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Effects of a Dog-Assisted Intervention Assessed by Salivary Cortisol Concentrations in Inmates of a Japanese Prison

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Abstract Physiological effects of a dog-assisted, stress management and communication training program conducted in a prison were investigated by assessing salivary cortisol concentrations of prison inmates before and after the sessions. The program was conducted with groups of inmates with psychiatric and/or developmental disorders. In the program, male inmates interacted with trained pet dogs and their volunteer handlers. Inmates evaluated their mood states before and after each session by using a questionnaire. Moreover, handlers evaluated the quality of the interaction with inmates after each session. Results indicated that the inmates' cortisol values in most cases decreased following their participation in the sessions. The inmates who demonstrated stress reduction by decreasing cortisol values were diagnosed only psychiatric disorders, were aware of their mood improvement, and were evaluated by the handlers as having interacted well during the sessions. This indicated the validity of psychiatrists' diagnoses, inmates' self-evaluation, and handlers' evaluation of inmates. Also, inmates who experienced a medium mood without mood changes had decreased cortisol values. It is suggested that these results are useful for predicting and selecting inmates who are expected to obtain effects by participating in the program. Moreover, it is suggested that providing feedback to inmates about changes in their salivary cortisol levels could help them better understand their psychophysical state, which could result in more effective stress management.

Keywords Dog-assisted intervention · Mood · Prison inmates · Salivary cortisol · Stress management

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Introduction

Imprisonment is a highly stressful life event (Holmes and Rahe 1967) that might result in other stressful life events, such as job loss, deterioration of human relationships, and changes in daily living conditions, among others. It is known that stressful life events and developmental disorders are risk factors for mental health problems and mental disorders, whereas social support and stress management skills are protective factors (Leskelä et al. 2006; Saxena et al. 2006). Moreover, it is known that both social support and stress management have beneficial effects on the mood and mental health (Inatani et al. 2006; McEwen 2007; Kim et al. 2009).

It is known that stress and physical conditions are related. Salivary cortisol levels were recognized as a physiological indicator of stress. The use of salivary cortisol to evaluate stress has the merit of facilitating objective stress assessment through a small volume of saliva, without invasive collection procedure (Vining et al. 1983). Cortisol levels rapidly increase after a stressful experience (Kirschbaum et al. 1993; Khalfa et al. 2003). Long-term stress is known to lead to prolonged, elevated levels of circulating endogenous secretions, which can have serious deleterious effects (Gaab et al. 2003; McEwen 2007). Higher cortisol levels in the saliva have also been associated with adverse mood, such as depression (Heaney et al. 2010). On the other hand, social support and stress management suppressed cortisol levels (McCraty et al. 1998; Heinrichs et al. 2003; Hammerfald et al. 2006).

In summary, mental health is known to be negatively associated with stressful life events, developmental disorders, and subjective feelings of negative mood, whereas it is known to be positively associated with social support and stress management skills. Moreover, self-reported mood and objective cortisol values could be regarded as useful indicators of mental states. Social support provided for offenders and offenders' stress management skills are important assets when considering the need for their smooth reintegration into society and eventually for the creation of a safe society. According to the Japanese White Paper on Crime (Ministry of Justice 2012), in recent years, the rate of repeat offenders in Japan is increasing. Moreover, the incidence of offenders with mental disorders is also gradually increasing. These trends suggest that rehabilitation programs should be improved to reduce recidivism and to provide appropriate treatment for inmates with mental health problems (Fryers et al. 1988).

As a result, prisons in Japan have facilitated educational opportunities for offenders with collaboration between the government and the private sector to improve their reintegration into society. The dog-assisted program (Koda et al. 2015a; 2015b) was one of these programs. It was provided to prison inmates as a preparatory educational program, as a part of stress management and communication training to improve the general mental condition of inmates. It was expected that the program would help increase the efficacy of subsequent specific rehabilitation programs, such as social skills training, cognitive behavioral therapy, and guidance for overcoming substance abuse. In this program, male inmates with mental health problems interacted with dogs and their handlers in a specialized prison unit. Results of the program indicated beneficial psychosocial effects on the inmates, without causing unnecessary burden on the dogs or their handlers.

