Shinrin-yoku (forest-bathing) as a Factor In Canine Well-Being

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Abstract

This pilot study examined the potential stress reduction benefits produced by both play and exposure to a novel forest condition in five average dogs. Studies on the effects of Shinrin-yoku (forest-bathing) on urban city dwellers have described significant decreases in cortisol, blood pressure, heart rate, and sympathetic nerve activity after only 20 minutes of exposure. Comparable reductions in canine cortisol levels have been reported after short play sessions in working and shelter populations. Based upon these health outcomes, this study considered the potential health benefits for dogs gained from playing in a novel forest setting compared to their urban home settings. Salivary cortisol measurements were taken from five canines pre and 20-minutes post play in each condition. Statistical analyses revealed no significant effect ($p > .05$) from either the forest intervention or play. While the results were unable to support the current findings and the initial assumptions of this study, these findings may suggest instead that the average family dog's stress levels are lower in many conditions due to their unique position and relationship with their established families. Since this is the first time cortisol has been evaluated in a normal canine population, this may account for the non-significant findings as none of the participants were working or living under stressful conditions that are associated with elevated cortisol levels. Taking this significant difference in populations into account, a new interpretation of the results is presented based upon Maslow's Hierarchy of Needs that suggests the frequent interactions common to canine-guardian relationships and the family setting are already meeting the well-being and health needs of these dogs. While additional research is needed, the inclusion of this alternative interpretation of cortisol results may prove valuable when assessing outcomes of specific populations.

Shinrin-yoku as a Factor in Canine Well-Being

Introduction

Assessing and evaluating canine well-being and health can take on many interpretations. Recently, researchers have begun examining the co-evolutionary aspects between dogs and humans that seem to point to a unique alliance (Kerepesi, Jonsson, Miklósi, Topál, Csányi, & Magusson, 2005; Rooney & Bradshaw, 2003). This unique relationship between humans and dogs, has lead many anthrozoologists and psychologists to study the variables responsible for influencing the health and welfare gains presently known to exist (Cohen, 2002; Friedmann & Son, 2009; Wells, 2009). For example, some of the health benefits that dogs spark in people are reductions in blood pressure (Anderson, Reik & Jennings, 1992; Katcher, Friedmann, Beck, & Lynch, 1893), heart rate (Friedmann & Son, 2009), cortisol (Horvath, Doka & Miklosi, 2008), depression, and isolation factors (Wells, 2009), while increasing oxytocin (Nagasawa, Kikusui, Onaka, & Ohta, 2009), immune response, and normalizing disabilities for increased social engagement with others (McNicholas & Collis, 2000). For dogs, their health benefits seem to also rely upon the type of interaction they receive from people.

Studies have shown that when dogs are approached with enthusiasm, positive motivation, and lots of petting they benefit with reductions in similar stress factors as humans do. Additionally, their confidence increases (Rooney & Bradshaw, 2003) and problem solving challenges come easier and quicker when their guardian is present (Cooper, Ashton, Bishop, West, Mills, & Young, 2007). The situation where many of these variables are easily found is within play. Play between dogs and their guardians offer both participants the chance to engage in a positive, enthusiastic, and physical contact activity where each gains the highest potential for health benefits. In observational studies where stress was measured through salivary cortisol,

those people who spoke to and physically interacted with their dogs in a positive way showed the most significant decreases in stress (Bergamasco et al., 2010; Horvath, Doka & Miklosi, 2008).

Coinciding with these findings are those of Shinrin-yoku, known as forest-bathing, which point to the psychophysiological benefits derived from exposure to forested areas. This is important to the animal-human bond due to the existing documentation describing the negative consequences that highly stressful environments (e.g. shelters and laboratories) (Bergamasco et al., 2010; Vormbrock & Grossberg, 1988) exhibit upon canine health and well-being. These studies show that people can derive many of the same health benefits as those described from mind-body medicine practices. Simply viewing or walking within such settings brings forth a multitude of health benefits for people previously reported from mindfulness meditation, biofeedback, and guided imagery. It seems reasonable then to suggest that similar benefits may be had for dogs in such settings.

Added to this dynamic between animal and human, are the social changes that today's modern guardian is challenged with due to technology. Observing guardians in dog parks today one can see how many guardians are now preoccupied with their smart phones and iPod/MP3 players rather than playing or supervising their companions (personal observations). In fact, this shift in attention has disseminated to young children where they have shown a steady negative correlation between daily interaction with TV, video games and computers and with that of time spent outdoors engaged in play. As there has been a decline in time spent engaged in outdoor activities, the same could be plausibly happening for dogs. It seems logical to conclude that dogs may be at risk for added stress due to a decrease in social interactions and outdoor opportunities.

