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Case Report

Horticultural therapy program for mental health of prisoners: A case report

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ABSTRACT

Background: The restricted environment in prison negatively affects psychological health of prisoners, which in turn affects the rehabilitation of the prisoners. Previous studies have shown that horticultural activities were effective in improving psychological health of prisoners. The objectives were to develop a horticultural therapy (HT) program and to determine the association of 12 sessions with participants' psychological health using case analysis.
Methods: Five cases who were imprisoned at K correctional institution in Gyeonggi-do, South Korea participated in this study. They were diagnosed as a potential risk group of psychological health. The prisoners participated in a HT program once a week (12 weeks, 90 min per session) between April and June 2018 at K correctional institution. The program consisted of cultivation-centered horticultural activities. At the completion of the HT program, depression (Beck Depression Inventory), anger (State-Trait Anger Expression Inventory), self-esteem (Rosenberg Self-esteem Scale), and life satisfaction (Satisfaction with Life Scale) were evaluated. Positive changes were found through observations of interviews, workbooks, and emotional change checklists that were recorded in each session.
Results: We observed positive changes in the prisoners' health conditions measured before and after participating in the HT program. The prisoners who participated in the HT program showed decreased depression (−2.6), and increased self-esteem (+1.2) and life satisfaction (+4.0).
Conclusions: The prisoner rehabilitation HT program was associated with improvements in the participants' psychological health. Future efforts will be required to investigate the effects of an HT program with a larger sample size to perform statistical analysis for providing convincing evidence.

1. Introduction

Statistics show that more than 10 million individuals worldwide are imprisoned, with more than 30 million circulating through prisons every year.[1] In 2018, South Korea had a population of 51.8 million, of which 54,744 people were imprisoned. This rate of imprisonment has grown rapidly by 10.7% over the past decade. At 115.4%, prisons' occupancy levels have exceeded their capacity, indirectly indicating the importance of prisoner rehabilitation.[2]

Prisoner rehabilitation is the primary objective of correctional systems. Prisoner rehabilitation allows prisoners to be treated so that they can return to a crime free lifestyle. Also, through rehabilitation, prisoners prepare themselves to successfully reintegrate into society release.[3] A broad array of programs including mental health, substance abuse, educational services etc. can be used to rehabilitate prisoners.[3]

The primary function of prison is to isolate criminals from society, offer reformative opportunities through rehabilitation programs and job training, and to further allow for community reintegration after release.[4] The prison environment is innately exclusive and isolated, which can negatively affect prisoners, in many cases leading to psychological health problems and social maladaptation.[5,6]

In fact, around one in seven prisoners is diagnosed with psychosis or clinical depression in the USA, Europe, and South Korea.[2,7] Various intrinsic and extrinsic factors account for these psychological problems: the existence of various forms of violence, enforcement of solitude, utter lack of privacy, difficulties in finding meaningful activities in which to engage, isolation from social

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networks, insecurity regarding the future, and inadequate health services.[8] The wide-ranging psychological consequences include chronic depression, frequent outbursts of anger, persecution complex, and so on.[7] These sometimes bring about serious corollaries such as violence or suicide, potentially aggravating other inmates' psychological health problems.[9]

For these reasons, these individuals experience difficulties in reintegrating into social communities after release.[10] Barriers to successful reintegration include, but are not restricted to, limited educational attainment and employment opportunities, unstable housing, substance abuse, physical and mental health concerns, family difficulties, and criminal history.[11–13] Being unable to overcome these obstacles, former prisoners are again alienated from society. Social isolation is associated with increased rates of recidivism; in South Korea, the recidivism rate is as high as 44.6%, similar to the USA and Europe, among others.[2,14]

Recently, comprehensive interventions have received particular attention in correctional and rehabilitation program management.[15,16] Comprehensive interventions span correctional systems and the community to build on prisoners' strengths while attending to the risks and needs that impact successful community reintegration.[15,17] Strengths-based approaches focus on identifying the resources and strengths of a prisoner and his/her environment (e.g., family, community), utilizing them to promote positive change.[18] These are opposed to the conventional disease and illness based-perspectives which view prisoners as lacking and are thus, centered around the provision of medication to cure problems18. Strengths-based approaches explore what helps prisoners move away from crime and deviance.[10,19,20] In this view, all clients have the ability to solve problems, develop, and change. It is closely related to emotional stability. Strengths-based approaches also improve client empowerment, positively affecting prisoners' adaptation to society.[21] Strengths-based approaches allow prisoners to recognize that they are of value and can positively contribute to the community and society at large.[22,23]

