



Effects of Horticultural Therapy on Mood and Heart Rate in Patients Participating in an Inpatient Cardiopulmonary Rehabilitation Program

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- **PURPOSE:** To assess the effects of horticultural therapy (HT) on mood state and heart rate (HR) in patients participating in an inpatient cardiac rehabilitation program.
- **METHODS:** Cardiac rehabilitation inpatients (n = 107) participated in the study. The HT group consisted of 59 subjects (34 males, 25 females). The control group, which participated in patient education classes (PECs), consisted of 48 subjects (31 males, 17 females). Both HT sessions and PEC are components of the inpatient rehabilitation program. Each group was evaluated before and after a class in their respective modality. Evaluation consisted of the completion of a Profile of Mood States (POMS) inventory, and an HR obtained by pulse oximetry.
- **RESULTS:** Changes in the POMS total mood disturbance (TMD) score and HR between preintervention and postintervention were compared between groups. There was no pre-session difference in either TMD score (16 ± 3.6 and 19.0 ± 3.2 , PEC and HT, respectively) or HR (73.5 ± 2.5 and 79 ± 1.8 , PEC and HT, respectively). Immediately following the intervention, the HT TMD was significantly reduced (post-TMD = 1.6 ± 3.2 , $P < .001$), while PEC TMD was not significantly changed (TMD = 17.0 ± 28.5). After intervention, HR fell in HT by 4 ± 9.6 bpm ($P < .001$) but was unchanged in PEC.
- **CONCLUSION:** These findings indicate that HT improves mood state, suggesting that it may be a useful tool in reducing stress. Therefore, to the extent that stress contributes to coronary heart disease, these findings support the role of HT as an effective component of cardiac rehabilitation.

K E Y W O R D S

cardiac rehabilitation
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mood state

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INTRODUCTION

Patients with coronary heart disease are often offered some form of cardiac rehabilitation, the nature of which varies between centers. The majority typically involve a combination of exercise program and health education. Psychosocial interventions aimed at reducing such risk factors as stress and anxiety are less frequently included despite the large body of work indicating their impor-

tance in the development and progression of coronary heart disease.¹⁻⁶

Following an event, cardiac patients report high levels of stress and anxiety during both their hospitalizations and postdischarge experiences. Between 40% and 50% of myocardial infarction patients report moderate to severe levels of anxiety while in the hospital, and about 20% continue to report anxiety at 1-year follow-up.⁷ Perceived quality of hospital stay, successful integration

of rehabilitation recommendations and goals, and quality of life after the return home can be affected by psychosocial interventions during hospitalization. A patient's overall mood may also modify rehabilitative efforts. Individuals with illnesses who also feel sad may be less likely to believe they can carry out illness-alleviating behaviors and are more likely to have pessimistic expectations of the effectiveness of these behaviors.⁸ Whereas, positive emotional states can offer people the opportunity to consider and plan for future events.⁹ In line with this, it has also been demonstrated that patients who participate in stress reduction interventions show greater improvement in rehabilitation outcomes than those not receiving these modalities.¹⁰⁻¹³

Gardening is a popular and accessible method of recreation that lends itself readily to a variety of healthy lifestyle activities. Horticultural therapy (HT) is a process through which plants, gardening activities, and innate closeness to nature are used as vehicles in therapy and rehabilitation programs.¹⁴ It is utilized for physical, cognitive, social, emotional, and recreational benefits. In practice, HT combines the therapeutic nature of a specially designed environment with activities aimed at meeting the therapeutic needs of the particular population served. Although the therapeutic use of horticultural activities has been practiced for hundreds of years,¹⁵ objective documentation of its benefits is relatively recent.

An increasing body of research has shown that HT is effective in reducing stress. Kaplan and Kaplan¹⁶ cite the stress-reducing, restorative effect resulting from viewing certain types of natural environments. Similarly, other studies have shown the stress-reducing capacity (as measured by decreasing blood pressure and heart rate (HR), skin conductance, and cortisol levels) and mood improvement effects of viewing and spending time in a natural environment.¹⁷⁻²¹

In our institution, education classes are an integral part of the inpatient cardiac rehabilitation program and include at least one horticulture class. The effect of these classes on the patients' subjective sense of wellbeing has not been assessed. Because of the role of stress and negative mood state as risk factors for coronary artery disease, we hypothesized that patients attending the HT session would have a positive shift in mood as measured by the Profile of Mood States (POMS) inventory and show a decreased level of stress as measured by HR when compared with a group of patients attending an education class (PEC).

