge by which therapists can reach patients who are withdrawn, uncooperative, and uncommunicative" (Oden, 1980).

According to Levinson (1972), beginning sessions of therapy are often fraught with anxiety. The first meetings with a new therapist are often accompanied by uncertainty, and fear. Levinson suggests that an animal may serve as a sort of lightning rod, redirecting and mollifying the anxiety of the patient, due to the fact that the pet is not associated with the dangerous situation. The pet provides for physical contact without fear of retaliation that the patient may have experienced in previous relationships.

**Delta Society**

The largest animal therapy organization is the Delta Society based in Seattle, Washington. The Delta Society provides training and materials in pet therapy for professionals, as well as volunteers and the public. The society has strict guidelines for the types of animals that can be used. They also run the National Service Dog Center and Pet Partners. This is a broad program which provides services to anyone who is interested in either becoming a volunteer to take animals to facilities, therapists who are interested in using animals, or general individuals who are interested in the subject.

The Delta Society supports many different forms of Animal Assisted therapy, as seen on their web site. One example given on their web site describes the use of Animals to assist with a mentally disabled client without the ability to sequence events. To accomplish this task the client and therapist practice the steps in brushing a dog: 1. Get the brush out of the bag, 2. Tell the dog to stay, 3. Brush the dog, 4. Tell the dog, "Good boy". It is suggested that the motivation to complete the task enables the client to understand the sequence.

The Delta Society maintains a long list of goals for AAT, which can be found on their web site. The list includes divisions of: physical, mental, motivational, and educational. All goals are expressed through a wide variety of activities utilized by each individual therapist at their discretion.

A "typical" session does not exist in the field of animal therapy. Due to the wide diversity of needs, the interventions and the sessions are quiet different depending on the needs of the client, or clients. Each treatment plan is individualized. As each client may
be suffering from different illnesses, the role needed from the animal is quite diverse. While one patient may need a non-judgmental friend, the next might need a loving touch. Dr. Levinson suggested, however, that in all therapy sessions the animal serves as an assessment tool in the client’s needs and growths (1970). According to Levinson these, “seeing heart dogs”, are a widely untapped resource.

Basic Principles of AAT

In 1970 Boris M. Levinson, PH.D. published an article for use of pets in therapy sessions, he article describes basic principles and general methodology of animal therapy. Levinson described the animal as an accessory or tool in the therapy sessions. The dogs presence created a relaxing and inviting environment, enabling the patient to feel more comfortable. He suggested that the dog made it possible for a strong foundation to be made between the patient and client, which permitted the communication to progress.

Boris explains that years ago parents and children lived circumscribed lives, listened to the same music, engaged in similar activities, and participated in the same religion. Every member of the family participated in the family enterprises. The family ate in the same location. Today life is much different. Many families have few common denominators. However the love of a pet seems to be universal. The love of a pet “May be the only activity in which they are equals and about which they see eye to eye” (1970). Therefore pets can be extremely helpful in the field of family therapy.

It seems that in many situations a pet can help with the stranglehold a parent has on a child. In many cases the parent will transfer this attachment to a pet, where as the parent may other wise be holding the child back. Levinson also says that the pet frequently indicates family tensions and conflicts as revealed in family member’s relationship to the pet. For example, if the child is hostile toward the pet, he/she could be reflecting hostility that is going on in the home (1970).

In cases of physical illness, Levinson describes a relationship of understanding. A patient may be able to share their discomfort with a pet, with out the fear of an upsetting reaction. Levinson claims that in the case of physical illness the pet becomes, “An antidote to apathy and a talisman against the fear of death”(Levinson, 1970). Patients who have been institutionalized for a long time tend to become apathetic and need a large
amount of sensory stimulation. An active pet in this case may stimulate the patient, motivating him/her to become more active in life (Levinson, 1972).

