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Research article

The impact of an agro-healing program on family resilience, parental stress, and social skills of children with developmental disabilities

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ABSTRACT

Developmental disabilities pose challenges for the entire family, making it crucial to enhance family resilience and promote a positive outlook for all members. This study aimed to investigate the impact of an agro-healing program based on horticultural activities using a family resilience framework among families with children with developmental disabilities in South Korea. A total of 15 participants, including children with developmental disabilities, from 6 families were recruited for the research. The program entailed conducting a 90-min agro-healing program based on horticultural activities for 8 weeks; a total of 8 sessions were delivered weekly. The Family Resilience Scale, Family Adaptability Scale, Korean Perceived Stress Scale, Social Skills Rating Scale, and Satisfaction Survey Questionnaire were utilized to evaluate the program's impact. The analysis of the agro-healing program's effects revealed that family resilience in families with children with developmental disabilities improved significantly. Additionally, the parents' stress levels decreased, and social skills of the children with developmental disabilities improved. The agro-healing program based on horticultural activities can serve as a social support measure to enhance psychological and social well-being and aid recovery in families with children with developmental disabilities.

1. Introduction

Family, as a social unit based on emotional and physical support, consists of two or more people who share mutual expectations, intimacy, and continuous protection [1]. Its functions are highly significant. From the perspective of these family functions, families with children with disabilities face various difficulties and constraints, greatly impacting overall family function.

"Developmental disabilities" encompass a wide range of cognitive and physical disabilities, each manifesting early in a child's development and persisting throughout life. Developmental disabilities occur among all racial, ethnic, and socioeconomic groups. Recent estimates in the United States show that about 1 in 6, or about 17 %, of children aged 3 through 17 years have one or more developmental disabilities [2]. Children with developmental disabilities (CWDD) often have low cognitive abilities, communication challenges, and frequent behavioral problems [3], which can weaken their mobility and limit their ability to participate in daily activities. For parents of CWDD, caregiving is a lifelong task, continuing throughout their child's life. The high physical and emotional

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demands experienced by families of CWDD place significant burdens on parents [4] and limit the time parents can spend with their other children, causing severe emotional and social effects. Overall, these families' economic, physical, emotional, and social demands often result in higher levels of constraints and stress, weakening overall family function [5]. Caring for a child with disabilities is typically more closely associated with the roles and responsibilities of mothers than fathers [6,7]. In many cases, mothers quit their jobs to care for their disabled children, which increases their likelihood of experiencing stress and health issues [8].

However, families of CWDD do not experience only adverse outcomes. Previous studies indicate that these families can have positive experiences, such as satisfaction and joy from caring for their disabled child [9], strengthened family cohesion [10], personal strength and growth [11], and becoming better parents because of their child [12]. These studies suggest that family resilience influences caregiving stress in families with CWDD. In other words, positive interpretations of the caregiving experience can help families perceive positive experiences, contributing to healthy family functioning [13].

Family resilience focuses on how families perceive and cope with stress rather than the difficulties and crises themselves, emphasizing the potential for the family system to lead to adaptation [14]. Based on the perspective of strength, family resilience enables successful family adaptation even in high-risk situations, such as raising a child with a disability, which can lead to increased family cohesion, flexibility, and interaction. According to Halstead et al. [15], resilience and sustained caregiving ability are closely related concepts, and the well-being of mothers of disabled children is crucial. As parents need to care for their children over long periods, maintaining caregiving ability is vital for the welfare of children with disabilities [16]. Providing support to reduce the anxiety and stress experienced by parents of CWDD is essential. In line with health and well-being, the "Healthy People 2030″ report aims to reduce the prevalence of anxiety and depression among family caregivers of individuals with disabilities [17].

In short, CWDD face significant physical, cognitive, and socio-emotional challenges, which can negatively impact the family members' quality of life. Parental resilience is a critical factor in indirectly supporting these children by helping parents adapt to stress and challenges, thereby fostering a positive parent-child relationship and enhancing the child's quality of life. Specifically, when parents have a good understanding of their child's characteristics, access social support, and maintain a positive perception of parenting, they can provide positive parenting in difficult situations, significantly improving the well-being of CWDD.

Recent studies have emphasized the significant role of the natural environment in supporting health and well-being [18], highlighting three key theories about the relationship between nature and humans: the biophilia hypothesis, attention restoration theory, and stress recovery theory [19–21]. Based on natural environmental elements, these health-promotion interventions are known in Europe as "Green Care," including a wide range of interventions such as nature-based rehabilitation, care farm, social farm, horticultural therapy, and animal-assisted interventions, all sharing the common goal of "healing through agricultural activities."

Green Care has developed alongside each country's cultural and economic conditions, thus showing different aspects across nations. In the UK, it provides healing and social services, targeting individuals with mental health issues such as mental disorders, learning disabilities, and autism. In Germany, it focuses on health, employment, education, and therapy for people with disabilities and those in need of social farming. Italy emphasizes it for labor integration in vulnerable groups [22], whereas Norway targets it for children, adolescents, the elderly, and individuals with mental illness [23]. In South Korea, research on agro-healing has been actively conducted since 2013, and the Agro-healing Act was enacted in March 2021. Agro-healing, which promotes all citizens' psychological, social, physical, and cognitive health through agriculture, rural resources (plants, animals, rural environment, and rural culture), or related activities and products, has been developing theoretically and practically through joint research with experts in related fields. After discussion and agreement on its concept and advanced cases, it was first used in 2013 [24]. This law defines the agro-healing industry, the scope of support, and implementation methods. This study is closely related to the Agro-Healing Act, as it evaluates the effects of a horticultural activity-based agro-healing program and seeks to explore ways to support it. The analysis of agro-healing trends in South Korea shows that 57.8 % of the participants are special needs-necessary individuals (including those with physical disabilities, stroke, cancer, prisoners, and dementia patients) [25]. Recent Green Care studies cover care and support services for diverse client groups and purposes, including dementia patients [23,26,27], family health-care farming [28], individuals with mental issues [29–31], trauma survivors [32], children with autism [33,34], and vocational rehabilitation for people with disabilities [35]. Green Care effectively targets individuals needing care, providing healing benefits in physical, emotional, cognitive, social, and vocational rehabilitation [36].

Bronfenbrenner [37] notes that cultural, socioeconomic, and environmental factors vary by country in the upbringing and care of children with developmental disabilities, requiring ongoing research and attention from a micro perspective of individuals and families. Families of CWDD have the most powerful and lasting impact on CWDD by contributing to the healthy development of the family itself [38]. Therefore, social support, such as family-centered programs and services, is essential to enhance family resilience. Additionally, since the care and support system for CWDD significantly impacts the quality of family life [39,40], it is crucial to provide support services continuously. Recently, studies on the effects of agro-healing on families have been published. Agro-healing programs for families have been shown to improve family communication skills, mothers' psychological health, and children's emotional intelligence [28], and positive results in dietary habits have been observed among families participating in family gardens [41–43]. Additionally, interviews with eight families and children hospitalized in pediatric wards over five weeks indicated that experiences at Fairy Gardens led to positive outcomes through healing, rest, and social interaction [44]. While various cases involving different families have been reported in existing studies, there is no research on the effects of agro-healing on families with CWDD.

Therefore, research on the impacts of agro-healing programs based on natural environmental elements on the psychological and social health and recovery of families with CWDD is necessary. This study aims to develop an agro-healing program based on horticultural activities, using the framework of family resilience, apply it to CWDD families, and examine its effects.

