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Feature Article

Efficacy of a horticultural activity program for reducing depression and loneliness in older residents of nursing homes in Taiwan

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ABSTRACT

Promoting psychological health in older populations is important. This study evaluated a horticultural activity program for reducing depression and loneliness in older residents of nursing homes in Taiwan. A convenience sample of 150 older residents of three nursing homes were recruited and randomly assigned to either an experimental group or a control group. The experimental group ($n = 75$) participated in an 8-week horticultural activity program. The control group ($n = 75$) received routine care. Generalized estimating equations analyses revealed significant time by treatment interaction effects for depression ($p < .001$) and loneliness ($p < .001$). This study provides a reference for improving psychological health in older people.

Introduction

Since ancient times, horticulture has been recognized as an effective therapeutic modality. A horticultural activity is a plant-dominated pastime purposefully designed to facilitate interaction with the healing elements of nature.[1] The process of interacting with plants promotes physical and mental health by simulating the senses of touch, smell, and sight.[1] In Taiwan, horticulture enables older people to relive their youthful experiences during the agricultural age, in which green natural resources were a part of daily life. Additional benefits of horticultural activity programs in nursing homes include increased social contact and improvements in positive adaptation behaviors, physical well-being, and mental well-being.[2,3] Studies show that approximately 15% of older people have mental disorders, and the percentage is even higher in nursing homes.[4–6] Depression and loneliness among older people are important public health issues.[6] Healthcare leaders in nursing homes should establish horticulture programs for older residents because they have proven effective for improving mental health and because most older people consider horticulture an enjoyable leisure activity.

Previous studies in various countries have developed and evaluated horticultural activity programs for older nursing home residents.[3,7,8] However, a systematic literature review indicates that such interventions are rarely reported in a Taiwan population.[3] Horticultural activity programs for older people in different countries vary according to the local culture, social environment and lifestyle.[9] Additionally, most studies have only been preliminary studies or have had poor methodologies.[3,7,8] Studies using randomized controlled trial method have been suggested to improve the quality of such studies.[3] Therefore, this study used a randomized controlled trial method to evaluate the efficacy of a horticultural activity program for reducing depression and loneliness in older residents of nursing homes in Taiwan.

Methods

Design

This study was performed from February, 2017 to May, 2018. Participants were randomly assigned to either an experimental group or a control group. Based on data from a systematic literature review indicating that most horticultural activity programs last 6–8 weeks,[3] an 8-week horticultural activity program was designed and implemented in the experimental group. The control group received

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routine care. Outcomes were assessed at baseline (T0) and at the end of the intervention (T1). Data for personal characteristics were only collected at T0. This study was approved by the Human Experiment and Ethics Committee of National Cheng Kung University.

Recruitment

Older people were recruited by convenience sampling from three nursing homes in Tainan, Taiwan. After 3-month pre-intervention, an announcement was posted on bulletin boards at the three nursing homes to provide details of the study and to invite the residents to participate. The inclusion criteria were (1) age over 65 years old, (2) clear mental status and ability to communicate, and (3) ability to perform independent self-care. Residents who had been diagnosed with cognitive impairment (Mini-mental State Examination (MMSE) score $\leq$24) were excluded because people with cognitive impairment were likely to lack the ability to participate in the intervention and because cognition was considered a confounding factor in the outcome of the intervention, i.e., depression.[5] A staff member at each nursing home used a personal characteristics questionnaire and the MMSE to screen potential participants for eligibility. Eligible residents were then referred to the researchers. The researchers explained the details of the study to potential participants and provided a brief written summary of the study and its objectives before requesting their written informed consent.

A total of 150 participants agreed to partake in the study. After the baseline measurements, an assistant researcher who did not participate in either data collection or data analysis randomized participants into an experimental group or a control group. The groups were randomly formed by writing the room numbers of the participants on slips of paper and then putting all slips in a tube. A research assistant then randomly withdrew the slips from the tube one at a time and alternately assigned them to the experimental group or control group. In each nursing home, 25 participants were assigned to the experimental group, and 25 participants were assigned to the control group. Thus, the analysis in this study included 75 participants in the experimental group and 75 participants in the control group.

