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# **Is Horticultural Therapy A Safe And Effective Treatment in Reducing Agitation For Dementia Patients In Nursing Homes?**

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A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

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Department of Physician Assistant Studies  
Philadelphia College of Osteopathic Medicine  
Philadelphia, Pennsylvania

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## ABSTRACT

Objective: The objective of this selective EBM review is to determine whether or not horticultural therapy is a safe and effective treatment in reducing agitation for dementia patients in nursing homes.

Study Design: Review of three English language primary studies published between 2008 and 2010

Data Sources: Two randomized control trials and a case series, which compare horticultural therapy to the use of traditional therapy methods.

Outcomes Measured: The primary outcome measured in all three studies focus on the level of agitation in dementia patients. Secondary outcomes also included efficacy of sleep as well as level of cognition.

Results: In the case series study by Lee et al, horticultural therapy was found to significantly improve level of agitation, cognition and certain aspects of sleep such as wake after sleep onset, nap duration, and nocturnal sleep time and efficiency. There was no improvement in sleep onset, wake-up time, or total sleep time. The two randomized control trials, indicated that no significant improvement in agitation after horticultural therapy based on corresponding p-values. In Jarrot et al, anxiety/agitation was not significantly decreased ( $p = 0.932$ ) after the AARS was converted with the Mann-Whitney test. Luk at el demonstrated lack of significant improvement in the CMAI score for control and therapy groups post-intervention;  $p = 0.115$  and  $p = 0.249$ , respectively.

Conclusions: The results of two randomized control trials demonstrated that horticultural therapy was not effective at reducing agitation in dementia patients, while the case series study indicated a possible decrease in agitation for the therapy group. Overall consistency was not provided and the data was inconclusive. All trials were limited due to small sample size and lack of follow-up studies.

Key words: Dementia, Horticultural Therapy

## INTRODUCTION

Alzheimer's disease and related dementia (ARD) are diseases categorized by a generalized loss of brain function that affect skills such as judgment, memory, language, behavior and thinking.<sup>1</sup> As the loss of brain function progresses, these patients experience decrease in quality of life and lack of independent functioning. Agitation and inefficient sleep often follow the progressive diagnoses of dementia, which worsen with the lack of meaningful activities that can be associated with life in a long-term care facility. Currently, the elderly population is most commonly affected by dementia and the pharmacologic therapies available for these diseases are only partially effective at treating and reducing symptoms. Recent interest in alternative therapy may avoid side effects associated with pharmacologic therapy as well as introducing the idea of patient centered care. This paper evaluates two randomized control trials and a pilot study case series comparing the efficacy of horticultural therapy to traditional therapy in dementia patients.

The number of individuals diagnosed with dementia in their lifetime continues to increase due to the generalized trend of prolonged life expectancy. More than 50% of dementia patients are diagnosed after the age of 85, confirming dementia as a disease of the aging population.<sup>1</sup> As of 2010, Alzheimer's dementia affected approximately 5 million individuals in the United States and over 35.6 million people worldwide.<sup>2</sup> These astonishing numbers are thought to increase to 65.7 million diagnoses worldwide by the year 2030.<sup>2</sup> It cannot be ignored that with more and more dementia patients, the cost of maintaining and providing for their care is an increasing issue. Although an exact number for the total healthcare cost of dementia in the United States is unknown, worldwide costs are approximated to be \$604 billion in 2010, with 70% of that being spent in North American and Western European countries.<sup>2</sup>

These costs include informal care by home caregivers, social care by the community, and direct medical costs through primary and secondary care. All of these sources are contributing factors toward the enormous financial burden dementia patients, their families, and the government-funded healthcare system experience. There is no doubt that there is an increased need for supportive care as the disease of dementia progresses. The Alzheimer's Association indicates that 47% of dementia patients reside in nursing home facilities to maintain their care, while 80% of the dementia population receives some form of care by a family caregiver.<sup>1</sup> Regardless of where the care takes place, these numbers indicate that as brain function reduces and mentation is altered, extended care is necessary in order to perform activities of daily living (ADLs) and reduce the symptoms of memory loss, sleep disturbances and agitation.

The exact cause of Alzheimer's dementia is unknown and there is no definitive cure at the current time. However, the disease is thought to be associated with a genetic component in addition to the presence of amyloid plaques and neurofibrillary tangles within the brain, eventually leading to neuron malfunction and cell death.<sup>1</sup> The physiologic changes associated with dementia affect the areas of the brain that are primarily responsible for memory, advanced thought processing, and bodily functions. The diagnosis of dementia is usually clinical and as the disease progresses so do the symptoms, usually beginning with memory loss and eventually leading to full loss of cognitive function.