2. Method

2.1. Research participants

For this study, we recruited program participants of families of CWDs in K City through announcements posted at local disability welfare facilities, targeting CWDD-aged elementary schools and above, along with their parents and their non-CWDD siblings. Before the study, the researcher conducted an orientation session with the participants to explain the research purpose procedures, and obtained written consent from those who voluntarily agreed to participate. For CWDD (intellectual disabilities and autism), additional written consent from legal guardians was obtained. In the end, 6 families from K City participated, with 15 participants. Considering the diversity in family structures, we put no restrictions on whether the mother or father participated; however, in this study, the parent participants were all mothers. The mothers of CWDDs were aged in their 30s (1), 40s (4), and 50s (1), with an average age of 44.8 years.

Nine child participants were included in the study: five with intellectual disabilities, two with autism, and two non-disabilities siblings (Table 1). The children ranged in age from elementary to high school (average age: 15.7 years) and included seven boys (78 %) and two girls (22 %). The Institutional Review Board at Konkuk University approved this study (IRB:7001355-202208-HR-571).

2.2. Development of the agro-healing program

This research was conducted at an agro-healing farm in City K, South Korea. The farm is a facility with a total area of 2800 square meters. Before the full-scale development of the program, we analyzed the resources of the agro-healing farm, which is a crucial step for designing a suitable program for the participants. This step is also essential for economically utilizing the farm's resources. For the development of the program, we investigated the plant resources available at the farm, including crops and horticultural plants. Four researchers visited the site three times, documenting the names of crops that could be cultivated at the farm and organizing horticultural activities that could be employed during crop cultivation using prepared forms. Through this process, plant resources applicable to the agro-healing program were identified as follows (Table 2). The plant resources identified through this process were integrated into horticultural activities in this research, including plant cultivation, management, propagation, harvesting, cooking and utilizing the produce, and appreciating the plants.

A series of pre-meetings were held to understand the needs of CWDD families during the development stage of the agro-healing program. Through the literature review, we identified the main issues: parental stress; emotional, social, and cognitive issues of CWDD; and family relationship tension. Additionally, we recognized the major needs of family resilience and well-being. Family resilience is maintaining and recovering emotional bonds and cohesion despite various crises and difficulties the family faces [14]. Therefore, the research team incorporated insights from pre-meetings to design a program based on the key elements of the family resilience theory, including belief systems, organizational patterns, and communication processes. Moreover, a meta-analysis of the effects of nature-based activities and horticultural therapy verified that the effective intervention period is generally 8–12 weeks, with activity sessions ranging from 20 to 90 min [45–47]. Regarding the size of the target group for the ago-healing program, in a study of a healing garden program for adolescents with autism, the number of program participants was 8 [48]. When conducting group sessions rather than one-on-one sessions, a group size of up to 15 participants is suitable, with 7–8 participants suggested for group counseling [49]. This size allows for active group dynamics and sufficient feedback exchange without participants feeling neglected within the given time. Considering these previous studies, the agro-healing program based on horticultural activities was developed to be conducted once a week, with each session lasting 90 min for eight sessions. The agro-healing program, which is based on horticultural activities and incorporates the three elements of family resilience, is outlined as follows (Fig. 1).

Each session was organized to include farm work using plant resources from the healing farm, horticultural activities, healing garden walks, and viewing. This agro-healing program provided a positive experience, helping families flexibly cope with challenges they encounter through farm work activities. Furthermore, it included stages of healing intervention that enhance communication skills by fostering cooperation among family members, social adaptation in new relationships, and free expression during activities.

Table 1
General characteristics of child participants.

Category			Number/Rate (%)
Sex		Male	7 (78 %)
		Female	2 (22 %)
School		Elementary	2 (22 %)
		Middle	5 (56 %)
		High	2 (22 %)
Disability	CWDD[a]	Intellectual disability	5 (56 %)
		Autism	2 (22 %)
	Non-CWDD		2 (22 %)

[a] CWDD: Children With Developmental Disabilities.

Table 2
Plant resources applied in the agro-healing program.

Category	Plant resources
Vegetables	Chinese Cabbage, Radish, Green Onions, Lettuce
Ornamental plants (including annuals and bulbs)	Pasqueflower, Daisy, Dendranthema Zawadskii, Golden Sedum, Violet, Hosta, Daffodil, Tulip
Trees and shrubs	Cornelian Cherry, Emerald Green Arborvitae, Dawn Redwood, Persian Silk Tree, Heavenly Bamboo, Boxwood, Rose of Sharon, Panicle Hydrangea, Weigela, Spirea
Fruit trees	Cherry Tree, Apricot Tree, Flowering Quince, Korean Whitebeam, Young Citrus Tree
Herbs	Lavender, Rosemary, Peppermint, Lemon Balm, Basil, Apple Mint, Chamomile

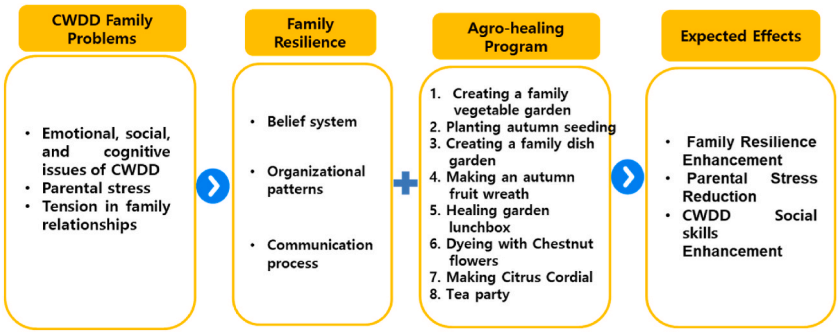

Fig. 1. Agro-healing program applying family resilience framework.

Fig. 2. Examples of the agro-healing program.

2.3. Implementation of the agro-healing program for families with CWDD

The agro-healing program based on horticultural activities was conducted once a week for 8 weeks, with each session lasting 90 min, totaling 8 sessions. The space was designed considering the user's healing needs and safety, ensuring stability, eco-friendliness, comfort, and accessibility.

Each CWDD family participating in this study was provided a raised planter box (2.0 × 1.0m) growing a vegetable garden. Each program session was structured into three stages: introduction, development, and closing. During the introduction stage, participants were encouraged to understand the session's central theme and goals related to the program in an open atmosphere. In the development stage, horticultural activities integrating the family resilience framework were organically linked to achieving activity goals (Fig. 2). In the closing stage, feedback from each activity of the agro-healing program based on horticultural activities was briefly observed and recorded, including parents' conversations and reactions and observations of conversations or behaviors of CWDD, for reference in the post-evaluation.

