Gardening and Art Study: Assessing Biometric Changes for Healthy Women in a Randomized, Controlled Intervention

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A human subject experiment involving healthy women ages 26-49 was conducted where study participants were randomly assigned to either a gardening or art intervention consisting of eight one-hour sessions over a four-week period. Self-report psychometric assessments were administered and heart rate and blood pressure monitored in order to quantify treatment effect outcomes relative to mental and physiological health.

Why is gardening so popular? The Million Women Study of physical activity and health, with about 600,000 middle-aged participants in the United Kingdom (UK), showed that women average three hours of gardening each week, and gardening was third in total time spent each week in physical activity behind housework and walking (Armstrong et al., 2011). In a longitudinal study of physical activity during mid-adulthood (ages 31–53) in the UK, it was found that 16.5% and 22.8% of men and women respectively engaged in gardening (Silverwood et al., 2011). According to a Nielsen Scarborough Survey, in 2017 an estimated 118 million adults engaged in some form of gardening within the previous 12 months in the United States (based on 250,000 U.S. respondents 18 years of age and older). Furthermore, according to the National Gardening Survey (Butterfield, 2009), 43 million American households (37%) had a food garden in 2009, and the average time spent per week engaging in food gardening was five hours. The average American food gardener was found to be female, age 45 or older, and had attended college.

One answer to the question “Why is gardening so popular?” may reside in the pioneering work of Rachel and Stephen Kaplan that has shown gardening, experiencing nature, and coming into contact with natural environments provide psychological benefits (Kaplan, 1973; Kaplan, 1995). Stephen Kaplan explained some of the benefits of connecting with nature may be the result of restoring psychological and cognitive resources that can be depleted by high task demand, stress responses, or inimical stimuli in everyday life (Kaplan, 1995). He postulated that voluntary directed attention, often necessary in everyday tasks, is a psychological and cognitive resource that can be depleted, and if not restored, then impaired performance and psychological stress will follow. In an increasingly fast-paced and urbanized world where psychological stress seems to be growing, opportunities to connect with nature to restore depleted directed attention resources are decreasing. Looking forward to an even more urbanized world in the future, the nature deficit will grow ever wider, but fortunately gardening may offer a way to reduce such a nature deficit.

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Early forms of gardening were practiced by humans in the tropics during the late Pleistocene (Upper Paleolithic Period) well before the beginning of the Holocene (Neolithic Period) about 12,000 years ago thereby providing food and nutrition for hunter-gatherer populations (Summerhayes et al., 2010). Paleolithic foragers apparently cultured tropical plants such as yam (Dioscorea spp.), banana (Musa spp.), and taro (Colocasia spp.) until they were domesticated by the beginning of the Neolithic Period (Roberts et al., 2017). Clearly, early forest gardening improved human chances for survival and linked humans to nature through these crucial people-plant interactions. In contrast, the concept of horticulture as therapy dates only to the early 19th century when Benjamin Rush, considered to be the father of American Psychiatry, was the first physician to recognize the therapeutic benefits of working in a garden for individuals suffering from mental health disorders (Rush, 1812). By the 20th Century, World Wars I and II served as catalysts for gardening therapy as large numbers of wounded soldiers were encouraged to participate in therapeutic treatments in the form of working in gardens to improve the function of injured bodies and recovery from “shell shock.” Plants and gardening became a common diversion for those who were hospitalized for long-durations. Following World War II, horticultural therapy (HT) became more widely practiced particularly in rehabilitative hospitals where garden club members established gardens, built greenhouses, and gave courses on plant identification and horticulture (Shoemaker and Diehl, 2012). Horticultural therapy in its most common form is largely an extension of the gardening and the horticulture that people have been doing for millennia, but assisted by a trained therapist to facilitate positive clinical and therapeutic outcomes. Horticultural therapy and therapeutic horticulture (TH), a less structured variation of HT, are now widely practiced in developed countries throughout the world (Neuberger, 2012).
Given the long history of people–plant interactions and the idea that gardens and gardening could be therapeutic, one would expect there to be a large body of scientific literature that quantitatively demonstrates the different therapeutic benefits and outcomes of HT. In fact, there is a surprisingly limited amount of quantitative experimental research on the topic. The cumulative body of research generally supports multiple beneficial effects of HT, but the evidence is mostly observational, qualitative, and descriptive. When quantitative, such studies have often been based on a variety of self-reporting survey instruments. There has been little replication and direct validation of published studies, and given the diversity of experimental designs, methods, objectives, and subject populations, there seems to be little direct comparability between most studies. Nevertheless, a meta-analysis of 22 gardening research studies revealed overall positive health outcomes attributed to the pooled data from the gardening interventions (Soga et al., 2017).

