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Original Paper

Relaxing and Communication-Promoting Effects of Wooden Tableware at Workplace Social Gathering

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Abstract

Human beings are thought to have evolved in close contact with wood and touching wood is known to have relaxing effects. In 10 health subjects participating workplace social gathering, the effects of the use of wooden tableware on autonomic functions and communication were examined in comparison to the use of porcelain-metal tableware with a crossover study design. Analysis of pulse rate variability revealed that, compared to porcelain-metal tableware, wooden tableware lowered the amplitude of low-frequency (LF, 0.04-0.15 Hz) component without affecting the amplitude of high-frequency (HF, 0.15-0.45 Hz) component, resulting lower LF-to-HF ratio. Communication measured by the total number of utterances did not differ with the type of tableware. Subjective evaluation by a post questionnaire also showed consistent results, indicating better impression, warmth, relaxation, remission, nostalgic feeling for wooden tableware than porcelain-metal tableware. The use of wooden tableware may reduce sympathetic tone at the workplace social gathering compared to porcelain-metal tableware.

Keywords

wooden tableware, social gathering, autonomic nervous system, relaxation, communication, pulse wave, heart rate variability

1. Introduction

The living space where wood was abundantly used makes us feel relaxation and security. Compared with artificial materials such as metal and plastic, contact with wood is known to cause less cardiovascular response (Morikawa et al., 1998; Sakuragawa et al, 2008). In a recent study using the analysis of Heart Rate Variability (HRV), Ikei et al., (2018) also showed that 90-s contact with the

cypress plate by the right palm enhances cardiac vagal activity. There are few studies, however, of the impacts of the use of wood products on the responses to social stimuli. In this study, we compared physiological and behavioral responses to social gathering at the workplace when using wooden tableware and porcelain-metal tableware.

2. Method

2.1 Subjects and Protocol

We studied ten healthy clinical laboratory technicians and hospital clerks (age, 23-43 yr, 5 females), who gave their written informed consent according to the study protocol approved by the Institutional Review Board of Nagoya City University Graduate School of Medical Sciences and Nagoya City University Hospital (approval number: 60-16-0213).

The subjects were colleagues working for the same hospital, and they had been acquainted with each other. None of them had present or past history of the psychiatric disorders including social phobia. Subjects were divided into groups A and B (n = 5 for both). They separated into a table with wooden tableware set (for group A) and a table with porcelain-metal tableware of the same composition set (for group B) and talked with each other within each group for 10 min while eating snacks (session 1). After 10 min, all the table sets were replaced with exactly the same new one but with wooden set for the table of group B and porcelain-metal set for the table of group A and they talked for 10 more min while eating snacks (session 2). It took 2 min to replace the tableware, during which the subjects were waiting away from the table.

The wooden tableware consisted of large (⌀ = 24 cm) and small (⌀ = 18 cm) plates with snacks and of individual dishes (⌀ = 18 cm), spoons (17 cm), and forks (18 cm), all of which made from beech wood (Tougei Co., Ltd., Kuwana city, Japan). The porcelain-metal tableware consisted of the same size of white porcelain plates and individual dishes and of stainless-steel spoons and forks (Figure 1).

Figure 1. The Scenery of a Meeting Room Setting Wooden and Porcelain Tableware

Pulse wave signals in all subjects were continuously measured during meeting by a wearable watch-shape pulse-wave sensor (AMP02, Suzuken Co. Ltd., Nagoya, Japan). The amount of communication during meeting was counted as the total number of utterances of all members of each group. After the completion of the measurement, a visual analog scale questionnaire about the impression on tableware was performed.

2.2 Data Analysis

Instantaneous pulse rate was derived from pulse-wave signal by pulse-frequency demodulation (Hayano et al., 2005) as the continuous function of time. Then, 5-min segments of pulse rate time series during the latter half of each of the sessions with wooden and porcelain-metal tableware were extracted. The amplitudes of low-frequency (LF, 0.04-0.15 Hz) and high-frequency (HF, 0.15-0.45 Hz) components and LF-to-HF power (= half of squared amplitude) ratio (LF/HF) of pulse rate variability were measured by complex demodulation (Hayano, Taylor et al., 1993, Hayano, 2016).