Literature Review

The importance of play provides an array of benefits from establishing social norms, developing communication to physiological advantages like stress reduction. In Horváth, Doka & Miklosi (2008) researchers examined the differences between boarder patrol guards and policemen with their working canine partners during short 20-minute play sessions and its effect upon canine stress. What they found was that the boarder guards, who lived with their partners, showed more affiliative behaviors and language toward their dogs during play and the dogs showed significant decreases in post-play salivary cortisol levels. Unlike their comparative group of police dogs, guard dogs were seen to engage more quickly in play, their human partners showed greater positive affection, both physically and verbally, and seemed to exhibit high levels of attachment and bonding. Counter to this, policemen exhibited more directive language and showed less physical affiliative behaviors toward their canine partners. In general, police dogs showed significant reduction in cortisol, but when compared to guard dogs they showed less reduction in post-play levels. Unexpectedly, it was noticed that the cortisol levels in the older police dogs actually increased after playing. This reversal of cortisol activity suggests several possible influences. This change could be due to the kennel environment in which the police dogs lived, the directive language was perceived as more negative, or even a combination of all these factors and others. Adding to this discussion is the findings from canine cognition (Cooper et al., 2007; Hare, & Tomasello, 1999) that implies the dog's perception of the person (e.g. is the person friend or foe?) influences the gains presented in play activity. Therefore, how a guardian is perceived, what is their motivation in engagement, and how they relate to the dog significantly alters the dog's cortisol levels.

The importance of cortisol upon health is due to its link with the hypothalamic-pituitary-adrenal (HPA) axis that responds to the activation of the sympathetic nervous system (Dinan, 2004). When an individual is challenged with a stressful event or task, cortisol is released in the body resulting in increased heart rate and blood pressure to ready the body for response. This elevated hormone level then activates the immune system in case of a wound or other potential infection agents. Yet, if this heightened response isn't lessened by the activation of the parasympathetic nervous system and continues to stay at an elevated level, cortisol can significantly affect immunological activity and response (De Amici, Gasparoni, Chirico, Ceriana, Bartoli, Ramajoli, et al., 2000). Furthermore, secretion of cortisol is taken as a reflection of mental stress within the individual, with an increase indicating higher stress (Chatterson, Vogelsong, Lu, Ellman, & Hudgens, 1996). Consequently, cortisol is a good indicator of psychological and physiological status and can be easily measured through saliva.

The additional component of oxytocin in play activities acts as the mediator or signal in increasing attachment and lowering stress. It wasn't until 2009 when Nagasawa and associates considered oxytocin's function in the canine-human bond and how it's triggered through mutual gazing. Using random assignment, guardian-dog pairs were asked to participate under two conditions. Pre and post urinary oxytocin levels in the guardians where collected in both conditions. The first trial required the guardian to sit in a chair, but to normally engage with their dog for 20 minutes. The second trial required the guardian to sit in a chair in front of a desk and only look at the wall in front of them while they engage with their dog. The results showed a significant positive difference between the conditions. When the guardian was allowed to make visual contact, oxytocin was released. Yet, this was not found within the desk condition. When videotapes were coded from both conditions, an unexpected relationship emerged between

the verbal patterns of the guardians and levels of bonding. The human participants were categorized by the amount of verbal dialogue present under the two conditions. They found two different groups emerged, those that talked a lot and those who didn't. These categories were then compared to the oxytocin results and it was discovered that those who talked less showed the largest differences in oxytocin levels. The authors attributed this finding to the differences in attachment and those less attached talked more, which corresponded to lower levels of oxytocin.

Levels of attachment can also be seeing through the lens of temporal patterns. Temporal patterns emerge in language and behavior between guardians and their dogs during cooperative problem solving tasks. Kerepesi et al. (2005) considered if temporal patterns would be established in the pair as it has been found in sport teams, synchronized dancing, and mother-child pairs were joint actions are necessary to attain a goal. In his study, canine-guardian pairs were videotaped while performing an easy task of moving a set of blocks from one location to another and to then build a tower. After examining and coding the verbal language on the videos, temporal patterns began to emerge quickly after the start of the exercise. This implies that dogs and humans unconsciously begin to synchronize their actions and reactions in accordance to the other's actions to create a sense of ease and flow in carrying out problem solving tasks. Including this outcome to the findings from play studies, it seems that dogs and their guardians move towards syncing their behaviors and reactions in order to create a harmonious state of mutual support and aid that holds the added benefits of reducing our stress levels and increasing attachment. Although these findings suggesting that play itself seems to heighten certain elements in this co-evolutionary alliance, the majority of these studies have been produced under laboratory conditions. While the laboratory setting may be able to control for certain variables, it does not represent the normal environment that most dogs experience in life