METHODS

After obtaining informed consent, a representative cohort of 107 patients participating in a Phase I cardiac rehabilitation program were included in the study. About 60% of this population is postcardiac surgery,

and the remainder are primarily postmyocardial infarction or congestive heart failure. All subjects evaluated had been discharged from an acute setting within the previous 10 days. The HT group consisted of 59 patients (34 men and 25 women) who attended a single horticulture session. The control group consisted of 48 patients (31 men and 17 women) who attended a patient education class (PEC).

Heart rate was assessed using a pulse oximeter. Mood state was evaluated using the self-administered POMS questionnaire, an adjective rating scale designed for assessing emotional states that are transient, and therefore expected to respond rapidly to interventions.²² The POMS consists of 65 single-word items rated from 0 (*not at all*) to 4 (*extremely*). Six dimensions are scored: (1) tension/anxiety, (2) depression/dejection, (3) anger/hostility, (4) fatigue/inertia, (5) confusion/bewilderment, and (6) vigor/activity. The first 5 dimensions are regarded as reflecting negative mood dimensions, and the sixth is considered to be positive. Total mood disturbance (TMD) is obtained by summing the 5 negative mood dimensions and subtracting the vigor score. A decreased TMD score indicates an improved emotional state. The POMS's reliability and validity are well supported in the literature.^{23,24}

Prior to the prospective HT or PEC, patients filled out the POMS and had their HR recorded. HT subjects were then escorted to the greenhouse where they participated in a 60-minute HT session. At the end of the session they filled out the POMS again and HR was recorded. Similarly, patients in the control group attended a 60-minute PEC and then completed the POMS again, and had their HR recorded.

The HT class begins with a talk regarding the benefits of a healthy lifestyle. Patients then take a brief tour of the greenhouse and gardens that emphasizes the educational and recreational applications of horticulture, and simultaneously, immerses them in the vast array of stimulating sensory elements in that environment. Following the tour, patients participate in a planting activity (ie, dividing and potting a house plant). The PEC consists of an interactive lecture on one of the following topics: social service, psychology, medication management, nutrition, and heart risk factors.

TMD data were analyzed using repeated-measures ANOVA with treatment as the between-group factor. When no treatment effect was encountered, Student *t* test for paired samples was used to detect an effect. Specific changes in individual preintervention and postintervention POMS scales were analyzed by the Wilcoxon test.

RESULTS

Baseline TMD (Table 1) and HR (Table 2) were similar in the HT and PEC groups. Immediately following HT,

TMD fell from a score of 19.3 ± 24.5 to 1.6 ± 24.8 (mean \pm SD, $P < .001$). Similarly, HR fell by 5 bpm, from a preintervention level of 79.2 ± 14.7 to 74.1 ± 13.6 bpm ($P < .001$). The reduction in TMD resulted from a significant reduction ($P < .001$) in all negative dimension scales (ie, tension, depression, anger, fatigue, and confusion) and an increase in the positive dimension of vigor/energy (Table 3). Following PEC, however, neither TMD nor HR changed significantly (Tables 1,2), nor were any individual POMS dimensions significantly changed (Table 3).

DISCUSSION

Mental stress and intense emotion appear to be potent triggers of daily life ischemia in coronary patients,¹⁰ and emotional stress may slow recovery from coronary heart disease.²⁵ Bennett and Carroll⁷ state that between 40% and 50% of myocardial infarction patients report moderate to severe levels of anxiety while in the hospital, and the evidence suggests that anxiety has significant prognostic weight in rehabilitation, and for some, is even associated with sudden cardiac death.¹¹

Depression is another psychosocial factor shown to contribute to the morbidity and mortality in coronary artery disease.^{10,26} The incidence of depression in cardiac patients ranges from 15% to 30%.^{10,11,26} In contrast, positive psychologic states are associated with healthier patterns of responding in both cardiovascular activity and the immune system.⁹ Positive mood state is also associated with reported subjective reductions in bodily pain, and a study of college students found those with more positive affect more likely to engage in exercise, good nutrition, positive self-care practices, and positive overall health practices.²⁷

Improved mood, therefore, is an important outcome of a successful cardiac rehabilitation program, even more so because the response to a specific clinical intervention is in part dictated by the individual's own perception of his/her health and wellbeing. The POMS assesses mood

Table 2 • HR BEFORE AND AFTER HT CLASS AND PEC

	Horticulture (n = 59)	Education Class (n = 48)	Intraclass Significance
Preclass	79.2 \pm 14.7	73.5 \pm 17.1	NS
Postclass	74.1 \pm 13.6	73.54 \pm 17.0	NS
Interclass significance (P)	<.001	NS	

No significant differences were noted either between classes or between preintervention and postintervention.
HR indicates heart rate.

state,² and thus, can be used to evaluate the subject's current emotional health. The POMS is a well-established tool for assessing mood state and current emotional health, and has been used to evaluate the effect of a variety of interventions in cardiac patients.^{23,24} The effect of a single psychosocial or education class on mood state in an early postevent cardiac population, however, had not been previously assessed.