2.3 Statistical Analysis

Statistical Analyses System version 9.4 (SAS institute Inc., Cary, NC, USA) was used for statistical analysis. Because this is a study of crossover design, the effects of tableware type (wooden or porcelain-metal), period (sessions 1 or 2), and group (A or B, for carry-over effect) on the measures of

pulse rate variability were evaluated. For this purpose, we used procedure Mixed for crossover study design with the type of tableware, period, group, age, and sex as fixed effects and subject as random effect. Differences in the amount of communication with the type of tableware and period (sessions 1 or 2) were evaluated by chi-square test. The responses to visual analog scale questionnaire were evaluated by one sample t-test to examine if the responses were biased toward either types of tableware. We used P <0.05 as the criteria of statistical significance.

Table 1. Effect of Tableware on the Amount of Communication

Tableware	Group A	Group B
Wooden	81 (Session 1)	113 (Session 2)
Porcelain-metal	111 (Session 2)	75 (Session 1)
Total	192	188
Chi-square (session)	11.50	P <0.001
Chi-square (tableware type)	0.21	P = 0.6

The data are the total number of utterances during each session. The subjects in group A used wooden tableware first, then porcelain-metal tableware, while the subjects in group B used in reverse order.

3. Result

Significant effects of the type of tableware were detected on LF amplitude (P = 0.03) and LF/HF (P =

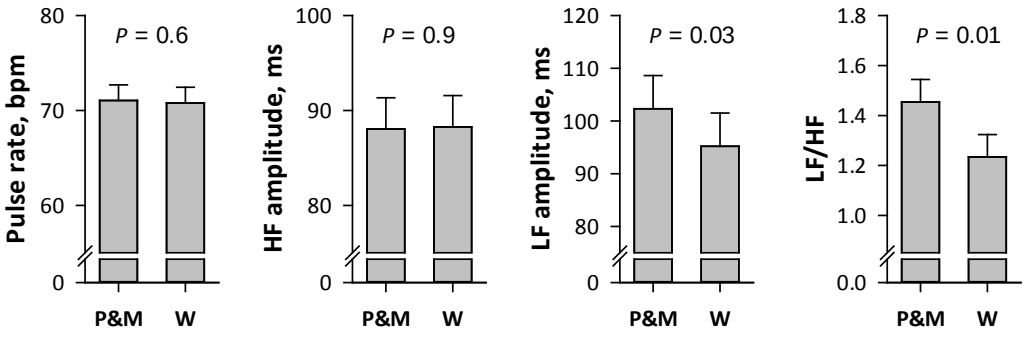

Figure 2. The Effects of the Type of Tableware on the Measures of Pulse Rate Variability

Data are least-square means and standard error of the mean adjusted for the effects of period, group, age and sex. P values represent significance of the effects of the type of tableware. HF = high-frequency component, LF = low-frequency component, LF/HF = LF-to-HF power ratio, P&M =

porcelain-metal tableware, W = wooden tableware.