For example, in the first session of the "Creating a Family Vegetable Garden" during the introduction stage of the agro-healing program, the horticultural therapists and families. During the development stage, families assigned names to their individual planter boxes for horticultural activities (a) and created "Family vegetable garden name tags." Horticultural activities (b) allowed CWDD families to explore their planter boxes, engage in various agricultural tasks, and understand their roles. The discussions included expectations for harvesting and utilizing vegetables and challenges related to management tasks such as watering and pest control. During the initial soil mixing activity, the horticultural therapist ensured that CWDD and their parents could participate without difficulty in activities such as touching the soil and mixing fertilizer. Horticultural activities (c) supported participants in recognizing and expressing their emotions through breathing and walking in nature, helping them focus on current activities. Throughout the agro-healing program, the horticultural therapist listened to and observed family conversations, roles, and problem-solving methods, intervening appropriately based on the process of family resilience. In the second session's horticultural activities (b), the horticultural therapist encouraged the division of roles based on the strengths of the CWDD families and provided repetitive training until the CWDD participants became familiar and comfortable with their assigned horticultural activities. CWDD participants showed interest and enjoyment in watering activities. The horticultural therapist instructed them on how to handle watering cans, carry water, prevent splashing, and bend their bodies as needed. As a result of such interventions, CWDD participants responded positively, with one stating, "Watering plants is fun. It was difficult at first, but now I can do it well" (Child participant K with intellectual disability, male). Parents of CWDD participants provided feedback such as, "It's a simple activity, but through repeated practice, our child seems to have gained confidence" (Parent of Child participant S with intellectual disability). During horticultural activities (c), CWDD families identified and expressed their current emotions through breathing exercises and walks in nature. CWDD participants observed nature, harvested fruits, showed interest in nearby flowers, and experienced sensory stimuli without external interference. Parents of CWDD participants spent time in nature during walks, enabling them to recover emotionally and share these experiences with other parents. During the closing stage, CWDD families shared their experiences and reflections on the activities, eagerly anticipating the next gathering while offering positive support and encouragement.

The agro-healing program was led by a certified horticultural therapist (Level 1) and supported by three assistant researchers.

2.4. Evaluation

This study employed evaluation tools to measure family resilience, family adaptability, perceived stress, and social skills of the child before and after implementing the agro-healing program. Additionally, participant satisfaction with the activities was surveyed after the program. This provided direct feedback on the program's effectiveness and served as foundational data for improving the program based on participants' subjective experiences.

The Family Resilience Framework Scale [50], based on Walsh's theory adopted by Kim [51], was used to measure family resilience. The Family Resilience Framework Scale consists of elements pertaining to belief systems, organizational patterns, and communication processes, each assessed using a 5-point Likert scale. The Cronbach's alpha was 0.78.

The Family Adaptability Scale is a modified version of the Parent Attitude Research Inventory, developed by Schaefer and Bell [52] to measure social functioning in South Korea. It consists of 15 items, 13 of which are scored on a five-point Likert scale, including reverse-scored items. Cronbach's alpha was 0.88.

The Korean Perceived Stress Scale measured parents' stress levels. This instrument is an adapted version of the Perceived Stress Scale, developed by Cohen, Kamarck, and Mermelstein [53], modified to fit the South Korean context. Participants responded based on their feelings over the past month, aiming to assess their general stress levels. The scale consists of 14 items rated on a five-point Likert scale, with items 4, 5, 6, 7, 10, and 13 being reverse-coded. The Cronbach's alpha was 0.76.

The Social Skill Rating System is based on the social skill-rating system Teacher Form Elementary Level, developed by Gresham and Elliot [54]. It measures a wide range of social behavior in children aged 3–18 years, and there are three types: for parents, teachers, and for self-reporting. This study used the form for teachers. The teacher form consists of 30 questions with three subfactors: cooperation, assertiveness, and self-control. It is a 3-point scale test strip that is scored according to the frequency of the behavior, with a score of 0 if the behavior is not observed at all, 1 point if the behavior occurs occasionally, and 2 points if the behavior occurs frequently. The Cronbach's alpha was 0.77.

After the program's completion, participants' satisfaction with it was assessed. The assessment included items such as activity satisfaction, satisfaction with the duration and frequency of the activities, the most enjoyable program, understanding of the program, and willingness to participate in future programs.

2.5. Data analysis

The participants' demographic data and the satisfaction survey results were analyzed using descriptive statistics in Excel (Microsoft Office 2007; Microsoft Corp., Redmond, WA, USA). SPSS Statistics software (version 24 for Windows; IBM, Armonk, NY, USA) was used to examine pre- and post-changes in family resilience, K-perceived stress, family adaptation, and social skill ratings. The Wilcoxon signed-rank and non-parametric test for paired samples were conducted.

3. Results

3.1. Family resilience

The pre-and post-program measurements indicated that overall family resilience increased from an average score of 325.50 (pre-program) to 343.68 (post-program), showing a statistically significant change ($p = 0.043$) (Table 3). When examining the three components of family resilience, the belief systems showed an increase in the average score from 170.50 to 175.67, but this change was not statistically significant ($p = 0.344$). The organizational patterns significantly increased the average score from 124.33 to 135.17 ($p = 0.028$). For communication processes, the average score increased from 43.17 (pre-program) to 44.67 (post-program), but the result was not statistically significant ($p = 0.077$) (Table 3).

3.2. Family adaptation

The pre- and post-program measurements indicated that family adaptation did not change significantly (Table 4).

3.3. Korean perceived stress

The pre- and post-program measurements indicated that the average score of perceived stress significantly decreased from 25.00 before the program to 20.33 after the program ($p = 0.046$) (Table 5), indicating an improvement in the level of perceived stress.

3.4. Social skill rating system

The pre- and post-program measurements indicated that the social skills assessment scale score increased from 15.29 before the program to 36.86 after the program, showing a significant improvement ($p = 0.018$) (Table 6).

3.5. Satisfaction with the ago-healing program

After completion of the agro-healing program, the preferences and satisfaction levels of two groups, parents and children, were evaluated. In the ranking of preferred activities across the eight sessions, children showed a high preference for "Healing garden lunch box" (Session 5, 55 %), "Dyeing with chestnut flower" (Session 6, 55 %), and "Making an autumn fruit wreath" (Sessions 4, 44 %). Parents preferred "Creating a family vegetable garden" (Session 1, 83 %), "Making an autumn fruit wreath" (Session 4, 66 %), and "Healing garden lunch box and making citrus cordial" (Sessions 5 and 7, 55 %) (Fig. 3).

Additionally, a satisfaction survey of the program evaluated five aspects: overall content of activities, duration, frequency, understanding of activities, and willingness to participate. Parents of CWDD showed very high levels of satisfaction in activity content (100 %), duration (83.3 %), frequency (83.3 %), and understanding (100 %). Child participants (including CWDD and non-CWDD) exhibited relatively high satisfaction in activity content (100 %), duration (55.6 %), frequency (77.8 %), and understanding (77.8 %). Moreover, the re-participation willingness rate was 90 % for children and 100 % for parents. The program's re-participation rate for CWDD families was 90 %.

Table 3
Family resilience before and after implementing the agro-healing program.

Variables	Mean (SD)		Z	*p*
	Pre-test	Post-test		
Belief systems	170.50(32.29)	175.67(29.48)	−0.946[b]	0.344 [NS]
Organizational patterns	124.33(8.36)	135.17(11.62)	−2.201[b]	0.028[a]
Communication processes	43.17(4.54)	44.67(3.83)	−1.769[b]	0.077 [NS]
Overall family resilience	325.50(20.75)	343.67(20.68)	−2.023[b]	0.043[a]

Note. NS, nonsignificant.
[a] indicates significant at $p < 0.05$; Z indicates the Wilcoxon signed-rank test.
[b] indicates the rank of negative significance.

Table 4
Families adaptation before and after implementing the agro-healing program.

Variables	Mean (SD)		Z	*p*
	Pre-test	Post-test		
Family adaptation	51.67(6.02)	51.67(11.17)	−0.674[b]	0.500 [NS]

Note. NS indicates nonsignificant; Z indicates the Wilcoxon signed-rank test; [b] indicates the rank of negative significance.

Table 5
Scores on Korean Perceived Stress Scale before and after implementing the agro-healing program.