The current FDA approved pharmacologic therapies available for reducing cognitive symptoms include cholinesterase inhibitors and NMDA receptor antagonists, but both drugs have limitations due to the potential for side effects and limited efficacy of approximately fifty percent.<sup>1</sup> Other medications such as sedative-hypnotics, neuro-epileptics, and antipsychotics are sometimes used for symptom relief but are not approved by the FDA.<sup>3</sup> Due to the limitations of

pharmacologic therapy, non-pharmacologic treatments such as supportive services, group therapy and memory exercises have been introduced but minimal data is provided about their long-term benefits and further research is needed.

Horticultural therapy is being proposed as an alternative adjunctive therapy for dementia patients in long term care facilities in order to introduce the idea of person-centered care and the importance of social interaction, which in turn may reduce agitation.<sup>4</sup> It offers reciprocal relationships and sensory stimulation, which are commonly lacking in nursing home and other long-term care facilities.<sup>5</sup> Although it is not currently a widely used form of treatment in dementia, several studies have suggested that horticultural therapy has the potential to reduce agitation in dementia patients residing in nursing homes.

## **OBJECTIVE**

The objective of this selective EBM review is to determine whether or not horticultural therapy is a safe and effective treatment in reducing agitation for dementia patients in nursing homes.

## **METHODS**

All three studies selected for this review focused on a population of adult patients (> 65 years of age) who had a clinical diagnosis of dementia and were currently residing in a nursing home facility. The intervention involved needed to include some aspect of horticultural therapy and the comparison groups included another form of alternative non-pharmacological therapy. The outcome measured in each of the studies focused on the level of agitation in dementia patients based on sleep diaries, Modified Cohen-Mansfield Agitation Inventory, Hasegawa Dementia scale, and the mini-mental status exam. Two of the studies selected for this review

were single blinded RCTs and the third was a pilot study case series; all were based on a pre and post-test design.

The author, using the keywords of “horticultural therapy” and “dementia”, completed a detailed search of PubMed, CINAHL Plus, and EBSCOhost web databases. All studies included were published in English between 2008 and 2010. Two of the three articles were published in peer-reviewed journals and the third as a letter to the editor. The articles were selected based on relevance to the clinical question and the importance of outcomes to the patient: (POEM; patient outcome evidence that matters). The inclusion criteria were studies that that were randomized, controlled, single blinded, prospective and included patient directed outcomes whereas the exclusion criteria were articles that didn’t directly specify use of horticultural therapy or included patients without a clinical diagnosis of dementia. Summaries of statistics reported or used include the Z-test, standard deviation, paired-t test, change from baseline, correlation coefficient, and p-values.

Table 1: Demographics and Characteristics of included studies

Study	Type	# Pts	Age	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Jarrott. 2010	RCT	129	Mean age: 80.09	Diagnosis of dementia; ability to attend activities; verbal assent; attended at least half of 1 observed horticultural therapy based or traditional activity session	N/A	0	Horticulture based therapy; Sowing seeds, training topiaries, craft activities incorporate horticultural material /themes

Study	Type	# Pts	Age	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Luk, 2011	RCT (single blinded, pre-/post-test design)	14	≥ 65; mean age: 84.9	Aged 65 or above; diagnosed with dementia; able to communicate in Cantonese (the main local Chinese dialect); showing symptoms of agitation	B/I blindness and deafness; acute illness; allergy to plants, mud, pollen, fertilizer, and seeds; physical incapability; horticultural activities in previous 6 mo	1	30-min 2x weekly horticultural activity conducted in an outdoor garden; fertilizing, seeding, flower, arranging, planting
Lee, 2008	Case series	23	N/A	Institutionalized patients diagnosed w/ dementia; Reported sleep disturbances and/or agitation Able to carry out the study protocol without any significant physical problems	N/A	0	Indoor gardening; selecting beans, setting roots, planting beans, emptying containers, watering, touching, cleaning and arranging containers, wiping floors, harvesting, cutting, washing

### OUTCOMES MEASURED

Each study analyzed the level of agitation in dementia patients as the primary outcome, with the efficiency of sleep and cognition as secondary outcomes. Efficiency of sleep was thought to be closely related to the level of agitation in these patients and was therefore considered to be a significant secondary outcome. In one study, efficiency of sleep was evaluated with twenty four-hour sleep diaries recorded for one week at baseline and then again

during the fifth week. Each of the three clinical trials also evaluated the level of agitation after horticultural therapy. The Modified Cohen-Mansfield Agitation Inventory (CMAI) was used to evaluate agitation on a direct observational scale, normalized for consistency with the KR-20 Index (0.88-0.94). The Apparent Affect Rating Scale (AARS), an observation scale (0-2), was used to assess pleasure, anxiety, and sadness. Both the Hasegawa Dementia Scale based on scores of 0-30 and the Mini-Mental Status Examination were done to evaluate the baseline and post-intervention cognitive level of the participants.

