

## Comparison of the Effects of Individual and Group Horticulture Interventions

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### Abstract

Chronic stress adversely affects the body, and stress and negative emotions affect the development and progression of diseases. This study focuses on horticultural therapy (HT) as a method of stress reduction. Although previous studies have reported that HT has many benefits, the effects of HT in relation to differences in the intervention style have not been investigated. The purpose of this study was to clarify whether there is a difference in the effect due to the difference in intervention style in HT. The participants were divided into three groups, a group intervention (GI group;  $n=15$ ), an individual intervention (II group;  $n=15$ ), and a control group (C group;  $n=15$ ). The GI and II groups underwent four weeks of a horticultural intervention, whereas the C group was provided with a gardening kit by an experimenter. The individuals in the C group cared for the plants by themselves for 15 min per day for one month. The GI group showed significant improvement in the WHO Quality of Life 26 (WHO-QOL26) subscore, the Emotional Intelligence Scale (EQS) subscore, the General Health Questionnaire (GHQ) score, and salivary cortisol level, as compared with the II group. These findings suggest that a group HT intervention might be more effective than an individual intervention.

**Keywords:** Horticultural therapy; Group intervention; Individual intervention

### Introduction

Many Japanese people lead stressful lives, as do many people in other parts of the world. Previous studies suggest that the chronic stress adversely affects the body [1] and that stress and negative emotions can affect the development and progression of diseases [2]. The reduction of stress is important for maintaining and enhancing health. In recent years, methods of stress relief have been sought by many researchers. This study focuses on horticultural therapy (HT).

HT is a method of psychological care for treating post-traumatic stress disorder (PTSD) that was developed in the United States after World War II for the psychological care and social rehabilitation of disabled soldiers and war veterans showing PTSD symptoms [3]. HT interventions are led by professionals trained to incorporate the use of plants and horticultural education into rehabilitation therapies [3]. It has been reported that participants begin to identify with plant growth, and regain health and motivation. Through such experiences and their association with nature, participants are thought to experience improvement [4]. HT has mainly been developed for elderly adults and people with disabilities [5,6]. Previous studies have suggested that HT and exposure to nature can have cognitive [7,8], psychological [3,9-12], social [13,14], and physical benefits [10]. It has also been suggested that HT has a positive effect on physiological factors, such as heart rate and salivary cortisol levels [15]. Previous studies have reported many therapeutic effects of HT in care and education programs for disabled patients and the elderly [12,14,16-19]. However, the effects of HT in relation to difference in the intervention style, such as group versus individual interventions, have not previously been investigated.

The purpose of this study was to clarify whether there is a difference in the effect of HT in relation to a difference in the style of the HT intervention, using psychological measures and salivary cortisol level. We hypothesized that a group HT intervention may produce better psychological effects than an individual intervention. Although the content of the intervention was different from that used in previous studies, it has been reported that group interventions may produce greater improvement than individual interventions [20].

### Materials and Methods

#### Participants

Forty-five healthy, right-handed university students or postgraduates (22 men and 23 women; age,  $21.22 \pm 2.42$  years) participated in this study. They had normal vision and none had a history of neurological or psychiatric illness. Written informed consent was obtained from each participant in accordance with the Declaration of Helsinki (1991). Then, they were randomly allocated into group intervention (GI), individual intervention (II), and control (C) groups. The study was approved by the Ethics Committee of Tohoku University School of Medicine.

#### Procedure

Participants who were assigned to the GI and II groups participated in a horticultural intervention in the laboratory at a specified date and time. Participants in the GI group took the horticultural intervention in groups of five (total 3 groups). Before the start of the intervention, all participants were assessed on the basis of some psychological measures. The horticultural intervention was designed in collaboration with a horticultural therapist and clinical psychologists. This intervention comprised a total of four weekly sessions (60 min each) at a university lab and 15 min per day at participants' homes. The sessions at the university lab comprised interactive lectures and practical horticultural training. Participants attended four horticultural lessons, including topics such as designing a garden planter, seeding, watering, weeding, and picking flowers. They filled out a horticultural intervention session

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checklist after each session as self-assessment. Participants took care of plants for 15 min per day at their convenience, using horticulture kits provided by the experimenters, and recorded the completion of this task daily on forms provided by the experimenters at the intervention sessions. The participants submitted these forms to the experimenters at the weekly horticultural intervention sessions. Participants who were assigned to the C group were provided with a gardening kit by an experimenter; they cared for the plants by themselves for 15 min per day for one month.

## Psychological measures

We used Japanese versions of the following psychological measures.