Horticultural therapy (HT) is a form of complementary and alternative medicine (CAM) in which a trained therapist offers clients remedial activities. These opportunities, which involve plants and horticulture, are based on individual remedial objectives and needs.[24,25] Horticultural therapy as CAM consider living organisms treatment media to mitigate symptoms of clients. This characteristic makes HT distinguished from other types of CAM.[26] Interaction between clients and plants in a HT program, particularly, nurturing and observing plants over the life cycle during HT intervention, is a powerful therapeutic tool and key element. The plant life cycle is relatively short and can be easily drawn an analogy with the human life cycle.[26] A HT therapist can integrate the client's experiences and events in their own life cycle into the plant life cycle, providing a platform where various topics of clients' mental well-being can be discussed during HT intervention.[26]

Many European countries and the USA generally include horticultural activities, such as harvesting or maintaining a garden, as job training or for the provision of produce for the institute, with the ultimate goal of correction/rehabilitation in prison.[27,28] Especially, in the case of the USA, one-third of prisons operate a rehabilitation program using horticultural activity in which community efforts are integrated with the participation of local educators, environmental organizations, or federal agencies.[29] Recently, the importance of well-structured HT programs for prisoner correction/rehabilitation has been emphasized.[20–34] In previous studies, HT programs for prisoner rehabilitation were shown to lead to improvements in mental health (e.g., depression, self-esteem, anxiety, stress, and life satisfaction) and social adaptation (e.g., relationship, prevention of recidivism).[29–33] However, development and research on HT programs for prisoner rehabilitation is currently lacking.

Accordingly, this study involved the development of an HT program for effective prisoner correction/rehabilitation, achieved through 1) a strengths-based approach and 2) comprehensive interventions by the correctional system and community resources such as educational institutions, the Ministry of Environment, and private HT professionals. The objectives were to develop a strengths-based HT program for more effective prisoner rehabilitation and to determine the association of 12 sessions with participants' psychological health using case analysis.

2. Methods

2.1. Cases characteristics and diagnostic

Prison officers recruited prisoners from K correctional institution in Gyeonggi-do, South Korea, using a flyer and registration forms. These were male prisoners screened by the prison officers to ensure that there were no dangers (e.g. self-injury, assault) involved in the program. A total of five prisoners volunteered to participate and provided informed consent. Demographic information such as age, participation motivation, and experience of horticultural activity was collected in a pre-program interview. All the participants had been sentenced during military service, the duration of which was anywhere between one and 28 years (Table 1).

Throughout the consultation, all of the five cases were diagnosed as a potential risk group. The five cases commonly showed that the participants were feeling failure and frustration from the life after the criminals they convicted. Also, the participants lacked engagement and willingness to live due to the restricted environment. Clinically, Cases C and D showed mild and moderate depression symptoms, respectively. Therefore, as a prognosis, these cases had potential to develop into a high-risk group in psychological health that likely results in mental diseases or suicide attempts if not mediated. For these reasons, we concluded that it was required to provide the participants with an intervention using a HT as preventive care for psychological health. Neither physical diseases nor medical history was found in the cases we studied.

This study employed a single-case research design, using questionnaire assessment, observation records, and interviews to analyze the HT program (Fig. 1). The researchers in the present

Table 1
Descriptive information of participants in the HT program.

Case	Descriptive information
A	A 48-year-old male who performed 28 years of military service and received an eight-year prison sentence for a military accident in 2016. Participated in the HT program to gain knowledge of growing plants to engage in farming after release from prison as well as to gain a sense of refreshment through vigorous outdoor activities.
B	A 47-year-old male who performed 24 years of military service and received a prison sentence for a lawsuit accident during military service. Had a deprived childhood because of financial difficulties. His 20 s as a university student were his heydays. Participated in the HT program to experience a little bit of happiness in prison.
C	A 40-year-old male who performed 20 years of military service. Experienced difficulties in adjusting to the military, got divorced in his 20 s, and led a happy life after remarriage in his early 40 s. Participated in the HT program to reignite his interest in horticulture that went beyond prison yardwork.
D	A 43-year-old male who performed 19 years of military service and received a 2.5-year prison sentence for a military accident in 2017. Spent his heyday with family and in the military between the ages of 25 and 41. Participated in the HT program to gain more horticultural knowledge as a person-in-charge for yardwork in prison.
E	A 28-year-old male who performed one year of military service. Went to study in the USA under parental pressure in his early 20 s, specializing in physical education and psychology. Participated in the HT program to gain more horticultural knowledge as a person-in-charge for yardwork in prison.