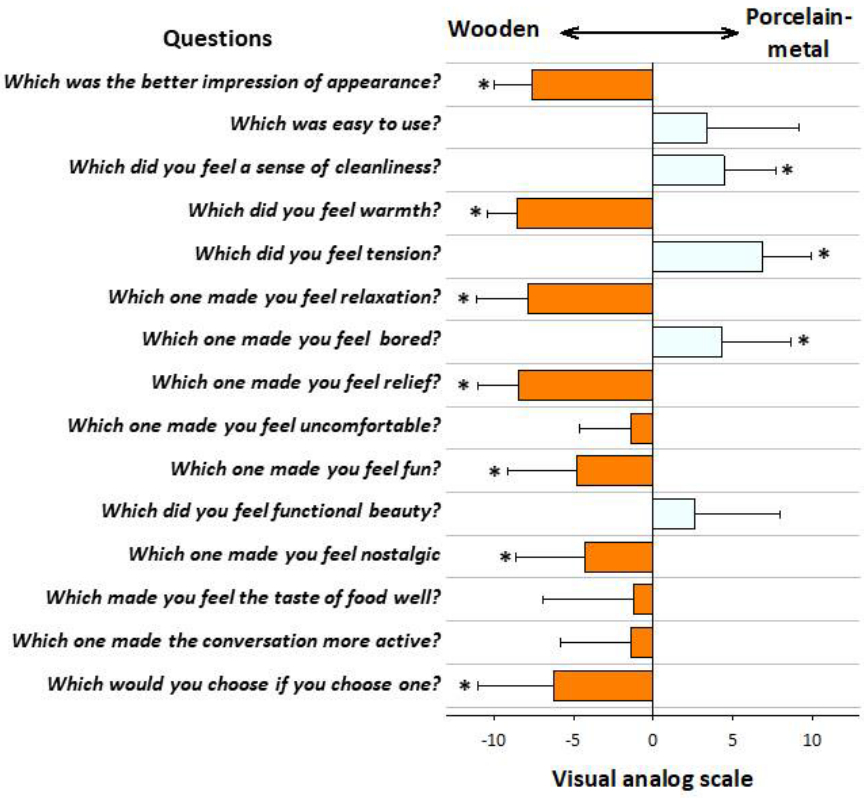

Figure 3. Responses to Visual Analog Scale Questionnaire about Subjective Impression to Tableware

*Responses significantly biased to ether wooden tableware or porcelain-metal tableware (P <0.05).

0.01) with no significant effects of period (sessions 1 and 2) or group (A and B) on these measures. No significant effect of the type of tableware was detected for pulse rate or HF amplitude. As shown in Figure 2, LF amplitude and LF/HF was lower during the use of wooden tableware than the use of porcelain-metal tableware.

On the other hand, the type of tableware did not affect significantly on the amount of communication, but period affected significantly (Table 1). The communication increased in session 2 compared to session 1 regardless of the type of tableware.

Figure 3 shows the response to visual analog scale questionnaire on the impression to tableware. Subjects had better impression, warmth, relaxation, remission, nostalgic feeling for wooden tableware than porcelain-metal tableware. No significant difference with sex or correlation with age was detected for any items.

4. Discussion

Although our observations are in the same line of those in earlier studies that reported the relaxing effect of wood-derived stimulation through olfactory, visual, auditory, and tactile sensations (Ikei et al., 2017), the present study may be unique in that it examined the impact of the use of wooden products on physiological and behavioral responses to social stimuli. Our observations are preliminary and those obtained from a small size of samples; but, given the long contacts of human beings with wood, the findings of this study may give important insights in considering the role of wood played in social situations.

We observed reductions in LF amplitude and LF/HF with wooden tableware. Because LF amplitude is known to be affected by interactions between sympathetic and vagal cardiac controls (Pomeranz et al., 1985; Berger et al., 1989; Rahman et al., 2011; Hayano, 2016), its relationship with autonomic function is not simple. In this study, however, we observed no significant difference in HF amplitude that reflects vagal cardiac control (Pomeranz et al., 1985; Berger et al., 1989; Hayano et al., 1991; Hayano, 2016). Therefore, reduced LF component observed when wooden tableware was used seems attributable to decreased sympathetic activity.

This study has limitations. We used pulse rate variability instead of ECG-derived heart rate variability for assessing autonomic functions. The correlations of the amplitudes of the frequency components between pulse rate and heart rate variability are only modest, particularly for HF amplitude (Hayano et al., 2005), which might have reduced the accuracy of detecting its difference with the type of tableware. Also, we failed to detect the impact of wooden tableware on the amount of communication, but we observed a significant effect of period (sessions 1 or 2) on it. This may suggest that the length of observation (10 min) was too short to evaluate appropriately the effects on communication.

In conclusion, we found that workplace social gathering using wooden tableware caused reductions in LF amplitude and LF-to-HF power ratio compared to that using porcelain-metal tableware, while the amount of communication were not affected by the type of tableware. Responses to questionnaire about subjective impression also showed consistent results. Although this is the preliminary study with a small sample size, our observations suggest that the use of wooden tableware may reduce sympathetic activity at the social gathering compared to the use of porcelain-metal tableware.

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