Intervention

After a comprehensive literature review,[3,9,10] the author of this study developed an 8-week horticultural activity program entitled, "Experiencing gardening for fun and vitality". The program had four objectives: (1) to simulate the senses of touch, smell, and sight; (2) to improve hand-eye coordination; (3) to develop horticultural activities that instill a sense of accomplishment and increase self-confidence in the participants; and (4) to encourage interpersonal interactions that can lead to friendship. The intervention included eight 1.5–2 h sessions. One session was delivered each week. Each session included introduction and warm-up activities, horticultural activities, and group sharing activities. The introduction and warm-up activities included self-introductions to enable the participants and staff to become acquainted. The staff then explained the purposes of the horticultural activities, teaching basic horticultural knowledge and skills, developing interest in working with plants, and distributing teaching materials to participants. The horticultural activities for each week had different themes and different activities. Table 1 shows that the content of the program included Green Field Trance, Enameled Clay Pottery, Evergreen Planting, Grass Dolls, New Clothes for Flowers, Sachet Dolls, Important Memories, and Welcome by Flowers. At the end of each session, the participants were encouraged to share their completed works with the group and to give each other feedback. The researchers also invited the participants to give feedback on activities included in the curriculum. All horticultural activities were held indoors at a table where residents could sit.

Table 1
Content of an 8-week horticultural activity program.

Week 1: Green fields trace (tissue bag rubbing)
1. Arrange the desired pattern of leaves on the tissue bag.
2. Use a watercolor pen to apply pigment evenly on one side of each leaf.
3. Place the leaves on the tissue bag with the painted side down. Place a sheet of paper over the leaves, and press it with one hand while using the other hand to wipe and press the paper in a back and forth motion.
4. Remove the leaves to reveal the rubbing.
5. Dry the rubbing with a hair dryer.

Week 2: Enameled clay pottery
1. Mold clay according to personal preferences and creativity.
2. Decorate pot with clay and sequins.

Week 3: Evergreen planting
1. Add soil to the clay pot produced in the previous week until it is two-thirds full.
2. Form a hole in the middle of the pot by gently pressing the soil, and plant the seeds; gently press the soil to fasten the seeds with a layer of soil.
3. Water the plant in the morning and evening. Water the plant generously but not too frequently.

Week 4: Grass doll
1. Pour the seeds (wheatgrass seeds) into the bottom of the stocking. Add a grapefruit-sized quantity of peat soil, and mix it with the coconut fiber by pinching and kneading it with your hands.
2. Use the stitch line at the bottom of the stocking as the reference point. Form ears by tightly wrapping a rubber band around a ball of material at each end.
3. Form the nose by wrapping a rubber band around a ball of material between the two ears; gently press the ends of the nose to form the cheeks.
4. Finally, use a hot glue gun to attach two eyes above the nose. The basic model of the grass doll is then complete.
5. Soak in water for 4 h until the soil and seeds absorb enough water to germinate.
6. Put the colored stocking in a glass of water for 3 to 5 days until sprouts appear.
7. Spray water on the roots when it gets dry. The observation period generally lasts for at least 2 months.

Week 5: New clothes for flowers (paper-tearing drawing)
1. Tear tissue paper into small pieces and attach the torn tissue paper to the graphics on the drawing paper according to personal preference and creativity.
2. Decorate the drawing paper with dry flowers and leaves.

Week 6:Sachet dolls
1. Stretch the colored stocking, and stuff it with foam cotton.
2. Put dry plants in the middle of the foam cotton, and add foam cotton to form a spherical shape.
3. Tie a knot at the end of the stocking, and turn the end with elastic band inside out to the middle of the ball to form the neck. Put a bow on the neck and a red sock on the head. Form the eyes and buttons by attaching sequins with styrofoam glue.

Week 7: Important memory (photo frame)
1. Assemble the photo frame with the bracket and then color it.
2. Use Chinese herbal medicine, which has a natural aroma and can be preserved for a long time, to decorate the photo frame.

Week 8: Welcome by flowers
1. To create wood notebooks decorated with dried flowers and leaves, cut cardstock in the shape of petals based on personal preferences and creativity or decorate with dried flowers and leaves
2. Dip the rubbing sponge in paint, and gently pat the cardstock to form the shapes of flowers and leaves on the wood notebook.
3. After the pigments dry, coat the wood notebook with waterproof glue. Tie string to a hole drilled in the cover, and hang the notebook on a door or wall.