Levinson suggests that the mental hygiene value of a pet is immense. He says that to deprive a child of the emotional experience of playing with a pet is to deprive him/her of many learning opportunities. Through play with a pet, "the child learns to express his views of the world, its animals, its problems, its human beings, including his parents and his peers" (Levinson, 1970). The child often learns to resolve some of the problems relating to his/her peers. Levinson indicates that it is through play with a pet that we may view many psychological and social needs, and in a sense give us a closer view of the child’s development level. It may give clues to whether the child’s difficulty is psychogenic or organic in origin.

Beck and Katcher believe that animals can make a unique contribution to therapy because of their capacity to make people feel safe, loved and worthwhile (1984). They report effectiveness in people who can no longer be helped by other people. Most patients who are depressed and withdrawn have been hurt by words, animals prove helpful because they do not use words (Beck & Katcher, 1984).

Beck and Katcher, refer to animals as the perfect mother, "An animal is a teddy bear and security blanket for young children" (1983). Later in life this same feeling of overflowing love and uncritical acceptance is attached to pets, who also have the ability to evoke love by those who have been hurt before. The most remarkable claim by these authors is that animals have the capacity to call forth speech from those who have given up speaking. They say this phenomenon exists because the love the pets elicit from patient is unambivalent, unalloyed with distrust and fear that frequently color even loving relationships with other human beings.

Another theory for the effectiveness of ATT is related to touch and connection. Connection is an essential part of life and has been proven to reduce stress, create feelings of intimacy, closeness and completion (Beck, 1984). Many scientists agree that touch is a crucial part of development as well as socialization. According to Dr. Caldwell, touch stimulates the hormone oxytosin, a bonding hormone that primes the brain to alert itself to the need for bonding and to respond to visual and non-verbal cues. In our society there are many ethical issues that prevent a therapist from touching his/her patient. It
seems that this is a place where therapeutic animals play a large role. While the therapist may not be able to calm his/her patient with a calming touch, the animal may serve as a replacement.

The physiology and Psychology of Anxiety

Webster’s Dictionary has defined anxiety as, “a painful or apprehensive uneasiness of mind” (1995). For researcher Spilberger (1972) anxiety is, “an emotional state consisting of feelings of tension, apprehension, nervousness and worry, and activation or arousal of the autonomic nervous system”. Anxiety is then broken down into two parts: state anxiety and trait anxiety. State anxiety is characterized as being a temporary emotional state that reflects the individual’s perception of the stressful event. Trait anxiety is reflective of the individual’s differences in anxiety tendency and the frequency to enter and anxiety state.

A further distinction is made, at both the levels of state and trait anxiety, between worry and emotionality (Spielberger, 1980). Worry refers to the cognitive component of the anxiety experience. Individuals respond to threat with worries about imminent danger and their perceived lack of competence to react. Emotionality is then the perceived arousal component of anxiety. Emotionality can be seen in individuals who experience, headache, nervousness, sweating, and other bodily reactions. While these two may be present at the same time, to some approximation, they are only moderately related to each other. Also, they differ in terms of their behavioral consequences. Worry is substantially related to performance impairment, and emotionality is not.

Stress and anxiety influence blood pressure. When blood pressure is taken, two measurements are recorded, systolic and diastolic values. If the two measurements were systolic 130 and diastolic 70, they would be written as "130/70." A physician or nurse would describe this blood pressure as "one-ten over seventy." A normal resting blood pressure reading is 120/70. Systolic pressure is the pressure or force the heart places on the walls of your blood vessels as it is working/pumping with each heartbeat. Diastolic pressure is the lowest pressure the blood places on the walls of your blood vessels when the heart is relaxed between beats. Both of these measurements are important. A high systolic pressure indicates strain on the blood vessels when the heart is attempting to
pump blood into your bloodstream. If your diastolic pressure is high, it means that your blood vessels have little chance to relax between heartbeats (Moser, 1983). It is the moderation of blood pressures that allow researchers to operationally define anxiety.

Clinical Studies

Multiple studies have researched the effects dogs have on subjects in diverse anxiety-producing situations has been investigated by several scientists. Hart J., Hart B., Benjamin & Bonita studied people in wheelchairs who have service dog (1986). The subjects were to report their experiences in public before and after obtaining their dogs. The hypothesis was that the acquisition of a service dog would increase the number of friendly approaches by strangers. They found that subjects reported a significantly higher number of social greetings from adults and children on a shopping trip with their dog, than when they were alone. They also found that the subject’s evenings out increased after obtaining their dogs. This study suggests that service dogs may provide a role in creating social acceptability, approachability, and interest for those with disabilities.