and has been documented to actually induce a certain amount of stress in dogs (Newton, & Lucas, 1982). It seems prudent then to explore how urban and natural settings may transform or modify these results. The limited amount of research exploring the average family dog is lacking in scope and depth. What types of changes in cortisol or oxytocin, if any, take place under normal exchanges and conditions? While many would agree that time spent in nature is valuable for attaining a sense of peace or releasing the tension brought on by the modern world, it's impact upon health and well-being have only recently begun to be measured.

From several studies performed in the vast forested areas in Japan, human participants have reported lower blood pressure (Tsunetsugu, Park, Ishii, Hirano, Kagawa, & Miyazaki, 2007; Furuhashi, Park, Tsunetsugu, Hirano, Kagawa, & Miyazaki, 2007; Park, Tsunetsugu, Kasetani, Kagawa, & Miyazaki, 2010), pulse rate (Park, Tsunetsugu, Ishii, Furuhashi, Hirano, Kagawa, et al., 2008; Furuhashi et al., 2007), sympathetic nerve activity (Furuhashi et al., 2007, Tsunetsugu et al., 2007; Park, Ishii, Furuhashi, Lee, Tsunetsugu, Morikawa, et al., 2006), and cortisol levels (Tsunetsugu et al., 2007; Park et al., 2006; Park et al., 2010; Yamaguchi, Deguchi, & Miyazaki, 2006) while increasing parasympathetic activity (Park et al., 2008), immune activity (Li, 2010), and mood (Park et al., 2010).

In research conducted by Park et al. (2010) a total of 280 participants in 24 different forests in Japan were asked to sit and view a forest (FV) and to take a walk (FW) in the same forest as a comparison to when participants viewed and walked in an urban setting (UV and UW). Pre- and post- physiological measurements revealed a highly significant lowering in pulse rate, blood pressure (BP), cortisol, and the sympathetic components of heart rate variability (HRV) under the FV and FW conditions. Immune system activity increased through testing salivary immunoglobulin A concentrations (IgA), and subjective measurements changed to more positive

states as measured by the Profile of Mood States (POM). Further studies in Japan have reproduced these significant findings and enhanced the importance of forest areas on human health by observing decreases in salivary amylase (cortisol) and blood glucose levels.

The reason for using salivary amylase is its association with plasma noradrenaline levels produce by the sympathetic nervous system. In Yamaguchi, Degunchi & Miyazaki (2006) differences between FV and UV environments yielded reductions in the circadian rhythm of amylase levels in healthy adults after walking in a forest for 20 minutes for two consecutive days. Similarly, Ohtsuka, Yabunaka, and Takayma, (1998) measured blood glucose fluctuations in diabetic patients who were exposed to either a forest or city setting. Those patients who either walked or viewed a forest showed a significant decrease in blood glucose levels.

Given the findings of these studies it seems sensible to examine the effects of forest environments upon the health of dogs. If dogs perceive their guardian as being positive and close then interactions within this partnership shifts toward rhythmic cooperation patterns that are reflected in their physiology by decreasing cortisol levels and elevating attachment. The addition of a forest environment into play sessions for normal urban dogs and their guardians may offer further health benefits since these dogs may exhibit similar urban stress effects that have been reported in the human literature. More precisely, it would be valuable to see if dogs show less stress (i.e. lower cortisol) after playing in nature with their guardian as a potential avenue to explore for enhancing health and strengthening attachment.

Method

Five canine-guardian pairs were recruited through existing networks of the author and lived in urban settings. Salivary measurements were taken pre and 20 minutes post play sessions following previously described techniques from the research (Dreschel, N. & Granger, D., 2009).

The forest setting was a fenced in location in the Santa Cruz Mountains approximately 250 sq. feet in the redwoods with no home, cars, or road visible from the site. Guardians were asked to park 200 feet away from the site in order to attain maximum seclusion. The researcher visited all pairs in their homes and used the same saliva collection methods in both settings. During all play sessions the researcher observed the pair and only engaged with either of the participants when solicited. Three different toys were provided at each session to assist the pairs in beginning the play session (i.e. a 8-10" tug rope, a rubber ball, and a soft plush squeaky toy). Guardians answered a brief intake history and questionnaire prior to their first condition. Cortisol testing was conducted by a laboratory specializing in salivary testing (Salimetrics) and two tests were performed on each sample to provide accurate results.