To ensure the fidelity of all participants in the experimental group, each participant received a booklet entitled, "My Green Life". A separate page in the booklet was designated for each theme of the horticultural activity. Each page of the booklet had three columns: a "My sweetheart sticker" column, a "My horticultural photos" column, and a "Group photo" column. Participants in the experimental group were asked to make entries in the booklet during the intervention. In the introduction and warm-up activities, the staff gave each participant a "My sweetheart sticker". Participants sitting next to each other pasted the stickers in each other's booklets. A research assistant photographed each participant with his/her completed work. After all participants finished their works, the research assistants took a group photograph that included all participants and their works. The participants received the photographs at the beginning of the next session and pasted them in their booklets.

All interventions were performed by a team that included the lead researcher and four research assistants. The lead researcher and all assistants had horticulture licenses. The lead researcher facilitated the activities, and each research assistant worked with a group of six to seven participants. The research assistants were responsible for ensuring that the participants completed their tasks without getting frustrated. The assistants were also responsible for ensuring operational safety during the experiment, e.g., they ensured that the participants did not accidentally ingest pigments, that they safely operated the hot melt glue gun without being burned, and that they did not injure themselves with needles during hand sewing. The plant materials were placed in an accessible area so that participants could have passive and active contact with the plants. Upon completion, the works were preserved by the participants.

To avoid contamination from interaction between participants in the experimental group and control group, the horticultural activities in the experimental group were scheduled at times while the control group were engaged in routine leisure activities such as watching TV, listening to music, and reading newspapers. Also, the horticultural activities in the experimental group were delivered in a separate room so that the control group would have no exposure to the horticultural activity.

Measures

Structured questionnaires, including depression and loneliness scales, were used to collect data.

Depression

Depression was assessed with the 15-item Geriatric Depression Scale (GDS-15).[11] The GDS-15 was developed to assess depressive symptoms for older adults. The instrument requires the participants to respond to each item with “yes” or “no”. For items 1,5,7,11,13, “yes” and “no” are scored as 0 point and 1 point respectively. For the other items, “yes” and “no” are scored as 1 point and 0 point, respectively. The total possible scores range from 0 to 15. Scores of 0–4 are considered normal, scores of 5–8 indicate mild depression symptoms, scores of 9–11 show moderate depression symptoms, and scores over 12 imply severe depression symptoms. The Chinese version of GDS-15 has been used in older Taiwanese with good psychometric properties.[12] In this study, the *t*-value in the item analysis was 2.39–4.15 ($p < .05$), which indicated good divergent validity. The content validity index (CVI) was 0.96, and the K-R 20 was 0.90.

Loneliness

The 20-item UCLA Loneliness Scale, Version 3(RULS-V3)[13] was used to assess loneliness. This is a self-report scale, which was developed to assess loneliness for different populations, including older people. Nine items are positively worded (i.e., “not lonely”, items 1, 5, 6, 9, 10, 15, 16, 19, 20), and the remaining eleven items are negatively worded (i.e., “lonely”). Each positively worded item is rated from 1 point (always) to 4 points (never); lower scores denote lower loneliness. Each negatively worded item is rated from 1 point (never) to 4 points (always); higher scores indicate higher loneliness. The total possible score ranges from 20 to 80. The Chinese version of RULS-V3 provides a reliable and valid assessment of loneliness in older people.[14] In this study, the *t*-value in the item analysis was 2.45–7.00 ($p < .05$), which showed good divergent validity. The CVI was 0.94, and the Cronbach's alpha was 0.71.

Personal characteristics

Personal characteristics included demographic and disease-related characteristics, i.e., sex, age, education level, religion, marital status, whether having children, disease history, and duration of nursing home stay.

Data collection procedure

At T0, a trained research assistant administered the questionnaire to participants in the nursing home. Data for personal characteristics were collected from medical records. Each participant required approximately 20 min to and to complete the depression and loneliness scales. Depending on the group assignment, each participant then either participated in the horticultural activity program or received routine care. The data collection procedures at T1 were identical to those at T0. The research assistant was blinded to the group assignments of the participants and did not provide medical services to any participants during the study.

Analysis

Data were analyzed with SPSS Version 17 (SPSS, Inc., Chicago, IL). Chi-square test was used to examine group differences in personal characteristics. The generalized estimating equation (GEE) model was used to identify the independent effects of the horticultural activity program.