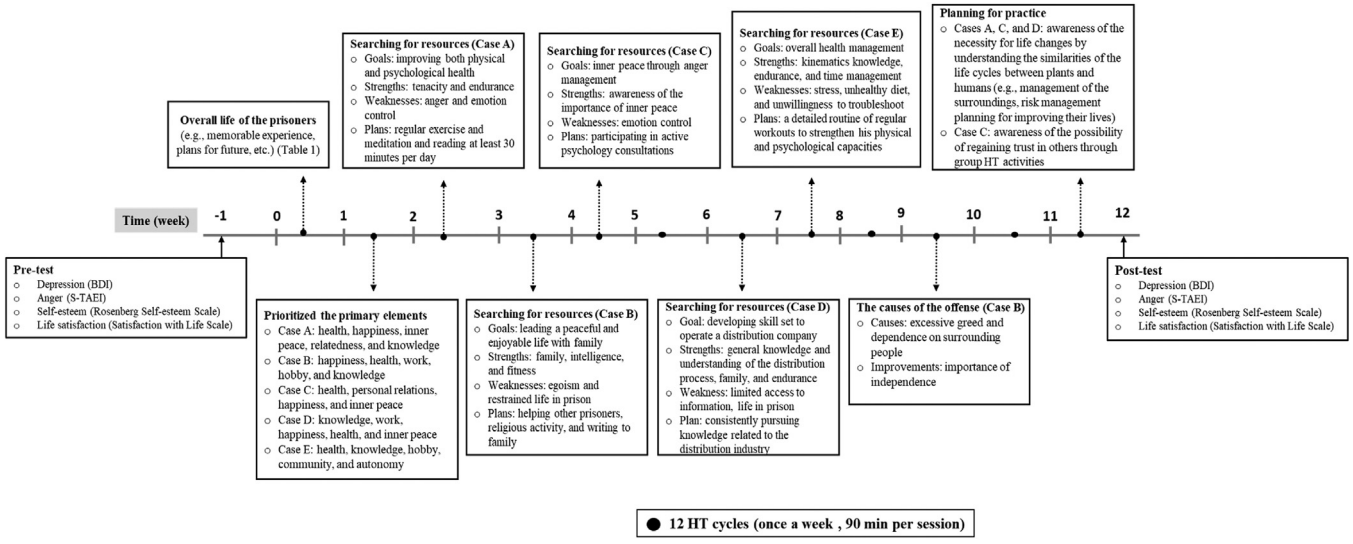

Fig. 1. Timeline for the horticultural therapy program and case evaluation.

study determined the contents and methodology of the study, considering and implementing rules and regulations on the operation of the HT program. These rules and regulations were reviewed thoroughly with the administrators and staff at the K correctional institution to protect the human rights of the participating prisoners. These methodology under the rules and regulations included 1) minimal acquisition of demographic information from the prisoners, 2) restrictions on producing unnecessary images and videos during the study, 3) anonymity collection (e.g. ID) of personal information during surveys and/or interviews with the prisoners, and 4) prohibition of potential tools that would lead to violent action of the prisoners during the study. Institutional Review Board of these procedures and protocols was approved by the Institutional Bioethics Committee at Konkuk University (7001355-201804-HR-236).

2.2. HT intervention for psychological health

The program, conducted at the farmyard ($16m^2$) and greenhouse at K correctional institution, involved developing garden plots, sowing seeds, transplanting plants to pots, and transplanting plants to garden plots (Table 2, Supplement 1). The five native plant seeds used were obtained from the National Institute of Biological Resources, Ministry of Environment, South Korea. These included the Taean daylily (*Hemerocallis taeanensis* S.S.Kang & M.G.Chung), Baekunsan daylily (*Hemerocallis hakuunensis* Nakai), Ilwol hosta (*Hosta capitata* (Koidz.) Nakai), Tiger lily (*Lilium lancifolium*), and Chinese astilbe (*Astilbe rubra Hook. f. & Thomson* var. rubra). The HT program was conducted once a week between April and June 2018, with the mean duration of a session being 90 min.