Variables	Mean (SD)		Z	*p*
	Pre-test	Post-test		
Social Skills Rating system	25.00(2.90)	20.33(3.45)	−1.997[b]	0.046[a]

Note. NS, nonsignificant.
[a] indicates significant at $p < 0.05$; Z indicates the Wilcoxon signed-rank test.
[b] indicates the rank of negative significance.

Table 6
Scores on Social Skiils Rating Scale before and after implementing the agro-healing program.

Variables	Mean (SD)		Z	*p*
	Pre-test	Post-test		
Social skills rating	15.29(9.43)	36.86(13.89)	−2.366[b]	0.018[a]

Note. NS, nonsignificant.
[a] indicates significant at $p < 0.05$; Z indicates the Wilcoxon signed-rank test.
[b] indicates the rank of negative significance.

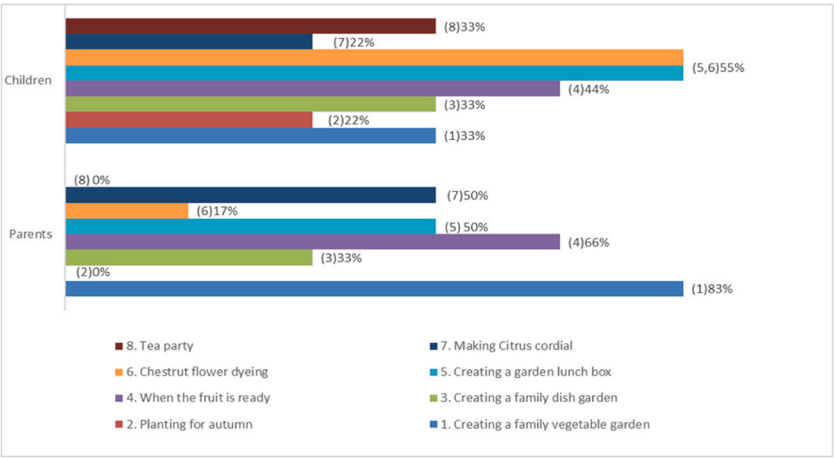

Fig. 3. Participants' preferences for sessions of the agro-healing program.

4. Discussion

The agro-healing program based on horticultural activities applying the family resilience framework was found to contribute to the recovery of family resilience, reduction of parental stress in CWDD families, and improvement of CWDD's social skills.

The belief systems within the framework of family resilience theory refer to how family members interpret and attribute activities, creating a family vegetable garden, touching soil, and nurturing plants under the warm sunlight, thereby depending on each other and experiencing positive interactions. Previous studies have shown that individuals with intellectual disabilities often exhibit low motivation and apathy, but designing agricultural activities with appropriate difficulty levels ensures successful experiences, leading to positive effects [55]. Skills in vegetable cultivation and harvesting can enhance self-efficacy among families, promoting the achievement of their goals [56]. Additionally, research by Greeff and Nolting [57] with parents of children with disabilities in South Africa showed their participation in processes such as creating meaning, reinterpreting crises as opportunities for growth, actively

accepting new experiences, relying on each other to overcome adversity, and adapting better to crises arising from the birth of a disabled child. Such approaches in agro-healing align with the concept of family resilience, where families of CWDD accept their current situations while supporting and trusting one another [58–60].

The organizational patterns of family resilience refer to the connectivity between the family system's stability and its ability to adapt to change, integrating external socio-economic resources. Horticultural activities facilitate role distribution through cooperative efforts in crop cultivation, fostering mutual understanding, collaboration, and responsibility-sharing, thereby strengthening family cohesion [61–63]. Group activities based on mutual respect and cooperation can improve interpersonal relationships and enhance self-efficacy, self-esteem, and overall quality of life [55]. Furthermore, agricultural activities can aid vocational rehabilitation, improving skills and productivity [60–64]. Breitkreuz, Wunderli, Savage, and McConnell [56] highlighted the importance of social support from local communities such as family, friends, neighbors, healthcare professionals, and churches for parents of children with disabilities in their daily lives. In this study, sharing experiences with the local society through agro-healing activities improved the sense of community of families with CWDD.

Throughout the program's implementation, CWDD and non-CWDD families engaged in task performance through role distribution and collaboration processes, sharing information, and increased psychological support and solidarity among parents of CWDD. While significant communication changes were not evident in the communication elements before and after the program, improvements were noted. Previous studies have indicated that agro-healing interventions significantly enhance communication between mothers and typically developing children [28,29]. In this study, families included two households with children diagnosed with autism spectrum disorder and one household with siblings all diagnosed with intellectual disabilities. This context highlights the need for tailored agro-healing approaches to enhance communication, fostering emotional expression and empathy through various natural activities, thus strengthening family members' emotional bonds.

Ultimately, the elements of family resilience applied in the agro-healing program based on horticultural activities interact synergistically, enhancing the family resilience framework described by Walsh [65] and enabling families of CWDD to cope better with stress and achieve positive changes and growth.

Family adaptation refers to the family system's ability to adjust and regulate in response to new situations or changes, with family adaptability indicating dynamic changes in leadership, relational rules, and function [66]. According to Olson's circumplex model, average levels of family cohesion and adaptability are desirable, although there are cultural differences in family cohesion and adaptability [67]. In this study, significant results related to family adaptation were not obtained, likely due to cultural factors such as differences in the perception of receiving help without others' assistance and strong family regulations prevalent in Eastern and Western societies [68]. In South Korea, caregiving patterns are predominantly led by women, homemakers, residents, or spouses. In this study, it was presumed that adjusting roles and initiating changes within families solely through maternal participation was challenging, considering these characteristics of Korean caregiving. Such differences underscore the importance of considering cultural contexts when evaluating family systems and intervening with support programs.

Mothers of disabled children typically bear greater caregiving burden and experience higher levels of stress compared to mothers of normally developing children [69]. Research indicates that mothers of children with ASD experience higher levels of anxiety compared to mothers of children with intellectual disabilities [70]. Continued exposure to the stigma associated with parenting disabled children affects parental adaptation strategies and negative impacts on parents' emotions and behaviors [71,72]. However, this study showed significant effects of stress reduction among CWDD parents. Horticultural activities in natural environments effectively improve mental health and nervous conditions [73,74]. Spending time in natural surroundings positively affects mood, stress reduction, concentration, and self-esteem [75]. According to research on plant and human psychophysiology, natural landscapes increase parasympathetic nervous system activity, inhibit sympathetic nervous system activity, and reduce blood pressure and heart rate [76–79]. Staring at green plants stabilizes the human autonomic nervous system and activates the alpha wave frequency of brain waves, leading to physiological and psychological relaxation [80,81]. In addition, when performing work activities in an environment with plants, the sympathetic nerve activity and oxyhemoglobin of the worker's left frontal cortex are reduced, resulting in physiological relaxation [82]. Park et al. [83] conducted metabolomic profiling to investigate the effects of horticultural interventions on cognitive function and reported that increasing tryptophan and serotonin levels in the serum of older adults positively impacts psychological and cognitive health. Additionally, contact with M. vaccae in soil influences human metabolism and autonomic responses, leading to an increase in alpha waves in the occipital cortex and decrease in heart rate, thereby stabilizing the autonomic nervous system [84]. These mechanisms are being studied to understand further the psychophysiological effects obtained through interactions with nature.

Furthermore, participation in social support programs like therapeutic horticulture affects social support and recovery through interactions with other parents of disabled children [85], enhancing family resilience, reducing stress levels, and alleviating psychological distress [86,87]. Therefore, previous research findings align with this study's results.