Results

Comparison of personal characteristics

Before the intervention, the experimental and control groups did not significantly differ in personal characteristics (Table 2). The average age was 79.2 years old and 77.9 years old in the experimental group and the control group, respectively. The majority of participants in the experimental and control groups were women (66.7%, 58.7%), Buddhist (69.3%, 56.0%), and widowed (53.3%, 64.0%). Therefore, the two groups had high homogeneity. None of the 150 participants who consented to the study were lost to follow up at T1. That is, both the experimental and control groups had 100% retention rates at T1.

Difference in outcome variables within and between the experimental and control groups

Table 3 shows that the analysis of depression revealed significant time by treatment interaction effect ($p < .001$). The mean score for depression in the experimental group significantly decreased from 7.31 at T0 to 2.71 at T1($p < .001$). In contrast, the mean score for depression in the control group significantly increased from 5.44 at T0 to 8.08 at T1 ($p < .001$) (Table 3 & Fig. 1).

Regarding loneliness, there was also significant time by treatment interaction effect ($p < .001$) (Table 3). The mean score for loneliness in the experimental group significantly decreased from 50.77 at T0 to 44.27 at T1($p < .001$), but the mean score for loneliness in the control group significantly increased from 49.59 at T0 to 52.63 at T1($p < .001$).

Discussion

The findings of this study provide additional preliminary support for the value of horticultural programs in nursing homes. Specifically, the experimental group that participated in the horticultural activity had significantly lower depression and loneliness compared to the control group. These results are consistent with previous reports in other countries showing that horticultural activity programs improve psychological outcomes in older populations, including the United States, China, and Korea.[3,10,15]

The mechanism through which the horticultural activity program in this study reduced depression and loneliness was interaction with

Table 2
Summary of personal characteristics by group.

Variables	Experimental group *n* (%)	Control group *n* (%)	χ^2	*p*
Sex				
Male	25(33.3)	31(41.3)	1.03	.31
Female	50(66.7)	44(58.7)		
Age (years)				
70 and below	23(30.7)	30(40.0)	1.43	.23
Above 70	52(69.3)	45(60.0)		
Education level				
Elementary school and no formal education	36(48.0)	31(41.3)	1.71	.19
Junior high school or higher	39(52.0)	44(58.7)		
Religion				
None	9(12.0)	16(21.3)	4.61	.20
Buddhism	52(69.3)	42(56.0)		
Taoism	9(12.0)	14(18.7)		
Christianity	5(6.7)	3(4.0)		
Marital status				
Married	35(46.7)	27(36.0)	1.76	.19
Widowed	40(53.3)	48(64.0)		
Whether having children				
Yes	67(89.3)	71(94.7)	1.45	.23
No	8(10.7)	4(5.3)		
Disease history				
None	16(21.3)	20(26.7)	5.25	.26
Heart disease	9(12.0)	13(17.3)		
HTN	29(38.7)	32(42.7)		
Diabetes	14(18.7)	7(9.3)		
Respiratory disease	7(9.3)	3(4.0)		
Duration of nursing home stay				
Under 1 year	21(28.0)	23(30.7)	3.95	.27
1–2 year	19(25.3)	28(37.3)		
2–3 year	13(17.3)	8(10.7)		
3–4 year	22(29.3)	16(21.3)		

Table 3
GEE analysis of difference in outcome variables within and between the experimental and control groups.

Variables	*Mean(SD)*	*B*	*SE*	*p* value
Depression				
Intercept		5.440	0.3777	<.001
Group(EG vs. CG)		1.867	0.5264	<.001
Time overall(T1 vs. T0)		2.640	0.3620	<.001
EG at T1	2.71(0.32)			
EG at T0	7.31(0.37)			
CG at T1	8.08(0.38)			
CG at T0	5.44(0.38)			
EG at T1 vs EG at T0	−4.60 (0.31)			<.001
CG at T1 vs CG at T0	2.64 (0.36)			<.001
Group*Time overall				<.001
EG*(T1 vs. T0) vs CG*(T1 vs. T0)		−7.240	0.4776	<.001
Loneliness				
Intercept		49.587	0.8540	<.001
Group(EG vs. CG)		1.187	1.0723	.268
Time overall(T1 vs. T0)		3.173	0.9532	<.001
EG at T1	44.27(0.50)			
EG at T0	50.77(0.65)			
CG at T1	52.76(0.55)			
CG at T0	49.59(0.85)			
EG at T1 vs EG at T0	−6.51 (0.71)			<.001
CG at T1 vs CG at T0	3.17 (0.95)			<.001
Group*Time overall				<.001
EG*(T1 vs. T0) vs CG*(T1 vs. T0)		−9.680	1.1861	<.001