The program was developed based on the Good Lives Model (GLM) to promote the psychological health of prisoners, developed at Konkuk University, Seoul (Table 2). The GLM is a theoretical framework that takes a strengths-based approach to prisoner rehabilitation, emphasizing prisoners' goal achievement by ensuring that they lead good lives.[10,35] This is done by encouraging knowledge, strengths, skills, and access to internal and external environmental resources. The main assumptions are that 1) prisoners are capable of managing risk and can make concrete plans to pursue good lives and 2) since prisoners struggle to lead good lives, they need support in their efforts to achieve their prosocial and meaningful goals in prison. A case manager can use constructive and collaborative ways to interact with prisoners in accomplishing their goals.[36] Thus, the HT program was developed to help prisoners with goal setting, planning, and execution in horticultural activities so that they could apply what they learned in the program to their own lives in accomplishing Good Lives.

Table 2
The 12-session HT program based on the Good Lives Model for improving prisoners' psychological health.

Stage[a]	Session	Horticultural activity
Searching for resources	1	Giving instructions on principles of horticultural activity
	2	Designing and making garden plot
	3	Sowing seeds
	4	
	5	
	6	
	7	Transplanting plants to pots
	8	
Looking for the causes of the offense	9	Transplanting plants to pots
	10	
Planning for practice	11	Transplanting plants to garden plot
	12	

[a] The HT program involved three stages[20]: In Stage 1, the participants searched internal and external resources to fulfill 11 primary elements such as happiness, health, knowledge, work, community, inner peace, relatedness, creativity, and so on, all of which are necessary to live good lives. In Stage 2, the participants conducted risk management practices while determining the causes of the offense that led to their sentencing. In Stage 3, the participants made action plans using available resources that are determined in Stage 1 to achieve good lives.

The HT program involved three stages: Stage 1, searching for resources (Sessions 1–8), Stage 2, looking for the causes of the offense (Session 9–10), and Stage 3, planning for practice (Sessions 11–12) (Table 2).[20]

In Stage 1, the participants searched internal and external resources to fulfill 11 primary elements such as happiness, health, knowledge, work, community, inner peace, relatedness, creativity, and so on, all of which are necessary to live good lives.[20] Session 1 also involved basic education, such as researching the plants' life cycles and their characteristics. Using a workbook, the prisoners were asked to describe their life in the past and their future plans compared to the plants' life cycles. Session 2, the prisoners listed the tasks that had to be completed to make the garden plots, and also prioritized the primary elements required for leading good lives in parallel to the HT activities. In Session 3, the prisoners made individual activity plans, considering the life cycles of the plants sown in either the garden plots or the trays. They also searched various

resources available to the plants such as light, water, and temperature for successful germination of the seeds while identifying their own strengths and deficits (e.g., internal capabilities, internal obstacles, external capabilities, and external obstacles) with regard to the primary elements and setting their goals in the future to secure the prioritized elements. This process continued throughout Session 8.

In Stage 2, the participants conducted risk management practices while determining the causes of the offense that led to their sentencing.[20] In Sessions 9 and 10, the prisoners analyzed the causes and consequences of the failure of the plants in successful establishment while transplanting the plants into pots. They were also asked to identify solutions and remedy the situation, and to take preventive actions in future. In parallel, the prisoners reflected on their mishaps and crimes, identified the causes of those negative events, and found potential solutions to prevent engaging in future criminal activities.

In Stage 3, the participants made action plans using available resources that are determined in Stage 1 to achieve good lives.[20] In Sessions 11 and 12, the prisoners discussed management plans to ensure that the plants successfully bloomed at later reproductive stages while transplanting them into the garden plots. Simultaneously, they discussed how their new routine would affect their futures, expecting positive changes.

This program was primarily managed by two horticultural therapists certified by the Korean Horticultural Therapy and Wellbeing Association. Their role was to support and facilitate the prisoners' achievement of their goals in the HT activity as well as in the context of leading good lives. At the beginning of each session, the horticultural therapists provided the prisoners with introductory information for them to initiate HT activities. The prisoners were then asked to plan their own HT activities for the rest of the program. For security purposes, a prison officer was present in each session.