While there is broad anecdotal perception and acceptance that gardening and HT provide real health benefits beyond nutritional enhancements, considerable clinical trial research is acutely needed to better quantitatively define the actual health benefits and outcomes horticultural activities can provide. Beyond elevating the potential healthcare value of HT, further research may suggest that gardening has the potential to become a recognized form of therapy in public health that does not involve or require pharmacological intervention.

Why might engaging in gardening and HT provide therapeutic benefits? On one level, gardening is considered to reduce stress, and consistent with this notion is the fact that salivary cortisol levels (a biomarker of stress levels) have been shown to decrease immediately following engaging in gardening activities (Van Den Berg and Custers, 2010). Additionally, gardening and horticultural therapy have proven to have beneficial effects on chronic pain (Verra et al., 2012), mood state (Wichrowski et al., 2005), depression (Gonzalez et al., 2009; 2010), quality of life (Perrins-Margalis et al 2000), and cognitive functioning (Berman et al., 2008).

The goal of the research briefly outlined in this work is to further support the hypothesis that participating in group-based gardening activities has measurable therapeutic benefits on the mental health status of gardening-naive healthy women. It is an audacious and bold idea to suggest the health status of healthy women could be improved by engaging in gardening activities. Yet, the magnitude of anecdotal support for such a concept coming from millions of gardeners is so overwhelming it seems impossible not to be true. The work on this hypothesis represents a first of its kind study given the demographics of the study’s participant population. In 2015, the same research consortium of investigators conducted a highly controlled pilot experiment with a population of 23 healthy premenopausal women ages 26–49. The results from that experiment produced compelling outcomes and quantitatively suggested the present study’s hypothesis (Penman, 2015). Briefly, scores from the psychometric assessments administered before and following the completion of the gardening treatment resulted in statistically significant improvements in the mental health profiles of the healthy women.

Materials and Methods

This study is a follow-on study to a 2015 gardening study conducted at Wilmot Gardens, which revealed significant therapeutic benefits for healthy women with respect to anxiety, depression, mood state and perceived stress in a gardening treatment group compared to a no treatment, concurrent control group (Penman, 2015). The present study parallels the earlier gardening study, while improving and reducing potential for bias in the experimental design with the addition of an active, concurrent control group in the form of a group arts intervention. This design model allows for statistical analyses of relative-effect estimates as compared to only absolute-effect estimates. After approval by University of Florida Institutional Review Board, 40 healthy women participants were recruited to participate in a series of highly controlled gardening or art activities in experimental treatment sessions taking place over a four-week period from October to November 2018, when greenhouse conditions were environmentally favorable for participant comfort. To reduce experimental variability, defined inclusion criteria were used to assess participant eligibility for the study. Random assignment of participants into equivalent gardening or arts groups allowed for testing the effects of engaging in group-based gardening or art on blood pressure and heart rate; satisfaction with leisure interests and relationships with friends; mental health, which included dimensions of depression symptomatology, anxiety, perceived stress, and mood disturbances; physical health; and overall quality of life of the participants.

The eight, one-hour gardening sessions were selected from the 12 gardening sessions of the earlier gardening pilot study (Penman, 2015), and sessions were led by a trained graduate-level horticulturalist at the Greenhouse at Wilmot Gardens. Professional artists from the Center for Arts in Medicine at the University of Florida designed and led the eight, one-hour art sessions at the Conference Center at Wilmot6 Gardens (located on the same site as the Greenhouse). The hypothesis was tested with a well-defined healthy population of women based on screening procedures. Considerable attention was paid to carefully define the parameters of the experimental treatment that could serve to catalyze standardization for similar gardening and HT studies in the future.