## **RESULTS**

The two randomized control trials and one case series all evaluated the efficacy of horticultural therapy in reducing agitation in dementia patients with the use of continuous data. The RCTs compared horticultural therapy to traditional non-pharmacologic therapies where as the case series used a pre and post intervention comparison.

In Jarrot et al,<sup>4</sup> randomized control trial, horticultural therapy was initiated in order to determine the efficacy of meaningful activities in the dementia population. Eight different long-term care and adult day service facilities, with a total of 129 male and female participants, were randomized into the treatment group or the comparison group and observed for a total of 6 weeks. The treatment group was based on horticultural activities such as seed sowing and training topiaries and the comparison group utilized traditional activities. Each of the participants needed to be observed for at least half of a 30-minutes therapy or activity session in order to qualify for the study. At each facility, two facilitators were present to monitor and facilitate the content of the activities. Observations were made and recorded twice a week in the morning during weeks 1, 2, 5, and 6 in order to assess which form of affect was expressed by the patients; anxiety, interest, or pleasure. Categorical data was obtained with specific coding of the Apparent

Affect Rate Scale (0 = not at all, 1 = up to ½ the observation, 2 = more than ½ the observation) and was used to assess the patients' time particularly spent in an anxiety/sadness state. The data was converted to continuous data and analyzed as percentage of time each patient spent in an anxiety state. Finally, the Wilcoxon-Mann-Whitney U test was used in order to evaluate the hypothesis and the p-value was determined to evaluate the statistical significance of the results. Although the results indicate a greater mean percentage of time spent in an anxiety state for the treatment group, the high p-value indicated there was no statistically significant difference in anxiety duration between the two groups ( $p=0.93$ ). The z value of -0.09 suggested that the null hypothesis could not be rejected and there was not definitive difference between the horticultural therapy and traditional activity groups.

**Table 2: Treatment vs. Control Group Percentage of Time Exhibited in Anxiety State**

Group	Mean	Median	z	P
HT Group (N=75)	1.2	0.0	-0.09	0.93
Comparison Group (N=54)	0.9	0.0		

In the Luk et al,<sup>5</sup> randomized controlled trail, fourteen subjects were selected from a single nursing home facility and randomly assigned to either the treatment group (horticultural therapy) or the control group (alternative sensory stimulation). There was one dropout in the control group; so all the original participants were not included in the final analysis. All participants were older than 65 years of age and had a clinical diagnosis of dementia. The treatment group participated in 30-minute outdoor gardening sessions twice a week for a total of 6 weeks, while the control group experienced alternative sensory stimulation therapy for equivalent duration and frequency of sessions. Agitation was assessed based on the Chinese version of the Cohen-Mansfield Agitation Inventory along with change from baseline values.

The C-CMAI values were recorded for both groups at baseline and post-intervention and statistically evaluated with a p-value for the change in baseline data as well as comparatively between the two analysis groups as seen in Table 3. Although the C-CMAI scores decreased post-intervention for the treatment group and increased post-intervention for the control group, all p values proved to be insignificant for change in baseline data ( $p>0.05$ ). The comparative studies between the two groups also proved to be statistically insignificant with an overall p value of 0.116, which suggests that there is no improvement in level of agitation following horticultural therapy in dementia patients.

**Table 3: Intervention vs. Control Group C-CMAI Scores And Change From Baseline**

	Intervention Group (N=7)		Control Group (N=6)		p-value
	Mean (SD)	p-value	Mean (SD)	p-value	
Agitated behaviors at baseline ( $T_0$ ) Total C-CMAI score	43 (11.80)		44.57 (16.64)		0.898
Agitated behaviors post-intervention ( $T_1$ ) Total C-CMAI score	39.29 (10.32)	0.115	56.33 (30.88)	0.249	0.352
Difference in agitated behaviors ( $T_1-T_0$ ) Total C-CMAI score	-3.71 (5.38)		10.5 (22.14)		0.116

In the case series, change from baseline, study by Lee et al,<sup>3</sup> twenty-three subjects, all with a clinical diagnosis of dementia, completed the five-week protocol to assess the level of agitation as well as efficacy of sleep following horticultural therapy. The first week focused on baseline data and the following four weeks evaluated treatment effects. There were no dropouts during the study; so all participants were included in the analysis. The study indicated that there were some improvements in certain areas of sleep, while other areas were unaffected. There were significant improvements in wake up after sleep onset ( $p=0.002$ ), nap

duration and frequency ( $p=0.000$ ), nocturnal sleep time ( $p=0.002$ ), and nocturnal sleep efficacy ( $p=0.006$ ).