2.3. Case evaluation

To evaluate the HT program, we used both qualitative and quantitative approaches. For the qualitative assessment, we described positive changes through the HT program in each case, based on observations of conversations and workbooks in each session. Also, the prisoners' emotional changes were incorporated into the assessment using the multiple affect adjective checklist after each session. For the quantitative assessment, we used standard questionnaires that are highly reliable and widely used in clinical settings. Forty-seven questions on depression, anxiety, self-esteem, and life satisfaction were asked before and after the 12-session program. The results of the qualitative and quantitative assessment were compiled and synthesized to carry out a case analysis.

For the quantitative assessment, we performed the following tests. Depression was assessed using the Korean version of the Beck Depression Inventory.[37,38] This 21-item tool is scored on a four-point Likert scale. The total score ranges from 0 to 63, with higher scores indicating more severe depression symptoms. A score $\leq$9 indicates normal condition, 10–16 indicates mild depression, 17–29 indicates moderate depression and $\geq$30 indicates severe depression. Cronbach's alpha was 0.84.[38]

The Korean version of the State-Trait Anger Expression Inventory was used to evaluate the degree state anger of the prisoners.[39] This 10-item tool is scored on a four-point Likert scale. The total score ranges from 0 to 40, with higher scores indicating a higher degree of state anger. Cronbach's alpha was 0.90.[39]

Self-esteem was evaluated with the Korean version of the Rosenberg Self-esteem Scale.[40,41] This 10-item tool is scored on a four-point Likert scale. The total score ranges from 10 to 40, with higher scores indicating a higher degree of self-esteem. Cronbach's alpha was 0.74.[40]

Life satisfaction was assessed with the Korean version of the Satisfaction with Life Scale, which consists of five questions scored on a seven-point Likert scale.[42,43] The total score ranges from 0 to 35, with higher scores indicating a higher degree of life satisfaction. Cronbach's alpha was 0.93.[42]

For the qualitative assessment, we measured changes in emotion. During each horticultural activity, we used the multiple affect adjective checklist.[44,45] This tool is composed of 77 response items with adjectives representing positive/negative emotions. Respondents were asked to check the adjectives closely associated with their current emotions. Cronbach's alphas of positive and negative emotions were 0.93 and 0.91, respectively.[44]

Additionally, we conducted a post-program satisfaction survey, composed of six questions measuring the following overall satisfaction, satisfaction with the program's duration, frequency, and activity time per session, subsequent positive life changes, and desire for continued participation.

3. Results

3.1. Psychological health conditions

Overall, we observed positive changes in the prisoners' health conditions measured before and after participating in the HT program. The depression score was decreased while the other scores were increased in the prisoners after participating in the HT program (Table 3). The reduction of the depression score was 2.6 on

Table 3
Pre- and post-test responses of the prisoners (n = 5) participated in the HT program. The HT program was organized under the basis of the Good Lives Model on the psychological health of the prisoners.

Case	Depression[a]		Anger[b]		Self-esteem[c]		Life satisfaction[d]	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
A	6	1	15	14	29	37	18	20
B	6	6	10	11	37	34	23	30
C	14	10	15	16	27	26	16	27
D	18	13	11	12	28	31	8	7
E	4	5	11	10	40	39	32	33
Mean (SD)	9.6 (6.0)	7.0 (4.6)	12.4 (2.4)	12.6 (2.4)	32.2 (5.9)	33.4 (5.1)	19.4 (8.9)	23.4 (10.4)
Difference[e]	−2.6		0.2		1.2		4.0	

[a] Derived using the Korean version of the Beck Depression Inventory (KBDI). The total score ranges from 0 to 63. A higher score indicates more severe depression symptoms.[38]
[b] Derived using the Korean version of the State-Trait Anger Expression Inventory. The total score ranges from 0 to 40. A higher score indicates a higher degree of state anger.[39]
[c] Derived using the Korean version of the Rosenberg Self-esteem Scale. The total score ranges from 10 to 40. A higher score indicates a higher degree of self-esteem.[40]
[d] Derived using the Korean version of the Satisfaction with Life Scale. The total score ranges from 0 to 35. A higher score indicates a higher degree of life satisfaction.[42]
[e] Differences between pre-test and post-test scores.

average over the five prisoners. The self-esteem and the life satisfaction scores were increased by 1.2 and 4.0 on average, respectively. The anger score was increased only about 0.2 point on average over the participants.