Participants

Dogs ranged between four and eight years of age and were of varying breeds (1-Pyrenean Shepard, 1-Rottweiler/Shepard mix, 1-Pug mix, 1- Great Dane, 1-Australian Shepard). Of these five, two were spayed females, two were neutered males and one was an intact male. All pairs had been living with each other for at least one year to rule out any potential behavioral issues, such as severe separation anxiety or social phobias. Four of the dogs lived in multiple dog homes (Pyrenean Shepard, Pug mix, Rottweiler/Shepard mix, Australian Shepard) and two of the dogs currently lived together, but were tested separately. One of the spayed females did exhibit a moderate amount of separation anxiety and was in treatment with a trainer. All guardians actively engaged with their dogs and showed varying styles of interaction (e.g. directional or soliciting). Following similar trends in previous studies, all five guardians were female and the dog's primary care taker. Based upon the brief survey questions filled out by each guardian prior to their participation, every guardian reported playing with their dog either frequently or daily,

and all except one, reported having strong reciprocated feelings of attachment with their dog. Two dogs were reported as being very stressed on average and both only visited a natural setting a couple of times a year. The remaining three dogs were described as having little to no stress on average and routinely visited natural settings (e.g. ocean, forest, country side).

It is worthy to note that even following prescribed salivary collection timing and practices, two of the dogs (Pug mix and Pyrenean Shepard) had extremely dry mouths and were not able to produce sufficient saliva amounts to run their pre-home cortisol tests.

Measurement

Stress in dogs was measured by pre- and post- salivary cortisol collection under each condition by the researcher. Collection followed previously established methods that have been used successfully in multiple settings (Bergamasco et al., 2010; Dreschel & Granger, 2009). Since cortisol has circadian rhythmic properties, the time of testing for each condition was kept within a 1-hour window (Bergamasco et al., 2010) between both conditions for each participant. Pre- and post- collection happened immediately prior to and directly after the 20-minute play session. The duration of play was based upon the significant findings in previous canine cortisol studies (Bergamasco et al., 2010; Horváth, Dóka, & Miklósi, 2008). To increase saliva flow in the dogs, each dog was allowed to smell approximately 1/4 cup of freeze-dried raw lamb or fresh grilled chicken that was kept in a plastic container with a slit top. Collection involved holding a cotton swab (Salimetrics #5016) in the inside cheek of the dog for 1-2 minutes. The cotton is then placed in a swab storage tube (Salimetrics #5001.05) and bar code labeled, along with the time of day and date. Samples were placed into a freezer reaching -20 C within 1 hour of collection and kept frozen until shipped overnight express on dry ice to Salimetric's laboratory (www.salimetrics.com).

Each sample was tested twice for accuracy and the mean value (ug/dL) for each were reported. Of the five dogs tested, two had "quantity not sufficient" to assess their pre-home levels, even though the researcher went over the 2-minute time span for collection. This was an unexpected occurrence in the field and shows how even encouraging saliva flow may not assure sufficient amounts. Additionally, it was noted that future saliva collection should incorporate a different swab (Salimetrics # 5001.08) than used in the present study to assist in the comfort level of the dogs. While the cotton rope used in this study had been previously used in others, on the smaller dogs this proved to be more challenging and awkward.

In addition, one modification in the field was made as to the collection location in the forest setting. Since most dogs were eager to leave their vehicles, collection in the first two dogs proved to be more difficult for this reason. A modification was made in the reaming 3 dogs so that collection occurred upon arriving at the enclosed area, but prior to being let loose to play.

Results

Analysis focused on the potential cortisol difference between the two settings, as well as, variation between pre and post play measurements within each setting. Results showed no significant differences between conditions, or pre and post measurements ($p>.05$). On average, participants showed slightly lower post-play stress in the forest setting ($M = .123$, $SE = .016$) than at home ($M = .130$, $SE = .026$). When comparing pre and post measurements in each setting, neither produced significant results. The forest pre and post values revealed ($M = .026$, $SE = .021$) $t(4) = 1.211$, $p > .05$ and the pre and post home values were ($M = .008$, $SE = .014$) $t(2) = .569$, $p > .05$. When comparing the two settings no statistical difference was found and with little effect ($M = -.007$, $SE = .018$), $t(4) = -.370$, $p = .730$, $r = .03$.