It has also been popular for pets to be part of an elderly community for years. A study concerning ATT was conducted with male and female nursing home residents, with ages ranging from 35-95 and length of stay from 1-165 months (Perelle & Granville, 1993). The residents were examined for change in psychological well being and socialization skills over a three month period of time. Patients were screened and those having the following conditions including: 1) hypertension, 2) cardiac problems, and 3) Alzheimer’s or dementia, and 4) Aids. The patients were introduced to pet assisted therapy 1.5 hour per day once a week for three months. Researchers noted the behaviors of the residents over Results showed that both sexes responded to the animals. The presentation of animals increased social interactions between residents and encouraged the expansion of social behaviors.

The ownership of animals can lead to possible health benefits. One study analyzed the archival data of the ill-fated CAST (Cardiac Arrhythmia Suppression Trial) (Pickering, 2001). Through comparison of those subjects who owned pets versus those who did not, Pickerings found that dog and cat owners have a better rate of survival than those who do not own pets. The socialization that comes with the ownership of animals,
as well as the exercise needed to maintain an animal enhanced survival of heart attack victims.

Talking to and petting companion animals results in less autonomic arousal than talking to other human beings (Beck & Katcher 1984). In some instances relating to animals produces a reduction in arousal below resting levels. Beck and Katcher found positive changes in speech patterns and facial expression while a subject was conversing with an animal. When the subjects held a conversation with a human, there were increases pitch, and a tensing in facial muscles. The writers indicated that in all cases, subjects appeared more at ease in presence of animals versus humans.

In a similar experiment 45 adult women performed a standard experimental stress task in the laboratory with only the experimenter present. Two weeks later they performed the same task at home in the presence of a female friend, a pet dog, or neither. The results demonstrated that autonomic reactivity was moderated by the presence of a companion. The reaction was even less stressful when the subject was in the presence of the dog, than when the subject was in the presence of a friend (Beck & Katcher, 1991).

The work by Beck and Katcher has spurred more research in the area of autonomic response to the presence of animals. One study went into the pet owner’s home and measured blood pressure and heart rate of people while petting their dog (Jenkins, 1985). Subjects in the experiment ranged from 9-58 in years, with a mean age of 29; there were 4 males and 16 females. The subjects were repeatedly measured for blood pressure while reading allowed and petting their dog. Researchers found a significant decrease in blood pressure, and confirmed reports by previous investigators.

The effects of a friendly dog on cardiovascular and autonomic responses to acute mild mental stress were investigated (Kingwell, 2001). He found that for dog owners, there is a decrease in blood pressure when in the presence of a dog; however there is an increase in blood pressure for those who did not own dogs. This research confirms previous findings that dog owners can have physical benefits in the presence of a dog; however it brings to light the fact that non-dog owners may not receive the same benefits. The purpose of this project was to determine if brief exposure to a dog among non-dog owning subjects could reduce the anxiety experienced during a stressor.
Method

Participants

A sample of eighteen undergraduate student subjects (four male and fourteen female) of various majors was recruited from the Introductory Psychology class. Subjects ranged in age from eighteen to twenty-seven, with an average of nineteen. Subjects were assumed to be well and had few health problems. Surveys indicated that none had abnormal blood pressure and all subjects had not owned, or lived with, a dog for the past year. Subjects were randomly assigned to one of three groups by experimenter. The numbers of participants in each group were: group A, 6, group B, 5, and group C, 7.

Materials

A UA-200 professional sphygmomanometer was used to measure blood pressure and a Littmann Classic II S.E. Stethoscope, was used to listen, while monitoring blood pressure. A Timex wristwatch was used to time the experiment, and duration of picture viewing.