Animal-assisted programs have existed in prisons primarily in Western countries, as part of vocational and social skills training. In these programs, the inmates care for pets, fish, livestock and injured wild animals and train dogs for socially vulnerable people. Several studies have reported that such programs have physiological and psychosocial effects on inmates (Moneymaker and Strimple 1991; Fredrickson 1995; Harkrader et al. 2004; Fournier et al. 2007; Furst 2011), which support the general notion that companion animals contribute to physical and psychosocial health and well-being of humans (Endenburg and Baarda 1995;

Friedmann 1995; Hart 1995). The effectiveness of dog-assisted interventions for people with mental disorders have been reported in places other than in prisons, such as for people with depression (Folse et al. 1994; Hoffmann et al. 2009), schizophrenic patients (Kovacs et al. 2006; Lang et al. 2010), patients with substance use disorders (Wesley et al. 2009), children with autism spectrum disorders (Redefer and Goodman 1989; Prothmann et al. 2009), and children with pervasive developmental disorders (Martin and Farnum 2002).

Our previous questionnaire surveys have clarified the psychosocial effects of a dog-assisted program in a prison, based on subjective evaluations by inmates and dog handlers (Koda et al. 2015a). This study was designed to investigate the physiological effects of the program on the inmates. In this study, we measured salivary cortisol values of male inmates with mental health problems and developmental disorders as an objective stress indicator, before and after an intervention session using dogs, and examined the relationship between salivary cortisol values and mental states of inmates as indicated by psychiatrists, inmates, and dog handlers.

Methods

The methods of this study have been partly described in previously published reports (Koda et al. 2015a; 2015b).

Location of the Study

We conducted the dog-assisted program in a specialized unit of Harima Rehabilitation Program Center in Japan, which is a correctional institution. This center houses male inmates who are 26 years or older and did not engage in advanced criminal behavior nor need regular medical treatment or intensive support. The inmates were imprisoned for the first time, and they were serving sentences between 1 and 10 years. This specialized unit houses inmates with mild mental health problems, and the unit provides special treatment programs to help them reintegrate smoothly into society. This dog-assisted program was one such program.

Inmates

Male inmates ($N = 78$) were divided into eight courses (8 or 10 persons per course). In order to avoid the possibility of the Hawthorne effect, which might increase an inmate's motivation and affect the results of this study, and to adhere to the center's policy of giving all inmates an opportunity to attend the course, we allowed all individuals to participate in the program and excluded only those individuals who had animal allergies or had a history of cruelty to animals. Moreover, data were not collected from one inmate who refused to give his saliva, and data from four inmates whose saliva sample was too small to be assayed were excluded, although they continued to attend the program sessions. The data of the remaining 73 inmates were analyzed. Psychiatric disorders were diagnosed in 34 inmates, developmental disorders were diagnosed in 32 inmates, and 7 inmates were diagnosed with both psychiatric and developmental disorders. The psychiatric disorders included depression (14 persons), insomnia (9), substance use disorders (8), anxiety disorders (5), dementia (4), relational problems (3), epilepsy (3), schizophrenia (2) and others (4). The developmental disorders included mental retardation (37 persons), pervasive developmental disorders (5), communication disorders (3) learning disorders (2) and hyperactivity disorders (2).

Program Team

There were 48 volunteer dog-handler pairs from the local community. A total of six men and 42 women participated in the sessions with their dogs; there were three to seven dog-handler pairs at each session. The 48 dogs included 22 pure-breeds, 6 Labrador Retrievers, 5 Shibas (a small Japanese breed), 4 Golden Retrievers, 4 Miniature Dachshunds, 4 Toy Poodles, 2 Shetland Sheepdogs, 2 Beagles, 2 Italian Greyhounds and others and 5 mixed-breeds. The handlers were members of a nonprofit organization, Japan Animal-Assisted Therapy Council (Rapport), who kept the dogs in their homes as pets and took them to the center on the day when the program was scheduled. The dog-handler pairs had attended classes for animal-assisted therapy provided by Rapport. The average number of sessions that each dog-handler pair participated was 10.92 (SD = 12.25; range, 1–59). Other team members were instructors, coordinators, and assistants. Clinical psychologists, occupational therapists, or social workers that were staff members at the center attended the sessions to help the visitation team. Also, there were prison guards present during the sessions, but they did not participate in the program itself.

