

Assessment of the efficacy of footbaths as a means of improving the mental health of nurses: a preliminary report

Setsuko Inoue, Fumiko Kaneko and Hitoshi Okamura^{*}

Key words : 1. chromogranin A 2. footbath 3. stress

Objective: There are few studies that have subjectively and objectively verified the efficacy of footbaths as a means of relieving stress. The purpose of the present study was to validate the stress-reducing efficacy of footbaths both subjectively and objectively by means of a stress indicator, chromogranin A (CgA).

Methods: The subjects were 21 female nurses working at a general hospital. After evaluating their current mental and physical condition, and measuring their salivary CgA levels, the subjects took a 10-min footbath. After the bath their mental and physical condition was evaluated again, and their salivary CgA levels were measured again. The changes in their mental and physical state before and after the footbath were assessed by the Wilcoxon signed-rank test. CgA levels taken before and after the footbath were assessed by the paired *t*-test.

Results: The results showed that both their subjective mental and physical condition improved and their CgA levels were lower after the footbath than before.

Conclusions: These results suggested that footbaths can exert a restorative effect on the stress associated with the performance of nursing duties and are effective in relieving nurses' stress.

Introduction

Nursing work is said to involve greater job stress than other occupations¹⁾, and for that reason there have been many studies examining nurses' stress management²⁻⁷⁾. Relaxation methods are one form of stress management. A variety of relaxation methods are available, e.g., listening to music or massage⁸⁾. In the present study we turned our attention to footbaths, which are familiar as a nursing activity. Footbaths require no special facilities and are more convenient than showers or taking a bath, and, unlike massage, they do not require any special skills. Some previous studies showed that footbaths produced (1) significant changes in the autonomic responses, indicating a shift to increased parasympathetic and decreased sympathetic activity and (2) significant increases in the white blood cell (WBC) count and natural killer (NK) cell cyto-

toxicity, suggesting an improved immune status^{9,10)}. However, few studies have focused on footbaths as a relaxation method for nurses' stress management, and although there have been subjective evaluations by means of questionnaires to assess the efficacy of footbaths, few evaluations have used objective indicators^{11,12)}.

Chromogranin A (CgA) is a protein secreted by the chromaffin cells of the adrenal medulla and by sympathetic neurons¹³⁾. It is present in endocrine organs and sympathetic neurons, where it is stored along with catecholamines, and they are secreted together in response to sympathetic nervous system stimulation¹⁴⁾. CgA is present in salivary glands and released into saliva in response to stimulation of the autonomic nervous system¹⁵⁻¹⁷⁾. According to a report of a study in which salivary concentrations of CgA, catecholamines, and cortisol were measured in association with stress

・看護職者のメンタルヘルス向上を目指した足浴の効果に関する予備的検討

・ Graduate School of Health Sciences, Hiroshima University

・ * Corresponding Author : Hitoshi Okamura, MD

Graduate School of Health Sciences, Hiroshima University, 1-2-3 Kasumi, Minami-ku, Hiroshima 734-8551, Japan

TEL : +81-82-257-5450 FAX : +81-82-257-5454 E-mail : hokamura@hiroshima-u.ac.jp

・ 広島大学保健学ジャーナル Vol. 9 (2) : 27~30, 2011

loading, when subjects were exposed to a stress load, the CgA level rose before the cortisol level, whereas during exercise stress loading the catecholamine levels increased dramatically, but there were no marked changes in the CgA level¹⁸⁾. The testing method is characterized by the advantages of requiring collection of saliva alone and enabling measurements to be made painlessly. Salivary CgA levels react specifically to stress. They rise even when exposed to only minor stress, and they rapidly decline at the conclusion of the stress¹⁹⁾. The major advantage of the use of salivary CgA, therefore, is that the sampling is non-invasive and can be performed in non-stressful conditions. Furthermore, CgA is secreted immediately after stress without the influence of circadian rhythm²⁰⁾.

The aim of this preliminary study was, subjectively and objectively and based on salivary CgA levels, to verify the efficacy of footbaths as a means of relieving the stress of nurses. If the efficacy of footbaths were demonstrated in this study, footbaths could possibly be used as a coping strategy to relieve stress and to contribute to improving the mental health of nurses.

Method

After obtaining the approval of the Institutional Review Board of the institution, the purpose, content, etc., of the study were explained to the candidates in a document requesting cooperation with the study. The study was conducted only on candidates who had given their written consent to participate.

The participants were 21 female nurses, with a mean age of 29.2 years (22 to 47 years). There were nine nurses with fewer than 5 years of nursing experience, seven with 5 to 9 years, and five with 10 or more years of experience.

The survey was conducted on the subjects after they had completed their day duty (8:20-17:00). All experiments were performed in an air-conditioned quiet room between 17:15 and 18:15. First, after basic information, including age and number of years of nursing experience, was taken during an interview when they came off duty, saliva was collected, and they were requested to fill out a questionnaire on their current mental and physical states. Current mental and physical states were evaluated on a 6-point Likert scale that the authors had prepared (1: very poor, 2: poor, 3: somewhat poor, 4: somewhat good, 5: good, 6: very good). Then a

special footbath vessel (MA-226; Marutaka, Tokyo, Japan) was filled with hot water so as to immerse the feet in 40°C water from the ankle joint to the dorsum of the foot and the toes. The footbath was continued for 10 min based on a previous study²¹⁾. After completion of the footbath, saliva was collected again, and the subject was asked to fill out the questionnaire on their current mental and physical states again.

