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HEALTH-RELATED LIFESTYLE AND PATTERNS OF BEHAVIOR RELATED TO HEALTH EFFECTS OF LEISURE TRAVEL

MASAHIRO TODA
Osaka University Graduate School of Medicine, Osaka, Japan
HIROAKI MAKINO AND HIDETOSHI KOBAYASHI
Japan Travel Bureau (Foundation)
KANEHISA MORIMOTO
Osaka University Graduate School of Medicine, Osaka, Japan

Whether or not leisure travel might have positive effects on personal health was investigated. During a short leisure trip, saliva samples were collected from 40 females. Levels of salivary cortisol and chromogranin A (CgA) were evaluated by enzyme-linked immunosorbent assay (ELISA). To quantitatively evaluate the health-related lifestyle and the patterns of behavior of the subjects, we also administered written questionnaires. For samples taken during the trip, there was a significant increase in the levels of CgA. Meanwhile, there was a significant increase in the levels of cortisol after the tour. These tendencies were more pronounced in individuals who scored well for health-related lifestyle. These findings suggest that the effects of travel were more beneficial for persons with positive characteristics related to health-related lifestyle.

Keywords: travel tours, health-related lifestyle, patterns of behavior, cortisol, chromogranin A (CgA).

Masahiro Toda, Department of Social and Environmental Medicine, Osaka University Graduate School of Medicine, Osaka, Japan; Hiroaki Makino and Hidetoshi Kobayashi, Japan Travel Bureau (Foundation); and Kanehisa Morimoto, PhD, Professor, Department of Social and Environmental Medicine, Osaka University Graduate School of Medicine, Osaka, Japan.
Appreciation is due to reviewers including: Jonathan Bricker, PhD, Department of Psychology, University of Washington, Seattle, WA, USA, Email: **jbricker@u.washington.edu**; Jens Gaab, PhD, Institute of Psychology, University of Zurich, Clinical Psychology and Psychotherapy Zurichbergstr 43, CH-8044 Zurich, Switzerland, Email: **j.gaab@psychologie.unizh.ch**
Please address correspondence and reprint requests to: Professor Kanehisa Morimoto, Department of Social and Environmental Medicine, Osaka University Graduate School of Medicine, 2-2 Yamada-Oka, Suita, Osaka, Japan 565-0871. Phone: +81 (6) 6879-3920; Fax: +81 (6) 6879-3929; Email: **morimoto@envi.med.osaka-u.ac.jp**

Travel is a complete change from everyday life, but whether or not it is actually beneficial has yet to be established by scientific study. A number of researchers have investigated the relationship between travel and health. Their reports, however, have mainly been concerned with the negative aspects of travel, for example, the effects of jet lag (Desir et al., 1981; Katz, Knobler, Laibel, Strauss, & Durst, 2002) and the risks of air travel such as economy class syndrome (Low & Chan, 2002; McIntosh, Swanson, Power, Raeside, & Dempster, 1998; Sahiar & Mohler, 1994).

In the present study, we examined changes in the salivary endocrinological stress markers over the course of a three-day leisure trip. Evaluation of endocrinological stress markers in saliva, such as cortisol or chromogranin A (CgA), is a very useful method for objectively assessing stress. Furthermore, collection of saliva is a convenient sampling method because it is noninvasive and relatively nonstressful (Kirschbaum & Hellhammer, 1994).

Produced in the adrenal cortex, cortisol is the main glucocorticoid hormone in humans. It is released in response to various psychosocial stimuli via the hypothalamus-pituitary-adrenal (HPA) axis. The level of cortisol in the saliva accurately reflects the level of active free cortisol in the blood (Kirschbaum & Hellhammer, 1989, 1994). Furthermore, previous studies have suggested that higher levels of cortisol in the morning, the time of the acrophase, are associated with good health (Van Cauter, Leproult, & Kupfer, 1996; Wolf, Fujiwara, Luwinski, Kirschbaum, & Markowitsch, 2005).

CgA is an acidic glucoprotein that is released along with catecholamines from the adrenal medulla and the sympathetic nerve endings (Smith & Kirshner, 1967; Smith & Winkler, 1967; Winkler & Fischer-Colbrie, 1992). A recent study has reported that CgA is produced by human submandibular glands and secreted into saliva (Saruta et al., 2005). Salivary CgA has recently gained attention as a new stress marker (Nakane et al., 1998; Nakane, Asami, Yamada, & Ohira, 2002).