Procedure

The program was conducted in a hall located in the rehabilitation center. Twelve weekly group sessions of 70 min each constituted one course of treatment. The center allocated the session days as days for educational activities, and inmates participated in the rehabilitation program instead of doing prison work.

The program was semi-structured and consisted of six activities, namely dog walking, dog obedience training, dog health check, dog massage, dog healthcare, and playing games with dogs. Each activity was repeated twice, in two successive weeks with different visiting dog-handler pairs. For example, if the first week's activity was dog walking, the second week's activity was a review of the previous week and an advanced session of dog walking with different dogs and their handlers. The procedure in each session was generally as follows. The session started with greetings, followed by activities to break the ice then there was an explanation of the day's session, and the class was divided into two or three groups, which was followed by lectures and practice, free interactions, and finally a synopsis of the day's session and a closing talk to end the session. Each group consisted of two to five inmates and one to four dog-handler pairs, so as to facilitate interactions. Neither the inmates nor the handlers shared their real names and identified by a preferred nickname. The handlers interacted with the inmates with an accepting attitude and attempted to create a relaxed atmosphere. The handlers were unaware of an inmate's diagnosis, unless an inmate had informed the handler.

Questionnaires

The inmates completed a questionnaire about their mood state in the morning, immediately before starting the session by choosing one of three drawings of faces that best expressed their overall mood, such that a smiling face indicated good, a neutral face medium, and a grimace face bad. Immediately after each session, the inmates completed the questionnaire again to indicate their mood at the end of the session. The handlers also filled out a questionnaire after each session to assess the interactional skills of each inmate in their group, by using a Likert scale, such that 1 indicated difficult, 2 indicated medium, and 3 indicated good.

Monitoring Salivary Cortisol

The inmates collected their saliva (about 100 μℓ) by inserting a cotton swab (Sorbette, No. 5029.00, Salimetrics, USA) under their tongue for 1 min, in order to absorb saliva. Saliva was collected pre- and post-session, and each swab was placed in a separate plastic bag, zippered and then stored at −20 °C until cortisol extraction. The pre-session saliva was collected about 30 min after lunch. The post-session saliva was collected immediately after each session. This sampling protocol was adopted to avoid the possible influence of diurnal rhythms and of activities other than those related to the dog-assisted intervention on cortisol secretion (Hucklebridge et al. 2005; Heaney et al. 2010).

Salivary cortisol was extracted from the swab using ether. To extract cortisol, each swab was placed in a glass tube, and 2 ml of diethyl ether (Wako Pure Chemicals, Osaka, Japan) was poured. Then, the tubes were vortexed for 3 min. After vortexing, ether was transferred into glass tubes and evaporated to dryness at 60 °C. Ether (0.5 ml) was then added to the tube to dislodge any hormones attached to glass, and the mixture was evaporated again. After cooling, 250 μℓ of phosphate buffer containing 1 % bovine serum albumin (BSA, SIGMA-Aldrich, Tokyo, Japan) was poured into the tube and mixed for another 3 min. Fifteen microliters of the sample was aliquoted to the assay tubes and diluted with 85 μℓ of phosphate buffer with 1 % BSA for enzyme immunoassay.

The cortisol concentrations were measured using a double-antibody enzyme immunoassay method with ^{125}I-labeled radioligands (MP Biomedicals, LLC, OH, USA) and antiserum against cortisol (anti-cortisol-3-(O-carboxymethyl) oximino: BSA; HAC-AA71-02RBP), as described in Taya et al. (1985). The intra- and inter-assay coefficients of variation were below 10 and 15 %, respectively.