When students arrived to the testing room they were asked to fill out a survey and consent form. The forms were both created by Natasha D. Adamson specifically for this research and have not been published. (These forms can be found in Appendix A & B)

Three separate photographs of the holocaust from the Donald S. Robinson Collection were used to show the subjects during the experiment, as a way to increase blood pressure (see figures 1, 2, & 3). A blood pressure record sheet was provided for each subject (see Tables: 1, 2 & 3).

The canine included in the research was a four-year-old boarder collie. Alpa, the dog, is owned by Dr. Anne Perkins, Psychology Department Head at Carroll College. The dog was well mannered and interested in approaching the subjects.

Procedure

A classroom of Carroll College’s Simperman Hall, room 312, was used for the experiment. When subjects arrived there was a sign on the door which read, “experiment in progress”. Subjects waited outside the room until they were invited in for the trial.
In the classroom, things were setup as normal, and the chalkboard was clear. On the first table, facing the chalkboard, the pictures, blood pressure cuff, experimenters clipboard, and pencils were resting. Around the room was a wrap-around table, which was used for class computers. Adjacent to the door, on the wrap around table, was a pile of wavers and surveys (Appendix 1 & 2).

I brought subjects into the room, thanked them for their participation, and introduced myself. Then I gave participants a survey and waiver to fill out. After the waver was signed the subjects were given a survey to fill out. When all the paperwork was finished, I directed subjects to the table, where the blood pressure cuff and other instruments lay, and asked them to sit down. Once subjects were seated I explained that I would be leaving the room for one minute.

Once outside of the room I set my watch for one minute. When time was up I returned to the room and promptly took a baseline blood pressure. Following the acquisition of blood pressure measurements, I showed the subject a series of holocaust photographs. There were a total of three holocaust photographs, and each was shown for exactly thirty seconds. Upon completion of the photo viewing I took the blood pressure again to indicate if, or how much, blood pressure had changed. After I collected the second set of blood pressure measurements I informed the subject that I would be leaving the room for another minute.

When I left the room I then set my watch for another minute. Upon returning I either came back with a dog, or no dog. For the control group (group C) I returned with no dog. If I returned with a dog, the dog was set in between myself and the subject at the table. Once the subject was seated, I began the same procedure that had taken place in the beginning. From acquiring blood pressure, to viewing the photographs, everything in the second test was the same as the first. The only difference would be the presence of a dog, for groups A & B.

Design

The design the experimenter used was a one-way analysis of variance. The independent variable was the presence of a dog: dog or no dog, and the dependent variable was blood pressure.
Subjects were randomly assigned to one of three groups. Group A, who had never met the dog, but who had the dog present in the second test. Group B, who was introduced to the dog four times for an hour before the experiment, and who had the dog present during the second part of the experiment. Group B’s four hour exposures consisted of the dog’s presence in the same classroom during a one hour lecture, which took place four times over the course of a month. During the sessions the dog was allowed to wander throughout the classroom and interact with the students. The last group was the control group, Group C, who had never met the dog, and the dog was not present during the experiment.

Results

Differences between baseline measures on diastolic and systolic blood pressures were measured for all subjects during a baseline measurement, and then again with the dog present, or not present, for comparison. An analysis of variance (ANOVA) was performed on changes in subject’s blood pressure responses during the experiment. The ANOVA performed on systolic blood pressure changes found no significant difference between the groups, F(2, 15) = 2.56, P > .05. While the ANOVA performed on diastolic blood pressure change indicated a significant effect of the experimental condition, F(2, 15) = 4, P < .05. Diastolic blood pressure changes differed significantly between groups where there was no dog present, X = 5.5, an unfamiliar dog present, X = 1.3, and a familiar dog present, X = .2 (see Table 4).

Discussion

The results of the experiment support the my hypothesis that four one hour exposures to an unfamiliar dog, does result in lowering blood pressure during a mild mental stress for a non dog owning person. The experiment also demonstrates that non-dog owning subjects experience a decrease in blood pressure during a mild mental stress when a dog is present. For those who were part of the group that was exposed to the dog prior to the experiment, their blood pressure decreased to a larger degree. The data support the findings of Beck and Katcher (1984), and Jenkins (1985). In contrast these
findings contradict the results of Kingwell (2001), who found that for non-dog owning subjects, the presents of a dog during a mild mental stress would increase blood pressure.