**Assessment of quality of life:** The World Health Organization Quality of Life 26 (WHO-QOL26) is a 26-item, self-report measure designed to assess quality of life [21]. Twenty-four items measure the four domains of QOL: physical, psychological, social, and environmental, and the other two items measure overall QOL and general health. The score for each question ranges from 1 to 5, with higher scores reflecting higher QOL. The present study used the Japanese version of the WHO-QOL26 [21].

**Assessment of depressive symptoms:** The Center for Epidemiologic Studies Depressive Symptoms Scale (CES-D) is a 20-item, self-report measure designed to assess depressive symptoms [22,23]. Scores for each item are summed to give a range of total scores from 0 to 60. A higher score indicates a greater tendency toward depressive symptoms. A score of 16 points or higher suggests the presence of clinical depressive symptoms. The reliability and validity of the Japanese version of the CES-D have been confirmed [23]. In the Japanese version, the cutoff value of 16 was also optimal, as assessed by comparing the proportion of patients with CES-D scores of 16 points or higher in a normal control group with that in a group of patients with mood disorders [23].

**Assessment of emotional intelligence:** The Japanese version of the Emotional Intelligence Scale (EQS) is a 65-item, self-report measure designed to assess emotionally intelligent behavior, which provides an estimate of one's underlying emotional and social intelligence [24-26]. The scale was developed and standardized for use with Japanese subjects. A more detailed discussion of the psychometric properties of this instrument and how it was developed is found in the Emotional Intelligence Scale technical manual [26]. The participant's responses render the following three composite scale scores (factors): (a) Intrapersonal factor (comprising self-insight, self-motivation, and self-control), (b) Interpersonal factor (comprising empathy, altruism, and interpersonal control), and (c) Situation Management factor (comprising insight into and control of a situation). Each composite scale score comprises three subscale scores. All three factors of the EQS have been shown to be associated with better mental health, as measured by the General Health Questionnaire (GHQ). The Situation Management factor has been shown to be strongly associated with better mental health [24]. This result suggests that higher emotional intelligence leads to better mental health [27].

**Assessment of mental health:** The GHQ is a 30-item self-report measure designed to assess mental health [28,29]. This scale includes six subscales: "general illness," "somatic symptoms," "sleep disturbance," "social dysfunction," "anxiety and dysthymia," and "suicidal depression." The questionnaire uses a four-point Likert scoring method. The total score for the GHQ-30 is six or lower in 85% of healthy adults; in this study, we used only the total score.

**Assessment of mood state:** The Profile of Mood States (POMS) is a 65-item self-report measure designed to assess mood states [30,31]. It consists of the following six mood state scales: tension-anxiety (T-A), depression-dejection (D), anger-hostility (A-H), fatigue (F), confusion (C), and vigor (V). The reliability and validity of the POMS have been examined in the Japanese population [31].

## Saliva sampling

We collected saliva samples from participants to measure their salivary cortisol levels. Distressing psychological stimuli are associated with an increased cortisol level [32,33]. Considering the participants' circadian cortisol rhythms, we collected all saliva samples at 4:00 pm on weekdays, before and after the intervention. We selected 4:00 pm because humans are less affected by circadian cortisol rhythms at this time of day [34]. Participants were asked to refrain from drinking, eating [35], and exercising [36] for two hours before saliva sampling. This method was same as that in our previous studies [32,37].

## Measurement of salivary cortisol

To assess physiological stress, we employed the same technique to measure salivary cortisol as described in a previous study [32,37]. Saliva samples were collected using the Salivette apparatus (Sarstedt, Nümbrecht, Germany). Cortisol was measured in the supernatant solutions, which were stored in airtight containers at -80°C. We measured salivary cortisol with a semi-microcolumn high-performance liquid chromatography (HPLC) system (Shiseido, Tokyo).

## Analytical methods

The psychological and salivary data were analyzed using the PASW statistical software package (ver. 18 for Windows; SPSS Inc., Chicago, IL, USA). To examine the psychological effects, a mixed design was used to compare the difference between the three groups pre- and post-intervention. Additionally, as our primary endpoint of interest was the beneficial effect of intervention training, test-retest changes were compared between the intervention and control groups using one-tailed tests ( $p < 0.05$ ), in the same manner as in previous studies [32,37].