MATERIALS AND METHOD

Subjects

We enrolled forty female volunteers aged 46–77 years old. These women participated in a short package tour (2 nights, 3 days) to Kyushu, the southernmost of Japan's main islands. It was a sightseeing tour which involved a short (1 hour) flight and local travel by bus to accommodation in a resort spa.

Saliva Sampling

Two days before departure, daily during the trip, and two days after return from the tour, at waking (6:00-7:00), saliva samples were collected using the Salivette system (Sarstedt Co. Ltd., Nümbrecht, Germany). This device extracts

saliva samples by centrifuging (at 3,000 rpm for 15 min) the cotton wads that subjects held in their mouths (for 2 min). The samples were stored at -80°C until the assay. Using enzyme-linked immunosorbent assay (ELISA), following a previously described method, we evaluated the levels of salivary cortisol and CgA (Nagasawa et al., 1998; Shimada, Takahashi, Ohkawa, Segawa, & Higurashi, 1995). To estimate the overall effect of the trip, resultant values during the trip were averaged.

Health-Related Lifestyle and Patterns of Behavior

Before the tour, we also quantitatively evaluated, using a written questionnaire, the health-related lifestyle and the patterns of behavior of the subjects.

Health-related lifestyle was evaluated using a Health Practice Index (HPI), which scores the responses given to eight lifestyle items: smoking habits, drinking habits, daily consumption of breakfast, daily duration of sleep and work, regular physical activity, nutritionally balanced diet, and subjectively assessed level of stress. Respondents were allocated to one of two HPI score groups: *good*, 6-8 points; and *poor*, 0-5 points. Based upon the lifestyle study by Belloc and Breslow (1972) and taking into consideration cultural differences, this questionnaire and scoring were designed for Japanese subjects. In addition, this method of classification has been found to be useful in evaluating personal lifestyles among Japanese (Ezoe & Morimoto, 1994; Hagihara & Morimoto, 1991; Kusaka, Kondou, & Morimoto, 1992; Morimoto, 2000).

Patterns of behavior were assessed using the Tokai University Type A Pattern Scale, and subjects were categorized as having either Type A or Type B behavior patterns (Hosaka & Tagawa, 1987, 1989). According to Hosaka and Tagawa (1987), comparing Americans and Japanese, hard-working and workaholic tendencies were found to be more stressed than were the hard-driving and competitive components among the Japanese. This property might be a reflection of the Japanese culture which stresses harmonious relationships rather than individualism and competitiveness. Thus the Type A behavior pattern can be modified according to culture and nationality. The Tokai University Type A Pattern Scale, designed for assessing the Type A behavior pattern among Japanese, consists of 11 items with 4-point Likert-type rating continua. Persons with scores of 43.1 points or more were placed in the Type A group.

Statistical Analyses

Changes in levels of salivary cortisol and CgA among lifestyle and behavior pattern groups were compared using ANOVA with repeated measures to detect intergroup and time-related differences. Bonferroni's test was used for multiple comparisons. Values were considered significantly different when $p < 0.05$.

RESULTS

Figure 1 shows the mean levels of salivary cortisol and CgA among all subjects during the sampling period. For samples taken after the tour, there was a significant increase in the levels of cortisol (a). Meanwhile, there was a significant increase in the levels of CgA during the trip (b).

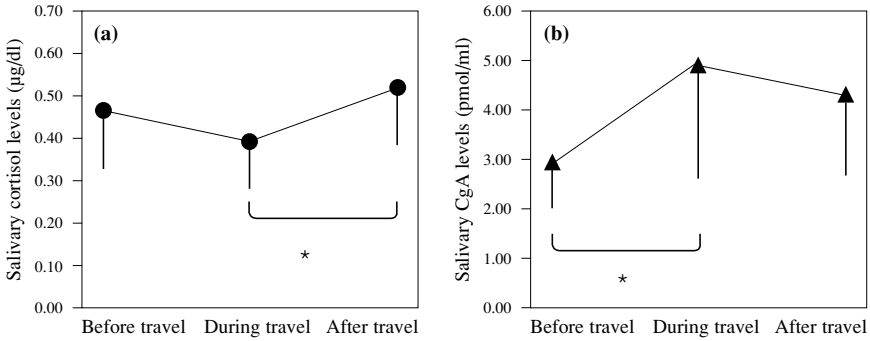

Figure 1: Mean values (±*SD*) for (a) salivary cortisol and (b) CgA (chromogranin A) levels during the sampling period ($n = 40$).
*$p < 0.05$ (repeated measures ANOVA and Bonferroni's test).

