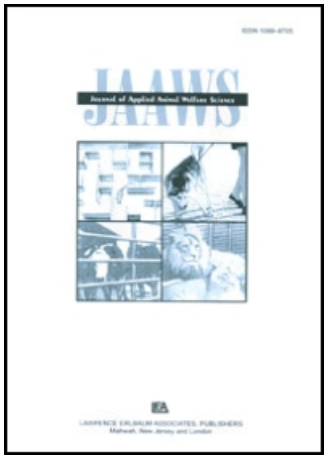

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BRIEF RESEARCH REPORT

Physiological Arousal for Companion Dogs Working With Their Owners in Animal-Assisted Activities and Animal-Assisted Therapy

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This study investigated the physiological reactions of companion dogs (*Canis familiaris*) used in animal-assisted activities and animal-assisted therapy by measuring salivary cortisol concentrations. The dog caregivers (owners) collected saliva samples (a) at 3 control days without therapeutic work, (b) directly before and after each therapeutic session during 3 consecutive months, and (c) again at 3 control days without therapeutic work. The study used an enzyme immunoassay to analyze the samples. Cortisol concentrations were significantly higher during therapy days than on control days. Dogs working during the first half of the day produced higher cortisol concentrations after therapeutic sessions than before, whereas dogs working in the afternoon produced lower cortisol concentrations. Cortisol concentrations were higher in short sessions than in long ones and increased relative to the number of therapeutic sessions done during the sampling period. The results indicate that therapeutic work was physiologically arousing for the dogs in this study. Whether these physiological responses are indicative of potentially negative stress or of positive excitement remains an open question.

For the last few decades, animal-assisted activities (AAAs) and animal-assisted therapies (AATs) have attracted increased interest in the general public and

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among scientists. Many studies have been done to evaluate the effects of exposure to animals—especially companion dogs (*Canis familiaris*) who work therapeutically—on varying groups of clients. Their main conclusion is that AAAs and AATs are beneficial for people with a wide range of physical and psychological diseases (Fine, 2000).

Although much attention has been paid to the positive effects of contact with dogs on human clients, the welfare of dogs used in AAAs and AATs has not been investigated as intensively. At present, only a handful of scientific studies have evaluated the effects of AAAs and AATs on therapy dogs. Iannuzzi and Rowan (1991) underscored the potential for animal abuse associated with fatigue and burnout for animals who live in institutions. Heimlich (2001) dealt with the negative consequences of therapeutic work on her own companion dog. Those negative consequences included signs of stress such as excessive panting, frequent urination, both ear and urinary tract infections, and Morbus Cushing's syndrome (canine hyperandrenocorticism). On the other hand, Ferrara, Natoli, and Fantini (2004) observed therapy dogs before, during, and after therapy sessions and concluded that these dogs did not show stressed behavior or stereotypy due to anxiety or hard work during AAAs and AATs. *Stereotypy* refers to the production of repeated movements or sounds over a longer period, lacking other reasonable explanation (Nagel & von Reinhardt, 2003). Thus, there is no clear consensus regarding the effect of therapy work on therapy dogs.

One of the difficulties is the great variety of methods used to study stress. In humans, one of the most accepted methods of studying work-related stress is through the measurement of salivary cortisol. Cortisol is an essential hormone and is considered to be a major indicator of altered physiological states in response to physiological arousal in most mammals, including humans and dogs (Von Faber & Haid, 1995). This method can easily be used with dogs and offers several advantages compared to other methods (Haubenhofer, Möstl, & Kirchengast, 2005). It has been shown that the measurement of salivary cortisol is an effective method of investigating both acute (Beerda, Schilder, Van Hooff, De Vries, & Mol, 1998) and chronic (Beerda, Schilder, Van Hooff, De Vries, & Mol, 1999) arousal and stress in dogs. Because stress during sampling is reduced (Beerda, Schilder, Janssen, & Mol, 1996), sampling saliva produces less biased results than does blood sampling.

Cortisol concentrations in saliva are proportional to plasma cortisol concentrations during stable secretion rates of cortisol (Kirschbaum, 1991). An increase of plasma cortisol follows the onset of an arousing stimulus by a short time delay. It takes another 4 min for salivary cortisol levels to increase following the onset of plasma cortisol increases (Kobelt, Hemsworth, Barnett, & Butler, 2003). Hence, if saliva sampling lasts less than 4 min, biases are reduced to a minimum. Some authors claim that secretion of cortisol in dogs varies during the day, as it does in hu-

mans (Kolevská, Brunclík, & Svoboda, 2003). Others propose that dogs do not vary in daily secretion of cortisol (Koyama, Omata, & Saito, 2003).

This study was designed to provide further information about work-related physiological arousal in dogs who work with their handlers (owners) as therapeutic teams in AAAs and AATs. Saliva samples were taken from a heterogeneous group of dogs in a nonlaboratory setting to measure salivary cortisol concentrations before and after therapeutic sessions in AAAs and AATs. A therapeutic session was defined as one visit to a facility and included all types of work in AAA and AAT. Data were compared to saliva samples taken from the same dogs during control days (i.e., days without therapeutic work). As the only difference between therapeutic and control days was the therapeutic work, the results provide information regarding the physiological arousal the dogs experienced in connection with therapeutic visitation.