3.1.1. Case A

Primary elements were prioritized as follows: health, happiness, inner peace, relatedness, and knowledge (Fig. 1). The results of self-reflection on health suggested that he strived to maintain only physical health, while his psychological health was poor. As such, for Case A, the health-related goal was to improve both physical and psychological health. His related strengths were strong tenacity and endurance while deficits were difficulties in anger and emotion control. He planned a detailed routine of regular exercise and meditation and reading at least 30 min per day. The life changes associated with the behavioral routine were expected to contribute to not only his own emotional stability but also of other prisoners and his family.

He stated "I felt impressed by the vitality of the plants; they managed to survive in the garden plot despite the poor growing environment. By equating this situation to my life, the program helped me feel revitalized and achieve emotional stability." He felt positive emotions such as peacefulness, liveliness, rejuvenation, honesty, and consideration during the program (Fig. 1).

Case A experienced decrease in depression score (from 6 (pre-test) to 1 (post-test)), while experiencing increases in scores of life satisfaction (from 18 (pre-test) to 20 (post-test)) and self-esteem (from 29 (pre-test) to 37 (post-test)) (Table 3).

3.1.2. Case B

Primary elements were prioritized as follows: happiness, health, work, hobby, and knowledge (Fig. 1). The results of self-reflection on happiness led to the formulation of the goal to lead a peaceful and enjoyable life with his family. Having little meaningful activity as a prisoner, he was not involved in any efforts to achieve the goal. However, his related strengths were family, intelligence, and strong fitness while deficits were egoism and restrained life in prison. He planned a detailed routine of voluntarily helping other prisoners, religious activity, and writing to family more regularly. The subsequent life changes were expected to contribute to a better prison life.

He inferred that plants' retarded growth and development was because of excessive sunlight, water stress, and harmful insects. He then made an analogy that his offense was caused by excessive greed and dependence on surrounding people. At the end of the program, he recognized the importance of independence (Fig. 1). He felt positive emotions such as a sense of freedom, cheerfulness, delight, comfortability, and rejuvenation during the program.

Case B experienced an increase in life satisfaction score (from 23 (pre-test) to 30 (post-test)) (Table 3).

3.1.3. Case C

Primary elements were prioritized as follows: health, personal relations, happiness, and inner peace (Fig. 1). Self-reflection suggested that his psychological condition was unstable and that he experienced difficulties in his personal relationships. As such, for Case C, the goal was to improve psychological health through anger management. His related strengths were good self-recognition of the importance of psychological health and direct access to a counselor while deficits were difficulties in emotion control. He planned a detailed routine of participating in active psychology consultations. The subsequent life changes were expected to lead to a better prison life through emotional stability and interpersonal relations.

He stated, "Earlier, I felt I had nobody to talk to, but the HT program has helped me build trust." He experienced positive emotions such as peacefulness, desire, warmth, happiness, and comfortability during the program (Fig. 1).

Case C experienced a decrease in depression score (from 14 (pre-test) to 10 (post-test)) and an increase in life satisfaction score (from 16 (pre-test) to 27 (post-test)) (Table 3).

3.1.4. Case D

Primary elements were prioritized as follows: knowledge, work, happiness, health, and inner peace (Fig. 1). As per the self-reflection on knowledge, the goal was to develop his skill set to operate a distribution company. He identified that he was halfway to achieving his goal by reading books and newspapers in prison. His related strengths were a high interest in general knowledge and understanding of the distribution process, a desire to be with family, and endurance while deficits were limited access to information about the distribution industry, regulations on life in prison, and maladjustment to society. He expected that consistently pursuing knowledge related to the distribution industry would help overcome his prison life-related deficits.

In parallel, over the course of the program, he had learned that the successful emergence and growth of plants requires highly viable seeds, proper air and soil temperatures, water and nutrient-sufficient soil, as well as careful attention and love; therefore, management of the growing environment and planning of management practices play crucial roles.

He stated, "I saw the similarity with my life, which also requires management of the environment." He felt positive emotions such as peacefulness, devotion, warmth, happiness, and liveliness during the program (Fig. 1).