The saliva was collected in the following manner. The subject gently bit on two cotton rolls with the molar teeth for about 1-2 min, allowing saliva to penetrate them thoroughly. The cotton rolls were then removed from the mouth by the subject. They were then returned to the original saliva collection vessel, and it was sealed. The vessel was then immediately stored in a cold place, and after placing it in a cold storage envelope, it was sent to a specialized facility for measurement. The concentration of CgA was determined using an enzyme-linked immunosorbent assay kit (YK070 Human Chromogranin A EIA, Yanaihara Institute, Shizuoka, Japan).

During the footbath the examiner was in the same room, and observed the subjects without speaking to them.

The changes in mental and physical state before and after the footbath were assessed by the Wilcoxon signed-rank test. CgA levels between before and after the footbath were assessed by the paired *t*-test. The *p* values in all of the tests were two-tailed, and *p* values <0.05 were considered significant. Statistical Package for the Social Sciences (SPSS) ver. 14.0J for Windows software was used to perform all of the statistical analyses.

Results

Comparisons between the CgA levels before and after the footbath showed a significant change in levels (Fig. 1).

Regarding their mental and physical states, at the end of duty, two subjects evaluated their mental and physical state before the footbath as "good", but after the bath both changed it to "very good". There were nine subjects who initially evaluated their mental and physical state as "somewhat good". Two of them changed it to "very good", while the other seven changed it to "good". There were three subjects who initially rated their condition as "somewhat poor", and all three changed it to "somewhat good". There were five

Table 1. Comparison of mental and physical state between before and after the footbath

	Before footbath			After footbath	
	N	CgA level ^a		N	CgA level ^a
Good	2	2.04 (1.97-2.10)	→	Very good	2 0.53 (0.27-0.78)
Somewhat good	9	0.83 (0.07-1.98)	→	Very good	2 0.56 (0.55-0.57)
			→	Good	7 0.52 (0.08-1.73)
Somewhat poor	3	1.11 (0.06-3.16)	→	Somewhat good	3 0.60 (0.13-1.53)
Poor	5	0.60 (0.29-1.56)	→	Good	2 0.31 (0.23-0.38)
			→	Somewhat good	3 0.90 (0.25-1.60)
Very poor	2	0.55 (0.27-0.82)	→	Somewhat poor	1 0.48
			→	Poor	1 0.25

a: mean (range)

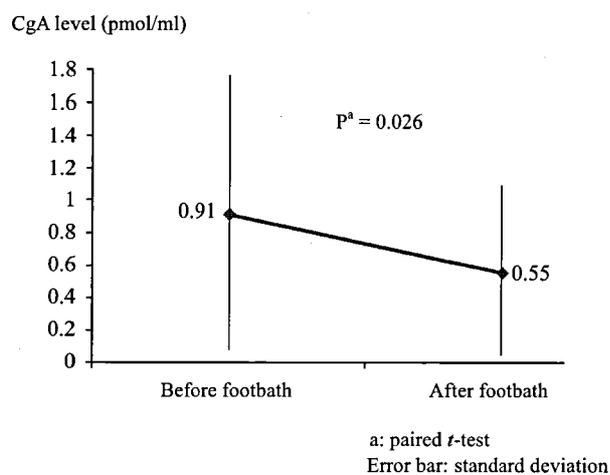


Fig. 1. Comparison of the CgA levels between before and after the footbath

subjects who evaluated their condition as “poor”, and two of them changed it to “good”, while the other three changed it to “somewhat good”. There were two subjects who rated their initial state as “very poor”. One changed it to “somewhat poor”, while the other changed it to “poor”. A comparative statistical evaluation of mental and physical states before and after the footbath showed significant changes in scores ($Z=-3.80$, $p < 0.001$) (Table 1).

Discussion

Subjective mental and physical states before and after the footbath showed improvement in all of the participants, and the fact that even those who answered “good” or “somewhat good” after duty showed a further improvement after the footbath suggests that footbaths after the completion of duty have a clear efficacy in reducing stress. In this study we filled a footbath vessel with hot water and evaluated the efficacy of the footbath by immersing the feet from the ankle to the dorsum of

the foot and the toes. That alone was sufficient to exert an effect on the mental and physical condition of nurses after the completion of their duties, suggesting that even the limited measure of taking a footbath is capable of exerting an adequate relaxation effect.

CgA is characterized by increasing during stress earlier than previously known stress indicators, such as cortisol, and also by declining sooner²⁰. It possesses the characteristic of responding to the stress that occurs as a result of everyday work, and is regarded as an indicator that is capable of specifically and very sensitively detecting stress¹⁵⁻¹⁷. In our previous pilot study, there were no significant changes in CgA levels between before and after when subjects sat down for 10 min (unpublished). These characteristics of CgA and the results of this study showing that CgA levels after the footbath significantly decreased suggest that footbaths have a stress relieving effect and are an effective means of recovering from the stress that is felt after the completion of nursing duties.