## Results

### Differences between three groups

The participants' demographic data are shown in Table 1; the ages of the three groups did not differ significantly. Comparisons of the psychological changes pre- and post-intervention are shown in Table 2. The GI group showed significant improvement, relative to the C group, in the WHO-QOL26 Psychological score [ $F(2,42)=4.37$ ,  $p < 0.01$ ], the WHO-QOL26 Social score [ $F(2,42)=4.76$ ,  $p < 0.01$ ], the EQS Interpersonal score [ $F(2,42)=2.80$ ,  $p < 0.05$ ], the EQS Empathy score [ $F(2,42)=4.38$ ,  $p < 0.01$ ], and the EQS Altruism score [ $F(2,42)=3.24$ ,  $p < 0.05$ ]. Furthermore, the GI group showed a significant decrease, relative to the C group, in the GHQ score [ $F(2,42)=2.66$ ,  $p < 0.05$ ] and POMS vigor score [ $F(2,42)=2.45$ ,  $p < 0.05$ ]. Additionally, the GI group showed a significant decrease in salivary cortisol level compared with the C group [ $F(2,42)=5.03$ ,  $p < 0.01$ ]. The II group did not differ significantly from the C group.

### Comparison of pre- and post-intervention scores in the GI and II groups

Comparisons of the psychological changes pre- and post-intervention between the GI and II groups are shown in Table 2. Relative to the II group, the GI group showed a significantly higher

Factor	GI group (N = 15)		II group (N = 15)		C group (N = 15)		Mean	SD	Mean	SD	p <sup>a</sup>
	Mean	SD	Mean	SD	Mean	SD					
Age	20.53	2.45	21.60	1.54	21.53	3.00					0.410

aOne-way analysis of variance.

GI, group intervention; II, individual intervention; C, control; SD, standard deviation

**Table 1.** Demographic data of the participants

Measures	GI group		II group		C group		Pre		Post		Mean	SD
	Pre	Post	Pre	Post	Pre	Post	Mean	SD	Mean	SD		
WHO-QOL26	3.23	0.53	2.93	0.58	3.23	0.4	3.01	0.69	3.07	0.57	3.18	0.55
Physical QOL score												
Psychological score	2.92	0.53	3.38	0.4	3.03	0.56	2.92	0.68	2.82	0.45	2.82	0.41
Social score	3.18	0.89	3.75	0.8	3.53	0.75	3.58	0.65	3.4	0.62	3.27	0.61
Environmental score	3.39	0.46	3.22	0.47	3.31	0.47	3.27	0.32	3.02	0.37	3.07	0.37
Global score	3.24	0.56	3.35	0.45	3.32	0.49	3.3	0.42	3.17	0.42	3.19	0.43
CES-D	13.53	10.32	7.67	3.64	9.53	5.28	8.87	6.67	14	11.77	13.73	4.04
EQS	46.6	11.87	49	13.52	54.67	11.88	56.93	12.5	42.4	7.43	46.4	9.3
Intrapersonal												
Self-awareness	12.07	3.65	12.73	4.06	15.47	4.93	16.33	4.55	11.33	3.7	12.33	3.92
Self-motivation	14.13	5.3	14.8	5.35	17.47	4.5	17.93	4.28	13.2	2.81	14.47	3.7
Self-control	20.4	4.52	21.47	6.6	21.73	6.32	22.67	6.11	17.87	4.73	19.6	4.5
Interpersonal	41.87	12.8	46.8	11.1	44.4	13.73	42.67	7.54	47.8	12.14	46.33	12.27
Empathy	13.67	4.12	15.53	3.4	16.53	5.57	14.87	3.62	15.87	3.6	15.87	3.46
Altruism	12.6	4.4	14.27	4.43	12.2	4.9	13.2	4.72	16.07	4.32	14.8	5.25
Interpersonal relationship	15.6	6.7	17	5.77	15.67	6.95	14.6	3.52	15.87	6.44	15.67	5.89
Situational	41.07	15.21	43.93	14.23	43.07	15.07	44	12.61	36.87	11.11	36.13	10.45
Situational awareness	18.53	6.65	19.13	5.78	18.4	8.64	19	6.11	17.07	4.28	16.6	5.49
Leadership	10.27	5.19	12.07	5.24	10.67	5.19	11.33	4.84	8.53	4.1	8.53	3.93
Flexibility	12.27	4.1	12.73	4.33	14	4.12	13.67	3.39	11.27	3.79	11	3.93
GHQ score	6	3.34	3.2	2.81	6.07	3.88	4.33	3.5	4.73	2.79	5.47	5.97
POMS Tension-Anxiety	6.53	4.42	6.07	2.89	8.73	4.32	7.4	4.27	8.2	4.9	7.93	4.35
Depression	5.87	5.58	2.73	2.55	6.4	4.03	4.87	3.85	5.67	6.5	5.6	5.96
Anger-Hostility	4.07	3.35	4	3.89	4.93	4.11	5.07	4.13	5	4.84	3.87	3.16
Vigor	8.87	3.52	10.47	3.72	8.73	4.42	9.93	3.9	9.73	4.04	9	4.02
Fatigue	8.27	4.1	5.73	3.41	8.2	3.88	6.13	3.2	8.8	5	7.07	5.23
Confusion	7.2	3.38	6.33	2.5	6.6	2.87	5.87	3.2	6.47	4.42	6.27	4.06
Total Mood Disturbance	23.07	19	14.4	13.68	26.13	15.25	19.4	15.78	24.4	22.03	21.73	19.87
Salivary cortisol level	3.96	0.96	2.15	0.79	4.54	3.21	3.97	1.74	3.97	1.41	4.21	0.94

<sup>a</sup>One-way analyses of covariance with pre-post differences in psychological measures as dependent variables and pre-intervention scores as covariates (one-tailed).