Case D experienced a decrease in depression score (from 18 (pre-test) to 13 (post-test)), with symptoms recovering from moderate depression before the treatment period to mild depression at the end of the study. Also, Case D experienced an increase in self-esteem score (from 28 (pre-test) to 31 (post-test)) (Table 3).

3.1.5. Case E

Primary elements were prioritized as follows: health, knowledge, hobby, community, and autonomy (Fig. 1). As per the results of self-reflection on health, the goal was overall physical and psychological health management. He identified that lethargy and demotivation significantly deterred the proper management of his life for better physical and psychological health. His related strengths were a knowledge of kinematics, endurance, and time management while deficits were susceptibility to stress, unhealthy diet, and an unwillingness to troubleshoot. He planned a detailed routine of regular workouts to strengthen his physical and psychological capacities.

He stated, "I got to understand the similarity of plants' and humans' life cycles. Through the program, I realized that both plants and humans should overcome challenges at every stage to move forward (Fig. 1)." He felt positive emotions such as honesty, adventuresomeness, comfortability, and kindness, as well as a feeling of refreshment, during the program.

Case E experienced a decrease in anger score (from 11 (pre-test) to 10 (post-test)) and an increase in life satisfaction score (from 32 (pre-test) to 33 (post-test)) (Table 3).

3.2. Program satisfaction

The prisoners reported being either "very satisfied" (n = 1) or "satisfied" (n = 4) with the HT program. Regarding the 12-week therapy period, two participants responded "very satisfied," one participant responded "satisfied," one participant responded "neutral," and one participant responded "not satisfied." As per the prisoner who was not satisfied (n = 1), more than 16 weeks was the adequate duration. Regarding the weekly frequency, one par-

ticipant responded "very satisfied," two participants responded "satisfied," one participant responded "neutral," and one participant responded "not satisfied." The prisoner who was not satisfied (n = 1) suggested a twice weekly frequency. Regarding the 90-minute activity time per session, two participants responded "very satisfied" while three participants responded "satisfied." Of the five participants, four reported positive changes in their lives. Additionally, all participants desired continued participation and would recommend the program to other prisoners.

4. Discussion

The GLM-based HT program was associated with reduced depression and increased self-esteem and life satisfaction. The five prisoners who participated in the 12-session HT program showed decreased depression, and increased self-esteem and life satisfaction.

A minimal clinically important difference (MCID) is defined as the smallest difference in the client perceived as beneficial or important, which is an objective measure of subjectively evaluated outcomes of a clinical trial.[46] According to Button et al. (2015), the MCID of the depression score is estimated a 17.5% reduction of the baseline score.[47] In our study, it corresponds to a reduction of 1.7 in the depression score. The prisoners showed the decrease in the depression score by 2.6 above the MCID criterion of 1.7, suggesting that the participation into the HT program was clinically effective in reducing depression of the prisoners. However, there was no MCID established for the measured psychological health parameters in the present study – self-esteem, life satisfaction, and anger – in the literature.

Chi, 2012 carried out an 8-session HT program on a total of 10 prisoners in their 50 s in which the self-esteem score of the prisoners was improved from 23.6 ± 6.7 to 27.2 ± 3.19 after participating in the HT program with an average difference of 3.6.[48] Our study showed a similar trend of the increased self-esteem score by the HT program from 32.3 ± 5.9 to 33.4 5 ± .1 with an average difference of 1.2 although the inclement of the self-esteem score was smaller than that of Chi, 2012 (Table 3). Such a lower inclement is thought to be derived from the higher average baseline self-esteem score of 32.3 out of 40 in our study compared to 23.6 of Chi, 2012.

The improvement in life satisfaction (Cases A, B, C, E) was due to the prisoners' organized and active participation and their willingness to apply their newly acquired knowledge to their prison routines. They appeared able to identify similarities in the human and plant life cycles, which might have provided a unique opportunity for reflection. Horticultural activity is considered to serve as a medium for the prisoners to connect the stages of their lives with those of plants, enabling better emotional expression and self-awareness.[26,49]