Participating in the agro-healing program based on horticultural activities significantly enhanced social skills among CWDD participants. The primary characteristics of developmental disabilities, such as deficits in emotional regulation, affect autonomy, social competence, and daily living skills, making it difficult for CWDD individuals to live independently [88,89]. Therefore, individuals with developmental disabilities need to practice emotional regulation techniques and may require various support services and tailored educational programs. In this study, trained horticultural therapists and assistant researchers observed and appropriately intervened in the conversations and behaviors of CWDD, promoting emotional stability through sensory stimulation and interaction with plants. Participants gained confidence and responsibility and enhanced interaction with other family members through repeated training in agricultural activities such as watering and harvesting cycles. According to previous studies, students with intellectual disabilities who participated in hydroponic cultivation programs saw significant improvements in their emotional behaviors and related subcategories

such as impulsivity-discouragement and socialization [90], enhancing attention and social skills [91], and improving emotional and behavioral resilience in green spaces such as gardens [92]. These findings suggest that agro-healing based on horticultural activities positively influences emotional recovery, including social skills, among CWDD.

During the implementation of the agro-healing program based on horticultural activities, the framework of family resilience was expressed through the actions and dialogues of children with disabilities and their parents and through observations. Families of CWDD faced stressors such as anxiety about new environments and attempts at agricultural work, as well as concerns about relationships with other families. Yet, they demonstrated understanding and shared roles in resolving these situations. Thus, family resilience when facing diverse crises [93] can dynamically improve, particularly regarding encouraging families of CWDD to adapt to new situations and promote healthy individual development through close interaction and positive support.

In conclusion, these findings suggest that agro-healing programs can positively affect participants' mental health and psychophysiological state through horticultural activities in natural environments. Horticultural activities promote stress reduction, autonomic nervous system stabilization, and psychological relaxation, contributing to improvements in participants' mental and cognitive health as an outcome of the program. However, an in-depth analysis of the mechanisms through which agro-healing programs produce psychophysiological effects could be a valuable focus for future research.

5. Limitations

This study has several limitations. It is a single-group study without a control group, which weakens the validity of the research, and the small sample size of 15 participants from 6 families limits robust conclusions about the effects. As a result, the findings' generalizability may be limited. However, this study focuses on children with developmental disabilities and their families, and it is a practical challenge to significantly increase the number of participants in this type of research. Therefore, to enhance the generalizability of this study, we suggest that the agro-healing program implemented here be repeated in future studies with a larger number of participants to verify its effectiveness further. In future research, if the opportunity arises, we will consider these points and refine the study design and methodology accordingly.

The difficulty in involving fathers can be explained by the fact that, in South Korea, caregiving for children with disabilities is primarily undertaken by female caregivers or mothers. The nature of caregiving varies culturally across different countries. Nevertheless, given that paternal involvement could impact family resilience differently, further research is needed in this area.

Recent European research on care farms for quality of life and sustainability [89] indicated evaluation methods such as interviews (43 %), surveys (41 %), and participant observation (8 %). In this study, researchers developed and implemented a program to examine how an ago-healing program based on horticultural activities interventions affects interactions within CWDD families through direct evaluations. The results confirmed a positive impact on the quality of life for CWDD families. Building on this study, future research could explore the long-term effects of agro-healing programs. Investigating the sustained impact of continuous participation in horticultural activities on mental health, stress levels, and cognitive function would provide valuable insights into the enduring benefits of such programs. Additionally, future studies could examine the applicability of agro-healing programs for diverse populations, including individuals with developmental disabilities. By analyzing how program effects vary across different age groups, types of disabilities, and family structures, researchers can develop tailored programs that meet specific needs, ultimately broadening the reach and impact of agro-healing initiatives.

Future research targeting families from diverse racial and socio-economic backgrounds is necessary to overcome the cultural context-specific limitations in South Korea and provide generalized insights into relevant healing agriculture.

6. Conclusions

The study examined the impact of an agro-healing program based on horticultural activities on the psychological and social well-being and family resilience of families with CWDD. A systematic agro-healing program based on horticultural activities, incorporating intervention based on family resilience theory, was developed and implemented to achieve this. The study's results indicated positive effects, including reduced stress among participating mothers, improved social skills of CWDD, and enhanced family resilience.

The agro-healing program based on horticultural activities can benefit CWDD families and other groups needing various social support. Practitioners and policymakers should explore ways to introduce this program to communities and adjust it to suit different groups. It is important to continuously evaluate the program's effectiveness and incorporate feedback for improvement. This will enhance the program's practicality and allow more families to benefit from it. Additionally, to expand the program's scope, it is essential to adopt a customized approach that considers diverse cultural backgrounds and types of disabilities. This will enable the development of a program that can be effectively applied across various cultural contexts.

CRediT authorship contribution statement

Hyo-Jung Son: Writing – original draft, Project administration, Methodology, Data curation. **Sin-Ae Park:** Writing – review & editing, Validation, Supervision, Software, Resources, Project administration, Methodology, Funding acquisition, Conceptualization.

Data availability statement

Data availability: Sharing research data helps other researchers evaluate your findings, build on your work, and increase trust in

your article. We encourage all our authors to make as much of their data publicly available as reasonably possible. Please note that your response to the following questions regarding public data availability and the reasons for potentially not making data available will be available alongside your article upon publication.

Has data associated with your study been deposited into a publicly available repository?

- No

Please select why.

- Personal Data: The research data contain personally identifiable information and thus cannot be shared to protect the privacy of individuals.

Ethics declarations

This study was reviewed and approved by the Institutional Review Board (IRB) at.