Note: GEE, generalized estimating equation.
T0, baseline; T1, at the end of the intervention.
EG, experimental group; CG, control group.

plants. By stimulating the senses of touch, smell, and sight, these interactions improved the hand-eye coordination and overall physical health of the participants.[2,16] Physical health has a well-established association with psychological well-being[10,16] The intervention in this study was designed to induce physical activity, which can relieve depressive symptoms and loneliness by improving physical health.[16] Also, the program in this study was implemented in groups and encouraged interpersonal interaction that can lead to friendship. A friendly environment improves depression and loneliness by decreasing social isolation.[1,16] The experiment in this study also established a link between horticulture and the personal experience of the participants in the agricultural era of Taiwan. This link induced an atmosphere of familiarity and elicited fond memories. Moreover, the horticultural works and the booklet used in this study instilled a sense of accomplishment in the participants, which increased their self-confidence. Participants who experience a sense of accomplishment and self-confidence are less likely to have depression symptoms and loneliness.

Interestingly, the experimental group that participated in the horticultural activity had reduced depression and loneliness whereas the control group that received routine care had increased depression and loneliness. The results in this study are consistent with studies of older residents of nursing homes in western populations showing that psychological well-being is increased in residents who participate in horticultural activity programs but is slightly decreased in control groups who receive routine care without horticulturalactivity programs.[3,15] A possible explanation is that the routine care received by the control group are general and static activities that are not designed to address the specific needs of older people. Interventions for improving health outcomes in older people should be specifically designed to encourage the participants to be active rather than passive.[17] Additionally, these results are particularly meaningful for older Chinese people. Approximately 81.8% of older Chinese people in nursing homes have depression.[18] Because filial piety is an important feature of Chinese culture, older people often live with their children. However, some families prefer that elderly parents, even those without illness, live in nursing homes because they lack the time or ability to care for them properly or because they believe that nursing homes would be safer in case of an accident or illness. For some elderly people, relocating to a nursing home can cause feelings of abandonment or uselessness, which can then lead to depression.[18] Also, nursing homes often have very limited social activities, which can lead to further decline in mental function for many older people who are long term residents of nursing homes.[8,19]

The positive outcomes observed in the experimental group after the 8-week horticultural activity program was possibly attributable to the high intensity of the intervention, the high fidelity of participants, and the high (100%) retention rate. The program was also designed to be implemented easily. For example, the horticultural activity program can be delivered indoors so that the participants can work comfortably regardless of the weather. The materials required for the intervention are inexpensive and easily available. The entire 8-week intervention was performed at a cost of only US 200 dollars. However, the plants used in the horticultural activity program should be carefully selected to ensure they are safe and non-toxic for the intended participants. Before the intervention, the lead researcher recruited four research assistants who had basic horticultural licenses. Each research assistant completed a 12-hr horticultural training course delivered by the lead researcher. The course content included personal communication, the psychology of older people, operational safety during the horticultural activity, and wound care. The results of this study indicate that a team comprising a lead researcher and four trained research assistants is effective for developing and delivering horticultural programs designed specifically for older populations.