Furthermore, the strengths-based approach, giving prisoners independence in organizing and planning the program, played a role in improving life satisfaction. The interventions, such as autonomous decision-making, planning, and gaining experience of both growing plants and building good lives, were firmly based on the GLM. This empowerment would have made it possible for them to invest more effort into making positive changes in their lives. As evidence, the participants stated that they felt revitalized by the analogy between the human and plant life cycles, the need for management in both horticulture and life, and the importance of overcoming challenges for building good lives and growing plants (Cases A, D, E). Striving for good lives is regarded as the most important goal in life, which enhances the quality of life. For prisoners, it reduces recidivism by creating meaning.[50,51] The HT program could teach prisoners not only horticultural but also life skills through the increased freedom it offered. Self-learned essential life skills—responsibility, accountability, organization, work ethics—could be utilized both in prison and on re-adaptation to society upon release.[52]

A previous community-based HT program for 477 prisoners, which emphasized their independence in planning and implementation, given their momentary escape from the confines of prison, had significant positive outcomes with regard to correction and rehabilitation and reduced recidivism.[30] Thus, it is expected that the present study's HT program could eventually lead to successful prisoner rehabilitation.

The results showed that the program was positively associated with emotional stability, such as through decreases in depression (Cases A, C, and D) and anger (Case A, E), and increases in self-esteem (Cases A and D) possibly because of the improvement of life satisfaction in the process of striving to lead good lives. Greater life satisfaction leads to greater emotional stability.[53,54]

All cases displayed changes in emotions such as peacefulness, a feeling of refreshment, comfortability, and warmth while carrying out horticultural activities. Participation in horticultural activities has been shown to generate psycho-physiological benefits following stress and attention fatigue. Previous studies have reported the effects of visual stimulation or physical involvement with green plants on psycho-physiological relaxation. Prison environments are often bleak, chaotic, overcrowded, and isolated, with little access to nature and plants. An HT program offers an opportunity for relaxation and relief from such harsh physical and social environments.[55] Therefore, the positive emotional changes were also considered to lead to an improvement in emotional stability.

Previous studies reported that HT promoted self-efficacy among prisoners, helping mitigate feelings of depression and aggression and making them more relaxed.[56–58] Lee et al. (2013)[31] also found decreased depression and stress in 37 prisoners who participated in a 12-session HT program with cultivation activities. Psychological health is a key determinant of the success of prisoners' rehabilitation and reintegration.[59] Our results imply that the prisoners' psychological health was positively associated with the HT program. Thus, our HT program could have the potential to be used as a prisoner rehabilitation program that can overcome obstacles such as psychological problems and increased recidivism in prisoner correction/rehabilitation.

However, we identified potential constraints and limitations of the study in prison as follows. Since concerns about the possible accidents that might have caused by plants in the living space of the prisoners in conducting HT activities, carrying such plants into the prison were strictly prohibited. This restriction limited the selection of the HT activities in the program to outdoor gardening activities, meaning that the prisoners were not exposed to a variety of horticultural activities and experiences. In addition, as the prisoners were not allowed to freely act and move within the prison, the prisoners did not have sufficient and spontaneous time to contact and interact with plants, such as, observing the growth and development of the plants over time, and managing the plants except the times they participated in the HT program over the course of the study.

In conclusion, the HT program was associated with improvements psychological health conditions such as depression, anger, self-esteem, and life satisfaction, suggesting that this GML-based therapy can be used for prisoner rehabilitation/management. Compared with the conventional disease and illness-based approach, this study provides a new perspective for those who conceptualize and implement HT programs for correction/rehabilitation. This case study is unique in that it used adjusting interventions that combined a strengths-based approach, the therapeutic aspect of HT, and community-based resource management practices in prisoner rehabilitation. Throughout these interventions, the connections in between the plant and human life cycles were integrated into the activities and highlighted. The present study has its value in that it

investigated the potential of using a HT program as prisoner rehabilitation for improving psychological health.

Future studies should employ causal-comparative designs with larger sample sizes to draw statistically reliable conclusions regarding the effects of HT for prisoner rehabilitation. It is also necessary to investigate the effects of HT programs on prisoner rehabilitation adjusting gender or crime type.

Author contribution

Conceptualization: AY and SA. Methodology: AY, HJ, SA, and SY. Investigation: AY, HJ, SA, and SY. Formal Analysis: AY and SA. Writing – Original Draft: AY and SA. Writing - Review & Editing: AY and SA.

Conflict of interest

The author declares no conflicts of interest.

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Ethical statement

The institutional review board of Konkuk University approved this study (7001355-201804-HR-236). The participants agreed to the use of collected data for scientific purposes.

Data availability

Data will be made available on request.

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