Results

There were no overt agonistic events in any sessions. The inmates were polite to the handlers and did not display any rude behaviors directed at the dogs. Among pre- and post-session saliva samples collected from the inmates, 72 % (605) were available for assay, and the amount of saliva was insufficient for assay in the remaining samples. Samples with insufficient saliva did not differ significantly from those with measurable cortisol concentrations for the independent variables in this study, including inmates' diagnosis ($\chi^2(2) = 1.84$, $p > 0.05$), inmates' mood change ($\chi^2(3) = 0.31$, $p > 0.05$), or handlers' evaluation of the ease of interaction ($\chi^2(1) = 0.13$, $p > 0.05$). Therefore, the 605 samples that could be assayed for the cortisol concentrations were used in the following analysis.

Mood Changes in Inmates

Four types of mood changes were observed in inmates that resulted from participating in the dog-assisted intervention sessions: 20 % reported "good" changes, in which pre- and post-session mood was good; 35 % reported "improved" changes, in which post-session mood was better than the pre-session (pre-post; medium-good, bad-good, bad-medium); 39 % reported "stable" changes, in which both pre- and post-session mood was medium; and 6 % reported "ineffective" changes, in which mood deteriorated after participation (good-medium, good-bad, medium-bad) or the mood remained bad both pre- and post-session. There were no inmates who always evaluated their mood as bad, and moods varied to some extent from

session to session. To summarize, results indicated that the inmates' mood improved in many cases as a result of the interventions with dogs, although there were some undesirable instances in which the sessions were ineffective in facilitating positive mood changes.

Handlers' Evaluation of Inmates

Multiple handlers evaluated each inmate in their groups on the ease of interaction. Inter-evaluator reliability between the evaluators was checked in a randomly chosen sample of 25 % of all evaluations. The reliability of evaluations was high, and only 1 % of the cases were scored in opposite directions by different evaluators. The average score given by multiple evaluators was used to assess each inmate, in order to minimize bias. Cases with average scores of two (medium), or more, were classified as "unproblematic" interaction group, and cases participants with an average score of less than two were classified as "difficult" interaction group. The handlers evaluated 93 % of cases as unproblematic and only 7 % of cases as difficult. Although the handlers stated that a few inmates were difficult to work with, on the whole, they positively evaluated the interactional skills of the inmates. Similar to the mood state of the inmates, the handlers did not always evaluate the same inmates as difficult to interact with and their evaluations varied to a certain extent from session to session.

Changes in Salivary Cortisol

The above findings on mood changes in inmates and evaluation of handlers regarding the inmates were based on subjective evaluations. In addition to these, cortisol levels in inmates' saliva were assessed as a physiological indicator of the effects of the program and the association between subjective evaluations and physiological indicators was examined. Changes in inmates' salivary cortisol values were analyzed using nonparametric tests, following a Shapiro-Wilk test showing that neither values in pre- nor post-sessions were normally distributed. First, the course with 12 sessions was divided into three periods with four sessions in each period to clarify whether there were longitudinal changes in salivary cortisol values. Friedman tests did not detect significant longitudinal changes in either pre- or post-sessions. Therefore, the following analysis was conducted after combining the data from the three periods.

Next, Wilcoxon signed-rank tests were performed for each independent variable of diagnosis, type of mood change, and evaluation by handlers to examine whether there were significant changes in salivary cortisol values of inmates between pre- and post-sessions. Figure 1 shows changes of salivary cortisol concentrations in inmates from pre- to post-sessions by their diagnoses. It can be seen that the inmates with only psychiatric disorders had significantly decreased salivary cortisol values in post-session compared to pre-session ($T(306) = 15{,}301$, $p < 0.001$). In contrast, neither inmates with only developmental disorders ($T(241) = 14{,}120$, $p > 0.05$) nor the inmates with both psychiatric and developmental disorders ($T(58) = 852$, $p > 0.05$) showed any significant changes in salivary cortisol values between the sessions.