METHOD

Subjects

Eighteen dogs of different breeds participated in this study, all between 3 and 9 years of age during the sampling period. Fifteen dogs were female (4 neutered), and 3 were male (1 neutered). None of the dogs suffered from pathological allergies, skin diseases, vomitus, diarrhea, or any other chronic disease. All dogs worked with their owners for the Austrian organization *Tiere als Therapie* (TAT; Animals as Therapy). This is the largest nonprofit animal therapy training organization in Austria and it trains humans and their animals for work in AAAs and AATs.

Apparatus

A self-administered questionnaire was used to gather general information about the dogs (breed; date of birth; sex; castration, if done; and date of training). For collection of saliva samples, Salivette tubes (No. 51.1534; Sarstedt, Wiener Neudorf, Austria) were used. Saliva samples were analyzed via an enzyme immunoassay called double-antibody biotin-linked enzyme immunoassay. This method can be used for very low concentrations of sample hormones, lower than would be detectable by standard enzyme immunoassays (Palme & Möstl, 1997). In addition, dog owners recorded every sampling point on self-administered protocol forms (date, time of day, actions of dogs before the sampling point, and events in the dogs' surroundings before the sampling point).

Procedure

After completing the questionnaire, owners were taught the correct procedure for the collection of saliva samples. They were instructed to place the cotton Salivette swab in the dogs' cheek pouches and leave it until the swab was saturated with saliva (usually 30 sec to 1 min). All dog owners were provided a sufficient number of labeled Salivettes. Owners were instructed to take saliva samples on 3 nonconsecutive control days at 8:00 a.m., 2:00 p.m., and 8:00 p.m.; samples were taken in the owners' homes. During the next 3 consecutive months, saliva samples were taken from dogs immediately before and after each therapeutic session. These samples were taken at the therapy session location. Finally, control data were taken during another 3 control days using the same procedure as before.

All samples were kept in household freezers until the beginning of the analysis. This storage method is acceptable as cortisol is quite stable even at temperatures just below freezing. The sampling period lasted from March 2004 to February 2005. Samples were then brought to the laboratory of the Institute for Biochemistry at the University of Veterinary Medicine in Vienna. There they were defrosted sequentially and centrifuged for about 10 min at 1.500G. Samples that did not contain sufficient saliva for at least two assay runs (100µl) were discarded. Data were grouped by sampling time: 8:00 a.m., 2:00 p.m., and 8:00 p.m. Data also were grouped by the time of day during which the therapeutic sessions had taken place: before 12:00 p.m., between 12:00 p.m. and 2:00 p.m., and after 2:00 p.m. Because the data normally were not distributed (KS–Z = 7.85, df = 554, $p \leq .001$), nonparametric tests were used in the analyses.

RESULTS

Secretion of Cortisol in Dogs on Control and Therapy Days

Valid cortisol readings were obtained from 512 of the samples (165 control samples, 347 therapy day samples). On therapy days, 161 samples were collected before beginning therapeutic work and 186 samples after. The sample size was too small and participating dogs too heterogeneous to conduct separate statistical analyses for age, sex, size, or reproductive status. However, the analyses shown here were controlled for possible influences of these parameters and corrected if necessary.

Cortisol levels were averaged for both conditions, and it was found that concentrations were significantly higher on therapy days than on control days (Wilcoxon $Z = -4.239$ based on negative ranks, $p \leq 001$). There were no significant differences in cortisol levels by sampling points in the day, for therapy days, or for control

days (Table 1). However, dogs in therapeutic sessions before 2:00 p.m. showed significantly higher cortisol concentrations after therapeutic sessions than before (until 12:00 p.m., Wilcoxon $Z = –4.89$ based on positive ranks, $p \leq 001$; between 12:00 p.m. and 2:00 p.m., Wilcoxon $Z = –2.15$ based on positive ranks, $p \leq 031$). Dogs in therapeutic sessions later than 2:00 p.m. showed significantly higher cortisol concentrations before than after therapeutic sessions (Wilcoxon $Z = –4.63$ based on positive ranks, $p \leq 001$; see Table 1).

Influence of Duration of Therapeutic Work on Cortisol Concentrations

The duration of therapeutic sessions varied, ranging from 1 to 8 hr. Cortisol levels were significantly related to length of session, with concentrations being higher in shorter sessions than in longer ones (Spearman correlation coefficient = .189, $p \leq 001$; see Figure 1).

Within the sampling period, from 9 to 50 therapeutic sessions had been completed by the handler–dog teams. Spearman correlation analysis showed that cortisol concentrations increased relative to the number of therapeutic sessions done (Spearman correlation coefficient = .431, $p \leq 001$; see Figure 2).