Our population was composed of subjects who had been transferred to the rehabilitation unit from the acute facility within the previous 10 days. The baseline scores for the POMS revealed significantly lower overall scores and markedly lower scores in the depression/dejection and the anger/hostility dimensions than in previously published data.^{28,29} This disparity appears best accounted for by the older age of the subjects in the current study. Nyenhuis et al³⁰ showed that in a healthy population, subjects (55 years old) had lower POMS scores than a younger population. Subjects in the current study were drawn from a patient pool with an average age of 76 years, while previous studies involved patients younger than 60 years.

Although the effect of HT has not been tested previously in this population, the assessed mood improvement is consistent with previous research indicating improved mood (as assessed by the Zuckerman Inventory of Personal Reactions) from viewing and spending time in a natural environment.¹⁷⁻²¹ Similarly, Shoemaker (unpublished data) found an increase in positive affective state in students completing horticultural activities compared with those completing non-horticultural activities.

Horticultural therapy has been shown to reduce stress as measured by a variety of physiologic markers (blood pressure, HR, skin conductance, and cortisol levels).¹⁷⁻²¹ Because there is a consistent association between increments in HR and sudden death in patients with heart disease, we chose to use HR as the most useful and easily accessible marker of physiologic stress. The use of HR as an indicator of stress dates to Cannon's work.³¹ It is also often used to assess the level of psychological stress (for review, see Ref. 32).

Table 1 • TMD BEFORE AND AFTER HT CLASS AND PEC

	Horticulture (n = 59)	Education Class (n = 48)	Intraclass Significance
Preclass	19.3 \pm 24.5	15.5 \pm 25.2	NS
Postclass	1.6 \pm 24.8	17.0 \pm 28.5	<.001
Interclass significance	<.001	NS	

There was a significant reduction in TMD following the HT class but not the PEC.
HT indicates horticultural therapy; PEC, patient educational class; TMD, total mood disturbance.

Table 3 • EFFECT OF HT AND PEC ON THE INDIVIDUAL MOOD DIMENSIONS ASSESSED BY THE POMS

	Tension	Depression	Anger	Vigor	Fatigue	Confusion
PEC (n = 49)						
Pre	7.76 ± 5.59	5.94 ± 7.06	2.22 ± 4.05	14.73 ± 6.39	8.22 ± 6.24	6.08 ± 3.68
Post	7.88 ± 6.22	6.18 ± 8.08	2.57 ± 5.22	13.90 ± 6.80	8.33 ± 6.56	5.92 ± 3.94
P	NS	NS	NS	NS	NS	NS
HT (n = 59)						
Pre	9.02 ± 6.51	5.80 ± 6.89	4.24 ± 5.68	15.10 ± 5.65	9.47 ± 5.79	5.83 ± 3.77
Post	4.86 ± 5.81	2.71 ± 5.66	1.90 ± 4.10	18.00 ± 6.11	6.00 ± 6.14	4.10 ± 3.39
P	<.001	<.001	<.001	<.001	<.001	<.001

POMS indicates profile of mood states.

The decrease in HR observed in our population following HT, but not after PEC, suggests that HT activity has the specific ability to modulate vagal and sympathetic tone and thereby reduced HR. Because this significant fall occurred in a cohort of patients taking a variety of prescribed cardiac medications that blunt HR response, we are of the opinion that the HT effect might actually have been more pronounced than observed. This suggests that future studies should take advantage of more specific markers, such as levels of cortisol, catecholamines, and indicators of immunocompetence, which would be more sensitive in assessing the effectiveness of HT.³³

In addition to these objective measures, this affective shift in the HT group was clearly noticeable to the healthcare professionals working with them. These patients routinely appeared in a better mood, were more lively and animated, and engage with greater frequency and ease in interpersonal interactions.

LIMITATIONS

Although this study demonstrates that HT has a positive effect on mood, it also raises several questions. The mood-enhancing effect was short term, with no attempt to evaluate how long this effect would last. Because this was a single intervention study, we do not know how multiple HT intervention would modulate the mood response. The study also does not identify the unique characteristics of HT that could account for the observed impact on mood. Finally, although subjects were chosen from a fairly homogeneous pool, in the absence of random allocation, selection bias cannot be ruled out.

CONCLUSION

These data support the notion that HT can improve mood state and reduce stress in coronary artery disease patients, and suggests that the introduction of HT as an integral component of the cardiac rehabilitation agenda

may have significant psychosocial benefits for participants (ie, patients appear less stressed and anxious, and are invigorated by their experience). These findings support Pashkow's³⁴ view of preventive cardiology, that is, "multi-factorial programs seem to be the most potentially effective means we have of preventing coronary events, and should become the standard of care."

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