Assessment of the effects of the gardening activities on the experimental population employed widely used and well-established self-reported assessment instruments that captured quantitative information about overall mental health function and well-being that provided a psychometrically-based health summary of the participants. Specifically, the self-report assessments characterized several major psychometric parameters, namely, depressive symptomatology, perceived stress, anxiety, mood states, and disturbances. Data on real-time cardiovascular physiology, heart rate, and blood pressure, was collected in triplicate at the beginning and end of every gardening and art session. An additional self-report assessment instrument was administered to measure participants’ perceived satisfaction of social activity. Based on review of the extant literature, this experimental design with the collaboration with the University of Florida Arts in Medicine program provided a novel approach to compare accessible leisure-time activities with the potential to both contribute new information and bolster evidence in support of gardening, therapeutic horticulture, people-plant interactions, and possibly art as beneficial therapeutic modalities.

Results

Data were processed with an intervention group by time repeated measures analysis of variance (RM-ANOVA), and main effects were decomposed to analyze the influence of the garden-
ing and art interventions and to distinguish between and within intervention differences on health outcomes. Results compare pre-intervention and post-intervention health outcomes.

Random assignment of participants to either the gardening or art treatment was found to result in equivalent demographics, i.e. age, education, socio-economic status, body mass index, etc., for the two interventions. The gardening and art groups both showed statistically significant improvements from pre- to post-intervention for total mood disturbance, perceived stress, and depression symptomatology. Both gardening and art groups showed no statistically significant changes from pre- to post-intervention for trait anxiety, general quality of life, or satisfaction with participation in social activities. Systolic and diastolic blood pressures were statistically unchanged for the gardening group participants throughout the gardening intervention. In contrast, systolic blood pressure was unchanged, while diastolic blood pressure increased for the art group participants throughout the art intervention. Heart rate was unchanged for both the gardening and art interventions.

Discussion

A comprehensive review of the existing experimental literature regarding HT and/or therapeutic horticulture reveals a broad lack of standardization of virtually any aspect regarding the horticultural activities and treatments employed from study to study. This surprising observation illustrates the vast array of activities that may constitute a treatment regime, the myriad range of treatment objectives and client populations, the inherent weakness of the results of individual studies not being directly comparable, and the absence of a measurable quantitative understanding of the benefit of any singular horticultural activity or closely related group of activities. Irrespective of the experimental design and assessment instruments used in past studies, which horticultural activities have the greatest therapeutic value for a particular clinical situation and outcome remain virtually unknown.

As the name implies, HT resides at the intersection of horticulture, plant sciences, medical sciences, psychiatry, psychology, sociology, social sciences, occupational therapy, clinical practice, and health and human sciences. A survey of the published literature commonly finds studies conducted by horticulturists, or horticultural therapists, health care analysts or psychologists, psychiatrists or other clinicians. Given the interdisciplinary nature of HT, the experimental design of many studies seeking to define HT benefits have focused on one aspect or another, but most studies have often lacked a proper holistic and well-controlled experimental designs. At the University of Florida, a land-grant university with an institute of agriculture and a medical school, the study outlined in this paper brought together an interdisciplinary faculty team consisting of a registered horticultural therapist (HTR), two professors of horticultural sciences, a physician and professor emeritus of the College of Medicine, and a professor from Psychiatry and Psychology and director of a Neurocognitive Laboratory.

The present study focused on the impact of a gardening intervention on the healthy women in an effort to assess the therapeutic the restorative and healing powers of plants, gardening and HT, thereby beginning to establish what horticultural therapists and millions of gardeners already know and feel, but are unable to experimentally establish. Without a better clinical understanding of the efficacy and treatment effects, it will not be possible for HT to make the next major transition to a mainstream healthcare treatment modality. Horticultural therapy and TH are not medically recognized therapeutic interventions nor are they reimbursable expenses covered by health insurance in the United States. Thus, an urgent need exists for a coherent foundation of solid clinical research demonstrating cause and effect of HT and gardening. The establishment of a body of reliable quantitative measures of benefit per given treatment regime, with dosage considerations that are well understood is needed before HT and TH can become medically accepted treatment modalities and a standard adjunct to current clinical practices. Similarly, for gardening to become a professionally recommended therapeutic behavioral modality to maintain or improve mental health and overall well-being, what we already know anecdotal must be well supported by robust experimental evidence.

The successful scientific demonstration that engaging in gardening activities quantitatively enhances wellness and quality of life measures contributes to the experimental foundation of empirical evidence necessary for transforming gardening and HT into a mainstream medically accepted therapeutic regime. In so doing, establishment of medical acceptance would greatly magnify the application of gardening and HT practices across a wide spectrum of demographic groups and settings, and thereby serve to expand the demand for plant materials and allied products produced by the green industry.

Literature Cited

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