Konkuk University, with the approval number (IRB:7001355-202208-HR-571). All participants provided informed consent to participate in the study and for publication.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] A. Giddens, The, Polity Press, Third Way. Cambridge, 1998.
[2] Centers for Disease Control and Prevention (CDC), Facts about developmental disabilities. https://www.cdc.gov/child-development/about/developmental-disability-basics.html. (Accessed 9 October 2024).
[3] Y.-R. Kim, G.-E. Kim, S.-Y. Kim, A study on factors influencing the care burden of parents having children with developmental disabilities: the focus on the children's life cycle, Women Stud 88 (2015) 117–164, https://doi.org/10.33949/tws.2015.88.1.004.
[4] G.H.S. Singer, Suggestions for a pragmatic program of research on families and disability, J. Spec. Educ. 36 (2002) 150–156, https://doi.org/10.1177/00224669020360030501.
[5] K.G. Scholl, The Influence of Inclusive Outdoor Recreation Experience on Families with a Child with a Disability, University of Minnesota, 2002.
[6] L. Marsh, M. Brown, E. McCann, The views and experiences of fathers of children with intellectual disabilities: a systematic review of the international evidence, J. Policy Pract. Intellect. Disabil. 17 (2020) 79–90, https://doi.org/10.1111/jppi.12328.
[7] T.S. Tomeny, Parenting stress as an indirect pathway to mental health concerns among mothers of children with autism spectrum disorder, Autism 21 (2017) 907–911, https://doi.org/10.1177/1362361316655322.
[8] D. McCann, R. Bull, T. Winzenberg, The daily patterns of time use for parents of children with complex needs: a systematic review, J. Child Health Care 16 (2012) 26–52, https://doi.org/10.1177/1367493511420186.
[9] R.P. Hastings, H.M. Taunt, Positive perceptions in families of children with developmental disabilities, Am. J. Ment. Retard. 107 (2002) 116–127, https://doi.org/10.1352/0895-8017(2002)107<0116:PPIFOC>2.0.CO;2.
[10] L. Singer, K.J. Farkas, The impact of infant disability on maternal perception of stress, Fam. Relat. 38 (1989) 444–449, https://doi.org/10.2307/585751.
[11] E.J. Erwin, L.C. Soodak, I never knew I could stand up to the system: families' perspectives on pursuing inclusive education, Assoc. Pers. Severe Handi, J. Assoc. Pers. Severe Handicaps. 20 (1995) 136–146, https://doi.org/10.1177/154079699502000204, 20.
[12] D. Skinner, D.B. Bailey Jr., V. Correa, P. Rodriguez, Narrating self and disability: latino mothers' construction of identities vis-à-vis their child with special needs, Except. Child. 65 (1999) 481–495, https://doi.org/10.1177/001440299906500404.
[13] M.M. Bristol, J.J. Gallagher, E. Schopler, Mothers and fathers of young developmentally disabled and nondisabled boys: adaptation and spousal support, Dev. Psychol. 24 (1988) 441–451, https://doi.org/10.1037/0012-1649.24.3.441.
[14] F. Walsh, A family resilience framework: innovative practice applications, Fam. Relat. 51 (2002) 130–137, https://doi.org/10.1111/j.1741-3729.2002.00130.x.
[15] E. Halstead, N. Ekas, R.P. Hastings, G.M. Griffith, Associations between resilience and the well-being of mothers of children with autism spectrum disorder and other developmental disabilities, J. Autism Dev. Disord. 48 (2018) 1108–1121, https://doi.org/10.1007/s10803-017-3447-z.
[16] P.Y. Collins, B. Pringle, C. Alexander, G.L. Darmstadt, J. Heymann, G. Huebner, V. Kutlesic, C. Polk, L. Sherr, A. Shih, D. Sretenov, M. Zindel, Global services and support for children with developmental delays and disabilities: bridging research and policy gaps, PLoS Med. 14 (2017) e1002393, https://doi.org/10.1371/journal.pmed.1002393.
[17] Healthy people 2030. Reduce anxiety and depression in family caregivers of people with disabilities, United States Department of Health and Human Services. Available at: https://health.gov/healthypeople/objectives-and-data/browse-objectives/parents-or-caregivers/reduce-anxiety-and-depression-family-care. (Accessed 21 December, 2022).
[18] L. Wood, P. Hooper, S. Foster, F. Bull, Public green spaces and positive mental health – investigating the relationship between access, quantity and types of parks and mental wellbeing, Health Place 48 (2017) 63–71, https://doi.org/10.1016/j.healthplace.2017.09.002.
[19] W.E.O. Biophilia, Harvard University Press, Cambridge, UK, 1984.
[20] S. Kaplan, R. Kaplan, The Experience of Nature. A Psychological Perspective, Cambridge University Press, Cambridge, UK, 1989, p. 340.
[21] R.S. Ulrich, Natural versus urban scenes: some psychophysiological effects, Environ. Behav. 13 (1981) 523–556, https://doi.org/10.1177/0013916581135001.
[22] J.J. Lim, K. Content, Assoc. 20 (2020) 466–479, https://doi.org/10.5392/JKCA.2020.20.08.466.
[23] S.R. De Bruin, A. Stoop, C.C.M. Molema, L. Vaandrager, P.J.W.M. Hop, C.A. Baan, Green care farms: an innovative type of adult day service to stimulate social participation of people with dementia, Gerontol. Geriatr. Med. 1 (2015) 2333721415607833, https://doi.org/10.1177/2333721415607833.
[24] G.M. Gim, J. Moon, S.J. Jeong, S.M. Lee, Analysis on the present status and characteristics of agro-healing in Korea, J. Agric. Ext Community Dev. 20 (2013) 909–936. Google Scholar.