The subjective and objective efficacy of footbaths suggest that they lead to relaxation in accordance with an increase in parasympathetic response and a decrease in sympathetic response, and CgA reduction.

This study is preliminary, and has several limitations. The first limitation is that there was no control group against which to compare the intervention. The second limitation regards the assessment of stress. In this study, we did not use existing validated instruments of stress other than CgA. Lastly, we only assessed the outcomes immediately after the intervention, and could not assess how long the effects would have continued. In future research it is necessary to assess the efficacy of footbaths in a randomized controlled study using validated assessment tools of stress.

References

1. Kawano, Y.: Association of job-related stress factors with psychological and somatic symptoms among Japanese hospital nurses: effect of departmental environment in acute care hospitals. *J. Occup. Health*, 50: 79-85, 2008
2. Brown, H. and Edelmann, R.: A study of expected and experienced stressors and support reported by students and qualified nurses. *J. Adv. Nurs.*, 31: 857-864, 2000
3. Jenkins, R. and Elliott, P.: Stressors, burnout and social support. *J. Adv. Nurs.*, 48: 622-631, 2004
4. Stordeur, S., D'hoore, W. and Vandenberghe, C.: Leadership, organizational stress, and emotional exhaustion among hospital nursing staff. *J. Adv. Nurs.*, 35: 533-542, 2001
5. Tully, A.: Stress, sources of stress and ways of coping among psychiatric nursing students. *J. Psychiatr. Ment. Health Nurs.*, 11: 43-47, 2004
6. Edwards, D. and Burnard, P.: A systematic review of stress and stress management interventions for mental health nurses. *J. Adv. Nurs.*, 42: 169-200, 2003
7. Edwards, D.: Stressors, moderators and stress outcomes: findings from the All-Wales Community Mental Health Nurse Study. *J. Psychiatr. Ment. Health Nurs.*, 7: 529-537, 2000
8. Jaber, S., Bahloul, H. and Guétin, S. et al.: Effects of music therapy in intensive care unit without sedation in weaning patients versus non-ventilated patients. *Ann. Fr. Anesth. Reanim.*, 26: 30-38, 2007
9. Saeki, Y., Nagai, N. and Hishinuma, M.: Effects of footbathing on autonomic nerve and immune function. *Complement. Ther. Clin. Pract.*, 13: 158-165, 2007
10. Yamamoto, K., Aso, Y. and Nagata, S. et al.: Autonomic, neuro-immunological and psychological responses to wrapped warm footbaths - a pilot study. *Complement. Ther. Clin. Pract.*, 14: 195-203, 2008
11. Saeki, Y.: The effect of foot-bath with or without the essential oil of lavender on the autonomic nervous system: a randomized trial. *Complement Ther. Med.*, 8: 2-7, 2000
12. Sung, E.J. and Tochihara, Y.: Effects of bathing and hot footbath on sleep in winter. *J. Physiol. Anthropol. Appl. Human Sci.*, 19: 21-27, 2000
13. Blaschko, H., Comline, R.S. and Schneider, F.H. et al.: Secretion of a chromaffin granule protein, chromogranin, from the adrenal gland after splanchnic stimulation. *Nature*, 215: 58-59, 1967
14. Saruta, J.: Expression and localization of chromogranin A gene and protein in human submandibular gland. *Cells Tissues Organs*, 180: 237-244, 2005
15. Smith, W.J. and Kirshner, N.: A specific soluble protein from the catecholamine storage vesicles of bovine adrenal medulla. *Molec. Pharmacol.*, 3: 52-62, 1967
16. Toda, M., Morimoto, K. and Nagasawa, S. et al.: Effect of snack eating on sensitive salivary stress markers cortisol and chromogranin A. *Environ. Health Prev. Med.*, 9: 27-29, 2004
17. Winkler, H. and Fischer-Colbrie, R.: The chromogranins A and B: the first 25 years and future perspectives. *Neuroscience*, 49: 497-528, 1992
18. Nakane, H., Asami, O. and Yamada, Y. et al.: Effect of negative air ions on computer operation, anxiety and salivary chromogranin A-like immunoreactivity. *Int. J. Psychophysiol.*, 46: 85-89, 2002
19. Nakane, H. and Asami, O.: Salivary chromogranin A as an index of psychosomatic stress response. *Biomed. Res.*, 19: 401-406, 1998
20. Den, R., Toda, M. and Nagasawa, S. et al.: Circadian rhythm of human salivary CgA. *Biomed. Res.*, 28: 57-60, 2007
21. Uebaba, K. and XU, F.H.: Temperature-dependent physiopsychological changes by footbath - changes in electroencephalogram, cerebral circulation, R-R variability and comfort -. *J. Jpn. Soc. Balneol. Climatol. Phys. Med.*, 67: 119-129, 2004