TABLE 1
Table of Percentiles 25, 50 (Median), and 75, Sorted Into Control Days and Before Therapeutic Sessions, Respectively, After Therapeutic Sessions at Therapy Days

	N	*Percentile 25 (CC)*	*Percentile 50 (CC)*	*Percentile 75 (CC)*
Control days				
Full sample	165	1.19	1.72	2.51
8:00 a.m.	57	1.31	2.06	2.59
2:00 p.m.	52	1.31	1.76	2.53
8:00 p.m.	56	0.89	1.44	2.27
Before therapy				
Full sample	161	1.17	2.06	4.25
Before 12:00 p.m.	67	0.89	2.03	7.85
12:00 p.m. to 2:00 p.m.	47	0.87	1.64	3.57
After 2:00 p.m.	47	1.56	2.47	5.41
After therapy				
Full sample	186	1.03	2.18	4.64
Before 12:00 p.m.	87	0.88	2.19	5.71
12:00 p.m. to 2:00 p.m.	42	1.25	2.09	3.19
After 2:00 p.m.	57	1.13	2.19	4.79

Note. Additional separation into averaged cortisol concentrations (CC) and day times of sampling points. CC presented in $NmoL/L^{-1}$.

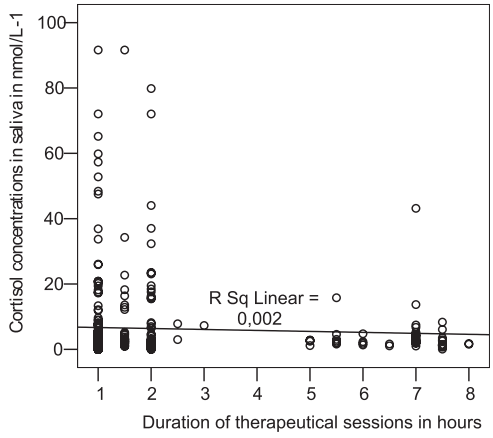

FIGURE 1 Scatter plot of cortisol concentrations compared to varying durations of therapeutic sessions. Linear regression added. Circles describe averages of samples collected both before and after therapeutic sessions at therapy days.

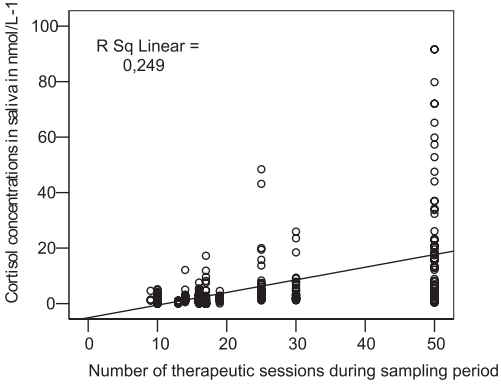

FIGURE 2 Scatter plot of cortisol concentrations compared to varying numbers of therapeutic sessions during sampling period (3 months). Linear regression added. Circles describe averages of samples collected both before and after therapeutic sessions at therapy days.

DISCUSSION

The dogs produced significantly higher levels of cortisol on days on which they did therapeutic work than on control days. Thus, activities related to therapeutic work increased physiological arousal. Such activities could include travel to the site, exposure to a new environment and unfamiliar humans, and the therapeutic work itself. The data do suggest that the change was not the result of extratherapeutic factors alone. The half-life of cortisol is between 70 and 110 min (Kirschbaum, 1991). If occurrences prior to the therapeutic sessions had produced the increase, the dogs' cortisol levels would have returned to prearousal levels before the end of the sessions. With the exception of sessions done after 2:00 p.m., the levels after sessions were significantly higher than those taken before, indicating that the therapeutic sessions themselves produced the increase.

Furthermore, dogs reached higher cortisol concentrations during short sessions. The owners' records indicate that there was more time pressure during short sessions, with dogs often working without breaks. Long sessions, on the other hand, were characterized by many breaks. The owners' comments suggest that the time effectively spent in therapeutic work was not shorter for dogs in shorter sessions; rather, it was more intense.

Another variable related to physiological arousal was the number of therapeutic sessions done each week, with cortisol concentrations increasing significantly with the number of sessions. This suggests that several days of rest after each therapeutic session might prevent extreme arousal, which could lead to signs of chronic stress.

Therapeutic sessions taking place before 2:00 p.m. yielded cortisol concentrations that were significantly higher after therapeutic sessions than before. When the therapeutic work had taken place after 2:00 p.m., cortisol concentrations were significantly higher before than after the sessions. The data from this study cannot explain these results. Further investigation is needed to determine whether the time of day differences are based on true differences in dog physiology or are idiosyncratic to this study (related to the dogs participating).

Although it can be said that therapeutic work was physiologically arousing and that both the length and the number of sessions influenced cortisol levels, it cannot be said that this increase is necessarily negative. Further research will be needed to determine whether dogs doing such work are experiencing stress that may be detrimental to their health or excitement generated by their therapeutic activities.

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