GI, group intervention; II, individual intervention; C, control; SD, standard deviation; WHO-QOL26, World Health Organization Quality of Life 26; CES-D, Center for epidemiologic studies depression scale; EQS, Emotional Intelligence Scale; GHQ, The General Health Questionnaire; POMS, Profile of Mood States.

**Table 2.** Psychological measures pre- and post-intervention

post-intervention WHO-QOL26 Psychological score [ $F(1,28)=5.92$ ,  $p<0.05$ ], WHO-QOL26 Social score [ $F(1,28)=3.97$ ,  $p<0.05$ ], EQS Interpersonal score [ $F(1,28)=4.15$ ,  $p<0.05$ ], and EQS Empathy score [ $F(1,28)=7.97$ ,  $p<0.005$ ]. The GI group also showed a significantly lower post-intervention GHQ score [ $F(1,28)=3.05$ ,  $p<0.05$ ] than the II group. Additionally, the GI group exhibited a significantly lower salivary cortisol level [ $F(1,28)=2.93$ ,  $p<0.05$ ] than the II group.

## Discussion

The purpose of this study was to investigate whether there is a difference in the effects of an HT intervention due to the difference in intervention style, using psychological measures and salivary cortisol level. The study revealed that the GI group showed improved psychological measures (WHO-QOL26, EQS, GHQ, and POMS) and salivary cortisol levels post-intervention compared with the other two groups. Additionally, the GI group was also showed improved psychological measures (WHO-QOL26, EQS, and GHQ) and salivary

cortisol levels post-intervention compared with the II group. These results are consistent with our hypothesis that HT may be more effective by group intervention compared with individual intervention.

The GI group showed improved WHO-QOL26 scores (psychological score and social score) than the II and C groups, indicating that the group HT intervention increased psychological and social QOL more than the individual intervention. Previous studies have reported that HT improved QOL [11,37,38]. The raising of plants in a group is thought to have brought new hope and stimulation to the participants, and this may have led to greater improvement of their QOL (in particular, psychological and social aspects), relative to an individual intervention, by synergy. The GI group showed improved EQS scores (interpersonal, empathy, and altruism scores) relative to the II and C groups, indicating that the group HT intervention increased interpersonal intelligence more than the individual intervention. Previous studies have suggested that HT improves emotional intelligence [39,40]. Conducting a multiple activity in a group is thought

to have developed a sense of community, interpersonal relationship, empathy, altruism, and so on. These effects were reflected more in the EQS interpersonal factor score of participants in the GI group than the II group. The GI group showed improved GHQ scores in comparison with the other two groups, indicating that the group HT intervention improved mental health more than the individual intervention. Many previous studies have suggested that HT improves mental health [41-44]. Our results confirmed this effect, and show that the mental health of the participants in the GI group had significantly improved, relative to the II group, by the synergistic effect of interaction with people and plants.

The GI group showed an improved POMS vigor score in comparison with the other two groups. Additionally, the GI and II groups did not differ in the change from pre- to post-intervention. POMS is a well-established tool for assessing mood state and current emotional health. Previous studies suggest that various mood states are improved by HT [19,45]. In the results of the present study, the vigor score had improved, as in previous studies. Horticultural activity causes a positive change in life and mood. The results suggest that the horticultural intervention elicits positive mood changes. The GI group also showed improved salivary cortisol levels, in comparison with the other two groups, indicating that HT reduced stress. The group HT intervention reduced salivary cortisol levels more than the individual intervention. Previous studies suggest that HT reduced salivary cortisol levels, and was an effective means of stress reduction [15,37,44]. The group HT intervention is thought to have improved stress more than the individual intervention, as reflected in the reduction of salivary cortisol levels.

Finally, this study raises some issues for future research. This was a preliminary experiment, with a small number of participants. A possible future direction would be to conduct the study with a larger number of participants and extend those findings.

In conclusion, this study suggests that it is easier to obtain many effects of HT with a group intervention than with an individual intervention. The results of this preliminary experiment will be reexamined in a future study.

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