The primary outcome measured in this study was based on the level of agitation in the participants after the four weeks of therapy. Analysis with the Modified Cohen-Mansfield Agitation Inventory (M-CMAI) was used based on daily observations made by research assistants during the one-hour therapy sessions. Internal consistency was established with the Kuder-Richardson KR-20 index and converted into a numerical value. Pre and post-intervention values are listed in Table 4, along with the paired-t test and the corresponding p-value. The paired-t test value (-4.002) and the p value (0.001) indicated a statistically significant difference in the agitation level for pre and post-intervention data, which in turn rejected the null hypothesis and may suggest a positive outcome for horticultural therapy in dementia patients.

**Table 4: Pre vs. Post-Intervention Change From Baseline M-CMAI Scores**

	Mean KR 20 index $\pm$ (SD)	Paired-t	p-value
Pre-Intervention	5.09 $\pm$ 2.76	-4.002	0.001
Post-Intervention	3.13 $\pm$ 2.30		

Due to the fact that all studies lacked dichotomous data and that the continuous data could not be converted, issues on safety and tolerability were not mentioned in any of the trials. Therefore, no statements could be made in reference to the safety of horticultural therapy in dementia patients.

## DISCUSSION

This systematic review investigated two RCTs and a case series for the safety and effectiveness of horticultural therapy in dementia patients. Overall, these studies indicated that there was no consistent improvement in level of agitation in dementia patients after participating

in horticultural therapy. Many of the trials indicated a slight decrease in agitation but only the Lee et al study provided data with statistical significance.

Dementia is a progressive disease with no current cure that can eventually be devastating to both the patient as well their family. Although there may not be a treatment to prolong the lives of those with dementia, there are current suggestions that different forms of therapy can be beneficial in improving quality of life in these patients. Horticultural therapy was first introduced as an accepted form of therapy during the 1940's and 1950's when it was originally used to rehabilitate war veterans.<sup>6</sup> Since then, its utilization has expanded to those with mental illness, vocational impairments, cognitive deficits, and physical deformities. The American Horticultural Therapy Association suggests that interaction with live plants in an environmental setting can improve memory and cognitive ability.<sup>6</sup> Specific to dementia patients, horticultural therapy has been introduced as an adjunct form of therapy to explore the idea of person-centered care with emphasis on reciprocal relationships.<sup>4,5</sup> Interactions with such focus are often void from long term care facilities due to lack of sufficient staff and funding, which are needed to implement an effective horticultural therapy program.

There were various limitations among the studies presented in this review. The overall limitation appeared to be that there were very few RCTs already established on this topic, therefore narrowing the source for reference data. All three studies also admitted that data was limited due to a small sample size and a concise time period of four to six week was insufficient for proper data collection. In addition to the common limitations experienced by many human centered trails, Jarrot et al and Lee et al specifically expressed that varying levels of cognition among participants may have limited the ability to make generalizations about horticultural therapy in the dementia community due to the varying degrees of assistance needed during

therapy sessions. Lee et al also expressed that there was limited reliability in the M-CMAI that was used to measure agitation, which may have led to falsely statistically significant results. Finally, although Luk et al was an RCT, it was limited as a letter to the editor and did not appear in a peer-reviewed journal. For all three studies, results may have been impacted by these limitations and further RCTs may provide more data for a more conclusive systematic review.

## **CONCLUSION**

It is concluded that the three studies included in this systematic review are inconclusive and provide conflicting evidence regarding horticultural therapy and its effect on agitation in dementia patients. The three studies reviewed here explore a relatively new form of therapy for dementia patients and each of the trials faced numerous limitations in conducting research. It would be beneficial to conduct further studies and expand the number of randomized control trials that are available regarding this topic. In addition to furthering available data, it might be beneficial to provide narrower inclusion criteria that specified a particular level of cognition based on a mini-mental status examination in order to eliminate outlying variables. Applying modifications to these research methods could lead to more definitive answers regarding the efficacy of horticultural therapy in dementia patients.

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