Implications of the present study indicate that dogs are a useful tool in the management of stress and anxiety. Blood pressure of those in the presents of the dog decreased significantly more than those of the subjects who were tested with out the dog. This implies that the presents of a dog can alter the physiological processes associated with anxiety.

This research adds to the firm foundation for understanding the relationship between animals and psychological processes associated with anxiety. Further research should test a larger sample size. Only one dog was used in this study. Future research might look at the influence of different breeds, sizes, and colors of dogs on subjects. Other suggestions include testing: different subject ages, subjects from different areas and cultures, and subjects under different mental stresses.

Thus research has shown that animal owners receive positive health, and social benefits, from the presence of animals. Many studies have indicated that animals may be helpful in facilitating socialization, where it may be difficult to attain. For those who have socialization problems, this research suggests that owning an animal has positive effects, even for those who were previously non-dog owners. Research has focused on the positive effects animals have on autonomic responses associated with stress. This project clearly supports the notion that even non-dog owners can have reduction in blood pressure with as few as four previous exposures to a pet dog.
References

Dogs and blood pressure


Springfield, MA: Merriam Webster.


Perelle, I.B; Grandville D. A: Assessment of the effectiveness of a pet facilitated therapy program in a Nursing home setting. 1993


Appendix A

**Survey**

General Psychology ID:

Sex:  M      F      Age: ......      Is your blood pressure usually in the normal range: Yes   No

If not how is it usually skewed: High   Low   How

How long has it been sense you lived with a dog: ........................................

Please describe your involvement with dogs over your life time (none, constant...)?
Appendix B

Informed Consent for a Psychological Study

I, ..................., voluntarily give my consent to serve as a participant in a psychological study conducted by Natasha D. Adamson, a Carroll College Student. I realize that it may not be possible for the examiner to explain all aspects of the study to me until it has been completed. It is also my understanding that I may terminate my participation in the study at any time without penalty. I also understand extra credit will only be given after completion of my participation in the study. I further understand that I will be informed of the results and that the results will be used in a report anonymously.

Name: .................................. Phone Number: 

Signature: .................................. Date: 
Table 1

Group A: Subjects who were introduced to an unfamiliar dog.

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Table 2

Group B: Subjects who were introduced to a familiar dog.

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<td>118</td>
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<th>trial 4 SS</th>
</tr>
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<td>68</td>
<td>62</td>
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<td>74</td>
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Table 3

Group C: Subjects who had no dog present (control).

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>trial 1 DS</th>
<th>trial 2 DS</th>
<th>trial 3 DS</th>
<th>trial 4 DS</th>
</tr>
</thead>
<tbody>
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<td>155</td>
<td>135</td>
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<td>145</td>
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<td>142</td>
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<td>121</td>
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Table 4

One way analysis of variance for diastolic blood pressure.

<table>
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<tr>
<th>Groups</th>
<th>Count</th>
<th>Sum</th>
<th>Average</th>
<th>Variance</th>
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</thead>
<tbody>
<tr>
<td>Column 1</td>
<td>7</td>
<td>9</td>
<td>1.29</td>
<td>3.24</td>
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<tr>
<td>Column 2</td>
<td>5</td>
<td>1</td>
<td>0.2</td>
<td>8.2</td>
</tr>
<tr>
<td>Column 3</td>
<td>6</td>
<td>33</td>
<td>5.5</td>
<td>23.5</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>90.55</td>
<td>2</td>
<td>45.27</td>
<td>4.00</td>
<td>0.040</td>
<td>3.68</td>
</tr>
<tr>
<td>Within Groups</td>
<td>169.73</td>
<td>15</td>
<td>11.32</td>
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</tr>
<tr>
<td>Total</td>
<td>260.28</td>
<td>17</td>
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</tr>
</tbody>
</table>
Figure 1. First image used in experiment.
Figure 2. Second image used in experiment.
Figure 3. Third image used in Experiment.