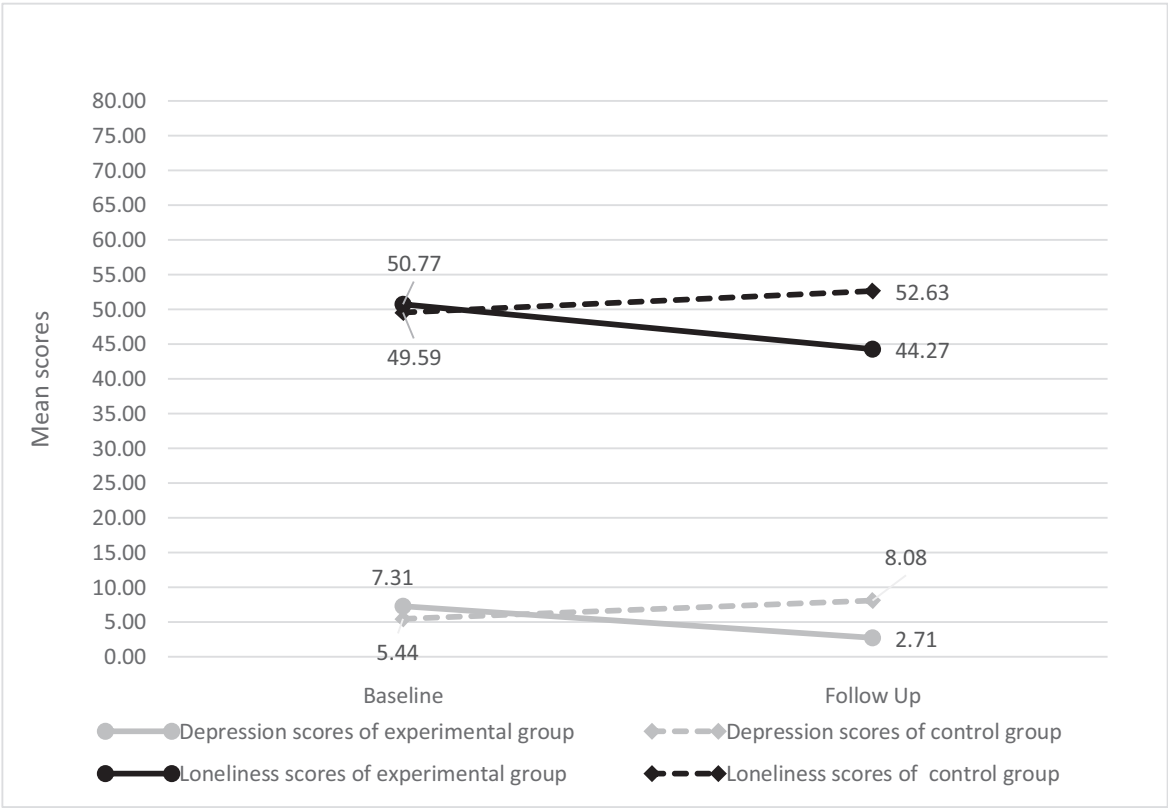

Fig. 1. Mean scores for depression and loneliness in the experimental group and control group at baseline and at the end of the intervention.

Regarding the study design, the randomized controlled trial method used in this study included the use of a control group, random assignment to the experimental group and control group, and avoidance of contamination from interaction between participants in the two groups. Also, the principal investigator was blinded to the collection and analysis of all outcome data. Randomized controlled trial was the most stringent method of determining whether a cause-effect relation existed between the horticultural activity program and depression and loneliness because it eliminated selection bias and minimized confounding variables.[20] Moreover, G*Power (Germany; version 3.1.1) software was used to evaluate whether the sample size was adequate.[21] The experimental and control groups each had a sample size of 75. The post-hoc power estimates for depression and loneliness at T1 were 1.0, which suggests that the sample size was adequate for examining the efficacy of the horticultural activity program for reducing depression and loneliness.

Limitations

Four limitations of this study should be considered. First, this study used a convenience sample. All participants were recruited from three nursing homes in southern Taiwan, which might limit the generalizability of the study. Therefore, the proposed horticultural activity program needs further evaluation in different populations. Second, the effect of the intervention was evaluated only at the end of the intervention. To assess the long-term effects of the horticultural activity program, further studies with longer follow-up periods are needed. A third limitation was the lack of control for some functions and factors that might have influenced the outcomes. Further studies are needed to explore other factors that might influence the outcomes of the horticultural activity program. Finally, other horticultural studies also reported improvements in biomarkers, physical health, positive behavior, and social health.[3,22] However, this study only focused on psychological outcomes. Further studies are needed to evaluate other outcomes.

Conclusion

Depression and loneliness are common problems in older residents of nursing homes in Taiwan. A horticultural activity program has the potential to be beneficial and safe for promoting health in this population as a result of reducing depression and loneliness. The results of this study can provide a reference for healthcare providers and researchers when they design horticultural activity programs of health promotion for older people.

Contribution

Study design: HYC; data collection and analysis: MFC, HYC, CCT, and manuscript preparation: HYC, MFC, CCT, HSC, TLW.

Conflict of interest

No authors of this study have personal, professional, or financial conflicts of interest to declare.