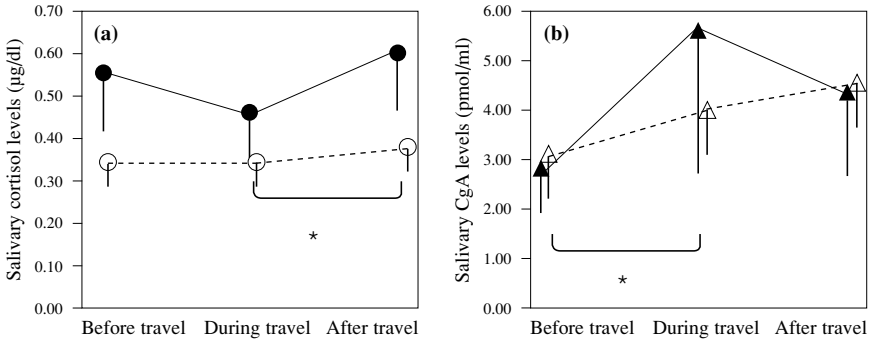

Figure 2: Mean values (±*SD*) for (a) salivary cortisol and (b) CgA (chromogranin A) levels in good HPI score group (solid line, $n = 24$) and poor HPI score group (dashed line, $n = 16$) during the sampling period.
*$p < 0.05$ (repeated measures ANOVA and Bonferroni's test).

Figure 2 shows the mean levels of salivary cortisol and CgA for volunteers grouped by their HPI scores. During the trip, the good HPI score group showed

significantly increased CgA levels (b). Furthermore, the good HPI score group showed significantly higher levels of cortisol after the tour (a). For the poor HPI score group, neither the levels of cortisol nor CgA showed any significant change.

During the sampling period, in both groups with Type A ($n = 29$) and Type B ($n = 11$) behavior pattern, there was no significant change in the levels of cortisol or CgA.

DISCUSSION

Baseline levels of cortisol at two days before departure were higher in the good HPI score group ($p < 0.05$) (Figure 2a). Previous studies have suggested that higher levels of cortisol in the morning, the time of the acrophase, are associated with good health (Van Cauter et al., 1996; Wolf et al., 2005). Throughout the sampling period, the good HPI score group had higher levels of cortisol compared to the poor HPI score group. Furthermore, in the good HPI score group, cortisol levels showed a significant increase two days after return from the tour. Meanwhile, in the poor HPI score group, cortisol levels remained low. These findings suggest that the effects of travel were more beneficial for persons with positive characteristics related to health-related lifestyle.

Whereas cortisol reflects both mental and physical stress, levels of salivary CgA are taken as an index of only mental stress, which is assumed to vary more sensitively in response to positive mental eustress and negative distress (Nakane et al., 1998, 2002). In recent studies, we found that moderate stress (eustress) such as spa bathing or coffee intake significantly increases salivary CgA levels for healthy low stress persons (Toda, Morimoto, Nagasawa, & Kitamura, 2006; Tsubouchi et al., 2006). In the good HPI score group, therefore, elevated CgA levels during the tour could arise from eustress caused by enjoyment, fulfilling experience, or other positive stimulation rather than distress (Figure 2b). Meanwhile, in the poor HPI score group, there was no such change.

The present findings suggest that, when health-related lifestyle is favorable, travel is likely to be more beneficial to the health of the individual and also bring the enjoyment of out-of-the-ordinary positive experiences. To get the most from short leisure trips, therefore, it is advisable to acquire healthy lifestyle habits before departure. Meanwhile, the effects of travel are probably not affected by patterns of behavior. This, however, may result from the Japanese culture and nationality (Hosaka & Tagawa, 1987). Other populations are needed for future studies.

In this study, we found that leisure travel probably has beneficial health effects. This research, however, has several limitations. A previous study suggests that air travel is stressful (Bricker, 2005). The tour in question involved a short (1 hour)

flight. Furthermore, all participants were elderly women. To elucidate the general effects of travel, we are planning further studies with different populations and various forms of travel.

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