Since the results presented non-parametric characteristics, related-samples Wilcoxon test was performed that showed no significant difference between either condition (Home, $p = .414$; Forest, $p = .225$). These results from this small sample size do not support the hypothesis that Shinrin-yoku or play produce significant lower stress levels dogs. While this study cannot support or deny previous findings in Shinrin-yoku or play, this outcome could be due to several factors unforeseen by the researcher. Such as, variations in playing styles, canine personality preferences, and types of language utilized by the guardians. Yet, since cortisol studies have not been conducted with a normal population, these results may represent the norm that is currently unknown.

To take into consideration any possible relationships between guardian survey answers, correlational analysis was conducted and found a significant negative relationship between the age of the dog and the frequency of visits to natural settings, $r = -.921$, $p<.05$ (two tailed) that shows the older dogs in the study frequent these environments less often than the younger dogs. Additionally, there was a significant relationship found between age and the perceived dog's stress level, $r = .964$, $p<.01$ (two tailed). The later results must take into consideration the fact that one of the older dogs reported having a moderate level of separation anxiety that would effectively skew the results and present a positive relationship when there is none. Therefore, this last correlation is not taken seriously, but looked at as a potential avenue to consider in future studies.

Discussion

Although the statistical analyses were unable to identify any significant differences between pre and post levels, the raw data did show a trend toward reduced cortisol levels after playing in the majority of participants. Yet, while the present study was unable to provide clear and

significant results in support of Shinrin-yoku in dogs, this could be for a several reasons. The most logical is the possibility that normal average family dogs will not show significant reductions in cortisol as the human-animal bond is already meeting their physical, psychological and social needs. Using Maslow's Hierarch of Needs theory (Maslow, 1943, 1970), if the dog's physical, safety, love and esteem needs are being met by the human-animal bond, then these individuals wouldn't be needing the health benefits presented by natural environments. Instead, these individuals would be searching to move towards the needs of self-actualization in order to become more fully themselves as unique individuals. It's quite possibly from this viewpoint that environmental gains are based upon qualitative aspects that would assist the dog in self-actualization gains that reach well beyond the scope of this present study.

Furthermore, it is suggested that the results form the established research may be re-interpreted using Maslow's theory (1970) and takes on new meaning, wider generalization and application. Those dogs that participated in the guard and police studies (Horváth, Dóka, & Miklósi, 2008), as well as, the shelter research (Bergamasco et al., 2010) were all involved in high-stress work or living conditions that produce high stress. Their basic physical and emotional needs (e.g. food, safety, love) would not be met and the act of play may have provided a temporary meeting of these needs and reduced cortisol levels significantly. Unlike dogs in high stress situations, the average family dog gains continual benefit from the frequent physical and emotional support within this relationship that may supersede any environmental influence.

Even though this interpretation may present a new line of inquiry, sample size cannot be overlooked. In every quantitative study a large sample size is desired in order to rule out the possible significant influence of a few that may skew the results and to properly represent the greater population. Since the current study was limited to five dogs, the effects of this limitation

may have negatively influenced the results. As well as, different styles of play that have been identified as being influential in altering canine cortisol levels (Horváth, Dóka, & Miklósi, 2008), particularly in aging dogs, were not taken into consideration in this pilot and may have altered the pre and post measurements. Two of the guardians were trainers and their style of engagement may have biased their dog's stress levels.

Last, the theories that this study was based upon are from a limited number of studies. Due to the novelty of canine cortisol testing in the field and the narrow scope of these studies (working and shelter dogs), normal populations may prove to have greater variation and be more difficult to discover the subtle changes in stress. Should their needs be already taken care of, as suggested by Maslow's hierarchy of needs (1970), then there would be little difference between conditions as shown in the present investigation. This distinction from previous research could answer why there were no significant findings.

Future studies would benefit from increasing sample size and to recruit from a wider array of participants and settings in order to more fully represent the larger population of the average family dog. Moreover, visual and audio data should be obtained to compare frequencies of different forms of engagement and language. While this was the first known study to examine the potential impact of natural environments on canine stress levels, it seem prudent to expand the scope of study in order to address the limitation of this pilot and see if the health benefits of Shinrin-yoku could be gained by specific canine populations (e.g. shelters and working dogs) and expand our understanding of how natural environments impact health and well-being.

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