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Supplementary data

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References

1. The American Horticultural Therapy Association (AHTA). Horticultural therapy; 2016. Available at: http://ahta.org/horticultural-therapy. Accessed 11.06.16.
2. Gonzalez MT, Kirkevold M. Benefits of sensory garden and horticultural activities in dementia care: a modified scoping review. *J Clin Nurs*. 2014;23(19):2698–2715. https://doi.org/10.1111/jocn.12388.
3. Kamioka H, Tsutani K, Yamada M, et al. Effectiveness of horticultural activity program: a systematic review of randomized controlled trials. Complement Ther Med. 2014;22(5):930–943. https://doi.org/10.1016/j.ctim.2014.08.009.
4. Aylaz R, Aktürk U, Erci B, et al. Relationship between depression and loneliness in elderly and examination of influential factors. *Arch Gerontol Geriatr*. 2012;55(3):548–554. https://doi.org/10.1016/j.archger.2012.03.006.
5. Lo HM, Lee LH, Lee H C, Hsu NL. Survey of depression and its related factors of the Veterans in long-term care facilities. J Health Archit. 2014;1(3):68–76. https://doi.org/10.6299/JHA.2014.1.3.R7.68.
6. World Health Organization [WHO]. Available at:. Mental health of older adults; December 2017. http://www.who.int/en/news-room/fact-sheets/detail/mental-health-of-older-adults. Accessed 10.28.18.
7. Chen YM, Ji YI. Effects of horticultural activity program on psychosocial health in older nursing home residents: a preliminary study. *J Nurs Res*. 2015;23(3):167–171. https://doi.org/10.1097/jnr.0000000000000063.
8. Bassi M, Rassiga C, Fumagalli N, Senes G. Quality of experience during horticultural activities: an experience sampling pilot study among older adults living in a nursing home. Geriatr Nurs. 2018;39(4):457–464.
9. Harris H. The social dimensions of therapeutic horticulture. *Health Soc Care Community*. 2017;25(4):1328–1336. https://doi.org/10.1111/hsc.12433. Epub 2017 Feb 22.
10. Perveen F. *Effects of Horticulture Therapy for Elderly With Dementia in an Institutional Setting*. Human ageing and elderly service thesis. Arcada University; 2013.
11. Sheikh JI, Yesavage JA. Geriatric Depression Scale (GDS):. recent evidence and development of a shorter version. *Clin Gerontol*. 1986;5:165–173.
12. Chin WC, Liu CY, Lee CP, Chu CL. Validation of five short versions of the Geriatric Depression Scale in the elder population in Taiwan. Taiwan J Psychiatry. 2014;28(3):156–163.
13. Russell DW. UCLA loneliness scale(version 3): reliability, validity, and factor structure. *J Pers Assess*. 1996;66(1):20–40.
14. Chen Y, Hicks A, While AE. Loneliness and social support of older people living alone in a county of Shanghai, China. *Health Soc Care Community*. 2014;22(4):429–438.
15. Barnicle1 T, Midden KS. The effects of a horticulture activity program on the psychological well-being of older people in a long-term care facility. *Hortechology*. 2003;13(1):81–84.
16. Noone S, Innes A, Kelly F, Mayers A. The nourishing soil of the soul': the role of horticultural therapy in promoting well-being in community-dwelling people with dementia. *Dementia*. 2017;16(7):897–910.
17. Gonzalez MT, Hartig T, Patil GC, Martinsen EW, Kirkevold M. Therapeutic horticultural in clinical depression: a prospective study of active components. *J Adv Nurs*. 2010;66(9):2002–2013. https://doi.org/10.1111/j.1365-2648.2010.05383.x.
18. Lin PC, Wang HH, Huang HT. Depressive symptoms among older residents at nursing homes in Taiwan. *J Clin Nurs*. 2007;16(9):1719–1725. https://doi.org/10.1111/j.1365-2702.2006.01743.x.
19. Lee IC. Discussion on choosing a nursing home based upon the elderly view-point. Taiwan J Gerontol Health Res. 2006;2(2):1–17.
20. Kendall JM. Designing a research project: randomised controlled trials and their principles. *Emerg Med J*. 2003;20(2):164–168.
21. Fual F, Erdfelder E, Lang AG, Buchner A. G*Power 3: a flexible statistical power analysis program for social, behavioral, and biomedical sciences. *Behav Res Methods*. 2007;39(2):175–191.
22. Ng KST, Sia A, Ng MKW, et al. Effects of horticultural therapy on Asian older adults: a randomized controlled trial. *Int J Environ Res Public Health*. 2018;15(8):1–14.