[25] S.J. Jeong, E.H. Yoo, J.S. Kim, H.S. Jang, G.W. Lee, Analysis of 2010s research trends in research on agro-healing in South Korea, J. People Plants Environ. 23 (2020) 267–276, https://doi.org/10.11628/ksppe.2020.23.3.267.
[26] J. Hassink, H. Agricola, E.J. Veen, R. Pijpker, S.R. de Bruin, H.A.B. Meulen, L.B. Plug, The Care Farming Sector in The Netherlands: a reflection on its developments and promising innovations, Sustainability 12 (2020) 3811, https://doi.org/10.3390/su12093811.
[27] S. de Bruin, B. de Boer, H. Beerens, Y. Buist, H. Verbeek, Rethinking dementia care: the value of green care farming, J. Am. Med. Dir. Assoc. 18 (2017) 200–203, https://doi.org/10.1016/j.jamda.2016.11.018.
[28] A.Y. Lee, S.O. Kim, G.M. Gim, D.S. Kim, S.A. Park, Care farming program for family health: a pilot study with mothers and children, Int. J. Environ. Res. Public Health. 17 (2019) 27, https://doi.org/10.3390/ijerph17010027.
[29] M. Elings, A. Beerens, The added value and effects of care farms on clients with psychiatric or addiction problems, Acta Hortic. 954 (2012) 57–66, https://doi.org/10.17660/ActaHortic.2012.954.6.
[30] L.H. Ellingsen-Dalskau, M. Morken, B. Berget, I. Pedersen, Autonomy support and need satisfaction in prevocational programs on care farms: the self-determination theory perspective, Work 53 (2015) 73–85, https://doi.org/10.3233/WOR-152217.
[31] A. Granerud, B.G. Eriksson, Mental health problems, recovery, and the impact of green care services: a qualitative, participant-focused approach, Occup. Ther. Ment. Health 30 (2014) 317–336, https://doi.org/10.1080/0164212X.2014.938558.
[32] J. Cacciatore, R. Gorman, K. Thieleman, Evaluating care farming as a means to care for those in trauma and grief, Health Place 62 (2020) 102281, https://doi.org/10.1016/j.healthplace.2019.102281.
[33] M.E. O'Haire, S.J. McKenzie, A.M. Beck, V. Slaughter, Social behaviors increase in children with autism in the presence of animals compared to toys, PLoS One 8 (2013) e57010, https://doi.org/10.1371/journal.pone.0057010.
[34] R.T. Ferwerda-van Zonneveld, S.J. Oosting, A. Kijlstra, Care farms as a short-break service for children with autism spectrum disorders, NJAS - Wageningen J. Life Sci. 59 (2012) 35–40, https://doi.org/10.1016/j.njas.2012.01.001.
[35] S.C. Iancu, M.B.M. Zweekhorst, D.J. Veltman, A.J.L.M. van Balkom, J.F.G. Bunders, Mental health recovery on care farms and day centres: a qualitative comparative study of users' perspectives, Disabil. Rehabil. 36 (2014) 573–583, https://doi.org/10.3109/09638288.2013.804595.
[36] I. Panțiru, A. Ronaldson, N. Sima, A. Dregan, R. Sima, The impact of gardening on well-being, mental health, and quality of life: an umbrella review and meta-analysis, Syst. Rev. 13 (2024) 45, https://doi.org/10.1186/s13643-024-02457-9.
[37] U. Bronfenbrenner, The Ecology of Human Development: Experiments by Nature and Design, Harvard University Press, 1979, https://doi.org/10.4159/9780674028845.
[38] D. Cook, D. Ferritor, The Family: a potential resource in the provision of rehabilitation services, J. Appl. Rehabil. Couns. 16 (1985) 52–53, https://doi.org/10.1891/0047-2220.16.2.52.
[39] H.E. Canary, Creating supportive connections: a decade of research on support for families of children with disabilities, Health Commun. 23 (2008) 413–426, https://doi.org/10.1080/10410230802342085.
[40] R.I. Brown, J. MacAdam-Crisp, M. Wang, G. Iarocci, Family quality of life when there is a child with a developmental disability, J. Policy Pract. Intellect. Disabil. 3 (2006) 238–245, https://doi.org/10.1111/j.1741-1130.2006.00085.x.
[41] E.C. Spears-Lanoix, E.L.J. Mckyer, A. Evans, W.A. McIntosh, M. Ory, L. Whittlesey, A. Kirk, D.M. Hoelscher, J.L. Warren, Using family-focused garden, nutrition, and physical activity programs to reduce childhood obesity: the Texas! Go! eat! grow! pilot study, Child, Obes 11 (2015) 707–714, https://doi.org/10.1089/chi.2015.0032.
[42] D.C. Castro, M. Samuels, A.E. Harman, Growing healthy kids: a community garden–based obesity prevention program, Am. J. Prev. Med. 44 (3) (2013) S193–S199, https://doi.org/10.1016/j.amepre.2012.11.024. Supplement 3.
[43] C. Chaufan, J. Yeh, B. Sigal, Advancing family health through the garden of eatin': on-site food gardens in early childhood education, Am. J. Public Health. 105 (2015) 625–628, https://doi.org/10.2105/AJPH.2014.302422.
[44] P. van der Riet, C. Jitsacorn, P. Junlapeeya, E. Thursby, P. Thursby, Family members' experiences of a "Fairy Garden" healing haven garden for sick children, Collegian 24 (2017) 165–173, https://doi.org/10.1016/j.colegn.2015.11.006.
[45] P.A. Coventry, J.E. Brown, J. Pervin, S. Brabyn, R. Pateman, J. Breedvelt, S. Gilbody, R. Stancliffe, R. McEachan, P.L. White, Nature-based outdoor activities for mental and physical health: systematic review and meta-analysis, SSM Popul, Health 16 (2021) 100934, https://doi.org/10.1016/j.ssmph.2021.100934.
[46] E. Jang, G. Han, J. Hong, S. Yoon, C. Pak, Meta-analysis of research papers on horticultural therapy program effect, Hortic. Sci. Technol. 28 (2010) 701–707.
[47] H.M. Tu, Effect of horticultural therapy on mental health: a meta-analysis of randomized controlled trials, J. Psychiatr. Ment. Health Nurs. 29 (2022) 603–615, https://doi.org/10.1111/jpm.12818.
[48] A. Scartazza, M.L. Mancini, S. Proietti, S. Moscatello, C. Mattioni, F. Costantini, D. Di Baccio, F. Villani, A. Massacci, Caring local biodiversity in a healing garden: therapeutic benefits in young subjects with autism, Urban For. Urban Green. 47 (2020) 126511, https://doi.org/10.1016/j.ufug.2019.126511.
[49] I.D. Yalom, M. Leszcz, The Theory and Practice of Group Psychotherapy, Basic Books, 2020.
[50] F. Walsh, Strengthening Family Resilience, Guilford Press, New York, 1998.
[51] M.O. Kim, A Study on Social Competence of Children and Adaptation of Family of Children with Disabilities: Focusing on the Effects of Family Resilience (PhD Thesis), Ewha Woman's University, Seoul, South Korea, 2001.
[52] E.S. Schaefer, R.Q. Bell, Development of a parental attitude research instrument, Child Dev. 29 (1958) 339–361, https://doi.org/10.1111/j.1467-8624.1958.tb04891.x.
[53] S. Cohen, T. Kamarck, R. Mermelstein, A global measure of perceived stress, J. Health Soc. Behav. 24 (1983) 385–396, https://doi.org/10.2307/2136404.
[54] F.M. Gresham, S.N. Elliott, Assessment and classification of children's social skills: a review of methods and issues, Sch, Psych. Rev. 13 (1984) 292–301.
[55] N.M. Perrins-Margalis, J. Rugletic, N.M. Schepis, H.R. Stepanski, M.A. Walsh, The immediate effects of a group-based horticulture experience on the quality of life of persons with chronic mental illness, Occup. Ther. Ment. Health 16 (2000) 15–32, https://doi.org/10.1300/J004v16n01_02.
[56] R. Breitkreuz, L. Wunderli, A. Savage, D. McConnell, Rethinking resilience in families of children with disabilities: a socioecological approach, Community Work. Fam. 17 (2014) 346–365, https://doi.org/10.1080/13668803.2014.893228.
[57] A.P. Greeff, C. Nolting, Resilience in families of children with developmental disabilities, Fam. Syst. Health 31 (2013) 396–405, https://doi.org/10.1037/a0035059.
[58] A.E. Van den Berg, J. Maas, R.A. Verheij, P.P. Groenewegen, Green space as a buffer between stressful life events and health, Soc. Sci. Med. 70 (2010) 1203–1210, https://doi.org/10.1016/j.socscimed.2010.01.002.
[59] M.H. Cho, The Effect of Marriage Migrant Women Stress on Marital Adjustment: Focusing on the Mediating Effects of Family Resilience (PhD Thesis), Sungkyul University, Anyang, South Korea, 2014.
[60] Y.S. Joy, A.Y. Lee, S.A. Park, A horticultural therapy program focused on succulent cultivation for the vocational rehabilitation training of individuals with intellectual disabilities, Int. J. Environ. Res. Public Health. 17 (2020) 1303, https://doi.org/10.3390/ijerph17041303.
[61] E. Diamant, A. Waterhouse, Gardening and belonging: reflections on how social and therapeutic horticulture may facilitate health, wellbeing, and inclusion, Br. J. Occup. Ther. 73 (2010) 84–88, https://doi.org/10.4276/030802210X12658062793924.
[62] M.T. Gonzalez, T. Hartig, G.G. Patil, E.W. Martinsen, M. Kirkevold, A prospective study of group cohesiveness in therapeutic horticulture for clinical depression, Int. J. Ment. Health Nurs. 20 (2011) 119–129, https://doi.org/10.1111/j.1447-0349.2010.00689.x.
[63] S. Noone, A. Innes, F. Kelly, A. Mayers, The nourishing soil of the soul: the role of horticultural therapy in promoting well-being in community-dwelling people with dementia, Dementia 16 (2017) 897–910, https://doi.org/10.1177/1471301215623889.
[64] H.J. Son, D.S. Kim, S.A. Park, Horticultural therapy for improving the work performance and interpersonal relationships of persons with intellectual disabilities, Int. J. Environ. Res. Public Health. 19 (2022) 13874, https://doi.org/10.3390/ijerph192113874.
[65] F. Walsh, Family resilience: a framework for clinical practice, Fam. Process 42 (2003) 1–18, https://doi.org/10.1111/j.1545-5300.2003.00001.x.
[66] D.H. Olson, Family Inventories: Inventories Used in a National Survey of Families across the Family Life Cycle. Family Social Science, University of Minnesota, 1985.