Figure 2 shows changes in pre- and post-session salivary cortisol concentrations of inmates by the types of mood changes reported by them. It can be seen that inmates' salivary cortisol values decreased significantly from pre- to post-sessions in improved inmates that evaluated their mood as being better at post-session compared to pre-session ($T(214) = 7794$, $p < 0.001$) and stable inmates that reported their mood as being medium in both pre- and post-sessions ($T(237) = 10{,}742$, $p < 0.01$). It is reasonable to conclude that cortisol levels in inmates' saliva decreased according to subjectively experienced improvements in their moods during the

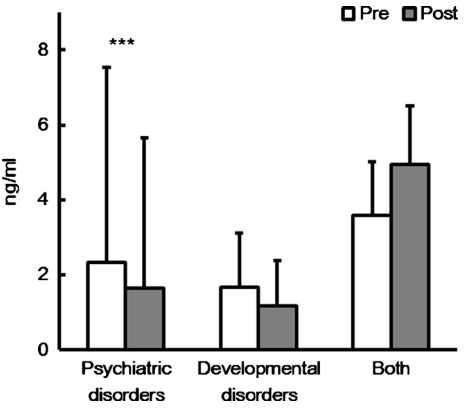

Fig. 1 Changes of cortisol concentrations in saliva of inmates (median and quartile deviation) from before to after the sessions by diagnoses. ***$p < 0.001$

intervention with dogs. In addition, the cortisol levels in saliva decreased even in the cases of inmates that reported their mood was medium before the session and maintained the medium mood state during the session. On the other hand, salivary cortisol values did not change significantly between pre- and post-sessions in good type of inmates that reported their mood as good in both pre- and post-sessions ($T(118) = 3113$, $p > 0.05$) or in ineffective type of inmates that reported their moods deteriorated after participation ($T(36) = 320$, $p > 0.05$).

Figure 3 shows changes of salivary cortisol concentrations in inmates between pre- and post-session by handlers' evaluation of the ease of interaction. It can be seen that inmates that were evaluated as having unproblematic interaction skills, significantly decreased salivary cortisol values between pre- and post-sessions ($T(563) = 65{,}436$, $p < 0.001$). Conversely, inmates that were evaluated as being difficult to interact with did not show significant changes in salivary cortisol values between pre- and post-sessions ($T(42) = 334$, $p > 0.05$). It can be seen that inmates' salivary cortisol values decreased when others evaluated them to have interacted well.

Discussion

Koda et al. (2015a) reported that a dog-visitation program in prison had remarkable a short-term relaxation effect on inmates with various psychiatric and/or developmental disorders. The inmates responded positively to basic communication training assisted by dogs. The results were consistent

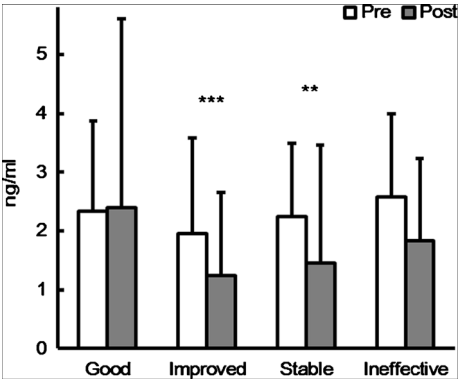

Fig. 2 Changes of cortisol concentrations in saliva of inmates (median and quartile deviation) from before to after the sessions by types of mood changes in inmates. **$p < 0.01$, ***$p < 0.001$