[67] S.L. Larrosa, El FACES II en la evaluación de la cohesión y la adaptabilidad familiar, Psicothema 14 (2002) 159–166.
[68] S.N. Jang, M. Avendano, I. Kawachi, Informal caregiving patterns in Korea and European countries: a cross-national comparison, Asian Nurs. Res. 6 (2012) 19–26, https://doi.org/10.1016/j.anr.2012.02.002.
[69] H.M. Bourke-Taylor, F. Jane, J. Peat, Healthy mothers healthy families workshop intervention: a preliminary investigation of healthy lifestyle changes for mothers of a child with a disability, J. Autism Dev. Disord. 49 (2019) 935–949, https://doi.org/10.1007/s10803-018-3789-1.
[70] A.M. Megreya, A.A. Al-Attiyah, A.A. Moustafa, E.E.A. Hassanein, Cognitive emotion regulation strategies, anxiety, and depression in mothers of children with or without neurodevelopmental disorders, Res. Autism Spec. Disord. 76 (2020) 1–9, https://doi.org/10.1016/j.rasd.2020.101600.
[71] T.R. Broady, G.J. Stoyles, C. Morse, Understanding carers' lived experience of stigma: the voice of families with a child on the autism spectrum, Health Soc. Care Community 25 (2017) 224–233, https://doi.org/10.1111/hsc.12297.
[72] A. Dabrowska, E. Pisula, Parenting stress and coping styles in mothers and fathers of pre-school children with autism and down syndrome, J. Intellect. Disabil. Res. 54 (2010) 266–280, https://doi.org/10.1111/j.1365-2788.2010.01258.x.
[73] M. Annerstedt, P. Währborg, Nature-assisted therapy: systematic review of controlled and observational studies, Scand. J. Public Health. 39 (2011) 371–388, https://doi.org/10.1177/1403494810396400.
[74] J. Cipriani, A. Benz, A. Holmgren, D. Kinter, J. McGarry, G. Rufino, A systematic review of the effects of horticultural therapy on persons with mental health conditions, Occup. Ther. Ment. Health 33 (2017) 47–69, https://doi.org/10.1080/0164212X.2016.1231602.
[75] G.N. Bratman, J.P. Hamilton, G.C. Daily, The impacts of nature experience on human cognitive function and mental health, Ann. N. Y. Acad. Sci. 1249 (2012) 118–136, https://doi.org/10.1111/j.1749-6632.2011.06400.x.
[76] B.J. Park, Y. Tsunetsugu, T. Kasetani, T. Kagawa, Y. Miyazaki, The physiological effects of shinrin-yoku (taking in the forest atmosphere or forest bathing): evidence from field experiments in 24 forests across Japan, Environ. Health Prev. Med. 15 (2010) 18–26, https://doi.org/10.1007/s12199-009-0086-9.
[77] B.J. Park, Y. Tsunetsugu, T. Kasetani, T. Morikawa, T. Kagawa, Y. Miyazaki, Physiological effects of forest recreation in a young conifer forest in Hinokage town, Japan, Silva Fenn. 43 (2009) 291–301, https://doi.org/10.14214/sf.213.
[78] Y. Tsunetsugu, J. Lee, B.J. Park, L. Tyrväinen, T. Kagawa, Y. Miyazaki, Physiological and psychological effects of viewing urban forest landscapes assessed by multiple measurements, Landsc. Urban Plan. 113 (2013) 90–93, https://doi.org/10.1016/j.landurbplan.2013.01.014.
[79] C.A. Lowry, J.H. Hollis, A. De Vries, B. Pan, L.R. Brunet, J.R. Hunt, J.F. Paton, E. van Kampen, D.M. Knight, A.K. Evans, G.A. Rook, S.L. Lightman, Identification of an immune-responsive mesolimbocortical serotonergic system: potential role in regulation of emotional behavior, Neuroscience 146 (2007) 756–772, https://doi.org/10.1016/j.neuroscience.2007.01.067.
[80] H. Ikei, M. Komatsu, C. Song, E. Himoro, Y. Miyazaki, The physiological and psychological relaxing effects of viewing rose flowers in office workers, J. Physiol. Anthropol. 33 (2014) 6, https://doi.org/10.1186/1880-6805-33-6.
[81] S.A. Park, C. Song, J.Y. Choi, K.C. Son, Y. Miyazaki, Foliage plants cause physiological and psychological relaxation as evidenced by measurements of prefrontal cortex activity and profile of mood states, Hortscience 51 (2016) 1308–1312, https://doi.org/10.21273/HORTSCI11104-16.
[82] S.A. Park, C. Song, Y.A. Oh, Y. Miyazaki, K.C. Son, Comparison of physiological and psychological relaxation using measurements of heart rate variability, prefrontal cortex activity, and subjective indexes after completing tasks with and without foliage plants, Int. J. Environ. Res. Public Health. 14 (2017) 1087, https://doi.org/10.3390/ijerph14091087.
[83] S.A. Park, S.Y. Son, A.Y. Lee, H.G. Park, W.L. Lee, C.H. Lee, Metabolite profiling revealed that a gardening activity program improves cognitive ability correlated with BDNF levels and serotonin metabolism in the elderly, Int. J. Environ. Res. Public Health. 17 (2020) 541, https://doi.org/10.3390/ijerph17020541.
[84] S.O. Kim, S.Y. Son, M.J. Kim, C.H. Lee, S.A. Park, Physiological responses of adults during soil-mixing activities based on the presence of soil microorganisms: a metabolomics approach, J. Am. Soc. Hortic. Sci. 147 (2022) 135–144, https://doi.org/10.21273/JASHS05146-21.
[85] M. Koro-Ljungberg, R. Bussing, The management of courtesy stigma in the lives of families with teenagers with ADHD, J. Fam. Issues 30 (2009) 1175–1200, https://doi.org/10.1177/0192513X09333707.
[86] G. Grant, P. Ramcharan, M. Flynn, Resilience in families with children and adult members with intellectual disabilities: tracing elements of a psycho-social model, J. Appl. Res. Intellect. Disabil. 20 (2007) 563–575, https://doi.org/10.1111/j.1468-3148.2007.00407.x.
[87] W.N. Lee, K.S. Kim, The caregiving stress and life satisfaction of parents of adult children with developmental disabilities: the mediating effects of family resilience and coping styles, Fam, Relat 21 (2017) 27–50, https://doi.org/10.21321/jfr.21.4.27.
[88] C.L. Kasari, L.B. Jahromi, A.C. Gulsrud, Emotional development in children with developmental disabilities, in: J.A. Burack, R.M. Hodapp, G. Iarocci, E. Zigler (Eds.), The Oxford Handbook of Intellectual Disability and Development, Oxford University Press, 2012, pp. 239–253.
[89] K.C. Pears, H.K. Kim, C.V. Healey, K. Yoerger, P.A. Fisher, Improving child self-regulation and parenting in families of pre-kindergarten children with developmental disabilities and behavioral difficulties, Prev. Sci. 16 (2015) 222–232, https://doi.org/10.1007/s11121-014-0482-2.
[90] B. Joo, S. Park, K. Son, Improving work adjustment skills in students with mental retardation using hydroponics program, Hortic. Sci. Technol. 30 (2012) 586–595.
[91] B.-Y. Kim, S.-A. Park, J.-E. Song, K.-C. Son, Horticultural therapy program for the improvement of attention and sociality in children with intellectual disabilities, HortTechnology 22 (2012) 320–324, https://doi.org/10.21273/HORTTECH.22.3.320.
[92] E. Flouri, E. Midouhas, H. Joshi, The role of urban neighborhood green space in children's emotional and behavioral resilience, J. Environ. Psychol. 40 (2014) 179–186, https://doi.org/10.1016/j.jenvp.2014.06.007.
[93] M. García-Llorente, R. Rubio-Olivar, I. Gutierrez-Briceño, Farming for life quality and sustainability: a literature review of green care research trends in Europe, Int. J. Environ. Res. Public Health. 15 (2018) 1282, https://doi.org/10.3390/ijerph15061282.