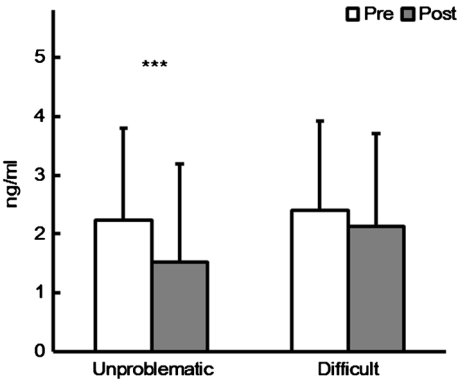

Fig. 3 Changes of cortisol concentrations in saliva of inmates (median and quartile deviation) from before to after the sessions by handlers' evaluation of ease of interaction with inmates. ***$p < 0.001$

with previous studies in prisons in Western countries, in other treatment situations, and in experimental settings, showing that interactions with companion animals have therapeutic effects, and in structured stress management programs without using animals. Therefore, based on both subjective evaluations of inmates and handlers using questionnaires, it was concluded that the program was effective as a stress management program for inmates. In this study, in addition to self and handler assessment data, salivary cortisol concentration of inmates was used as a physiological indicator of stress. Results indicated that inmates' salivary cortisol values in most cases decreased following participation in the sessions. Other stress management programs without animals have reported reduction in cortisol levels (Gaab et al. 2003; Khalfa et al. 2003). Therefore, it was concluded that this study demonstrated the stress management effects of a dog-assisted program on inmates, by using objective physiological data. In the future, studies would need to examine whether animals make a significant difference in comparison to other types of stress management programs.

Regarding the attributions of the inmates, the inmates who demonstrated stress reduction by decreasing cortisol values in saliva were diagnosed with only psychiatric disorders, were aware of their mood improvement, and were evaluated by the handlers as having interacted well during the sessions. It indicated the validity of psychiatrists' diagnoses, inmates' self-evaluation, and handlers' evaluation of inmates. Furthermore, results indicated stress reduction in inmates, who did not notice changes in their mood, i.e., they reported their mood as medium in both pre- and post-sessions, could be identified by physiological data. This finding could be useful for accurately predicting and selecting inmates who could benefit by participating in this and similar programs. Moreover, providing feedback to inmates about changes in their salivary cortisol levels could also help them to develop a more accurate grasp of their psychophysical state, which could lead to the development of improved stress management techniques.

This dog-assisted program had other advantages. Animal interventions can be adopted in various situations, such as therapy, recreational activities, educational activities and usual care of animals, in order to improve or maintain the well-being of people, such as patients, persons at risk, and the general population, irrespective of their age and symptoms (Fine 2006). There are fewer stereotypes or stigmas because animal-assisted interventions are not limited to people with specific problems. Thus, even people who do not acknowledge their mental health problems could participate positively in such programs. Also, the calming effects brought about by amicable animals are significant (Vormbrock and Grossberg 1988; Wilson 1991). In a previous study (Koda et al. 2015a) almost all inmates who participated in the program showed positive interest in unconditionally accepting dogs. They could interact using simple and basic skills

without depending on complex verbal communication and alleviate the tension of interpersonal face-to-face communication in dog presence. Results of previous studies on plasma cortisol concentrations during human-dog interactions are also consistent with the findings of this study. Humans had decreased cortisol concentrations after cooperative interactions with dogs (Odendaal and Meintjes 2003). Dog owners' lower level of cortisol during interactions with dogs was related to the owners' perception of a good relationship with their dogs (Handlin et al. 2012).

This dog-assisted visitation program in prison established the effects of this program on inmates, not only through psychosocial data but also using physical data. Stress management, social support, and positive mood are crucial components in the mental health of humans (Inatani et al. 2006; Leskelä et al. 2006; Saxena et al. 2006; McEwen 2007; Kim et al. 2009). It is suggested that when stress in prison inmates is reduced, and inmates have improved mood states, as well as experience of social support from civilian volunteers through this educational program assisted by dogs, they would more effectively attend to rehabilitation provided for specific problems of each inmate. A similar dog-assisted program has also been conducted by our team in a juvenile training school for delinquents (Moroto et al. 2008). Dog-assisted intervention with female inmates and advanced criminals could also be effective in Asian countries. Further studies are needed to improve these novel dog-assisted programs in prisons, as well as to clarify additional effects of such programs on efficient rehabilitation of inmates.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research association and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved by Harima Rehabilitation Program Center and Japan Animal-Assisted Therapy Council.

Informed Consent Data were collected from participants after obtaining their informed consent.

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