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Effects of ACT-Based Agro-Healing Programs on Subjective Emotions: A Cross-Age Group Comparison

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ABSTRACT

Background and objective: Rapid changes in modern society have intensified psychological and emotional challenges across all age groups. This study examined the effects of a life cycle-based agro-healing program on children, adults, and older adults. The program incorporated nature-based activities and the theoretical principles of Acceptance and Commitment Therapy (ACT), addressing age-specific issues: school bullying in children, job burnout in adults, and emotional isolation in older adults. The objective was to assess changes in emotional expression and psychological well-being through engagement with nature.

Methods: This study was conducted with 30 children, 21 adults, and 20 older adult participants. Over the course of eight weeks, they engaged in weekly 90-minute sessions tailored to their age groups. The activities, which were designed to align with the six core processes of ACT, ranged from seed planting to herb garden creation. Emotional expression was assessed through open-ended responses, which were analyzed using DEUS, a Korean text analysis system, to identify linguistic and emotional changes.

Results: Significant emotional changes were observed across all groups. Children exhibited simpler, but more stable, emotional language, indicating improved emotional regulation. Adults used more nuanced and articulate expressions, suggesting enhanced emotional awareness. Older adults displayed more structured and contextually rich, emotional expressions. Statistical analysis confirmed significant differences in emotional expression before and after the program across all age groups ($p < 0.05$).

Conclusion: The horticulture program, grounded in ACT and nature-based interaction, was found to effectively promote emotional stability and psychological flexibility among children, adults, and older adults. The findings support the potential of agro-healing as a meaningful intervention for enhancing emotional resilience and overall well-being across diverse age groups, offering an alternative approach to addressing mental health needs in contemporary society.

Keywords: acceptance and commitment therapy, emotional expression, agro-healing, lifespan intervention, psychological well-being

Introduction

The rapid economic and social changes in modern society have contributed to heightened levels of stress, intensified competition, and shifts in social relationships, thereby exacerbating a range of psychological and emo-

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tional issues across the human lifespan (Hidaka, 2012). Manifestations of these challenges include school violence among children, job burnout in adults, and physical and mental health deterioration in older adults; these issues not only diminish individual quality of life but also lead to rising social and economic costs (Kim and Ha, 2021). Accordingly, there is a growing emphasis on the need for comprehensive and effective interventions to address these problems (Park et al., 2020).

Childhood is a critical period for emotional development and the formation of peer relationships. Elementary school students, in particular, are more vulnerable to experiencing school violence (Jeong and Lee, 2009). The victimization rate among 4th-grade students is reported to be 3.9%, suggesting the importance of early intervention for school violence prevention during this stage (Kim, 2007). School bullying encompasses physical, verbal, and psychological abuse, and can result in significant psychological distress for victims, including anxiety, depression, low self-esteem, and difficulties in interpersonal relationships (Park and Heo, 2021). These emotional and social challenges often lead to decreased academic performance and increased social isolation (Gottfredson and Hirschi, 1990). The consequences of school violence are not limited to short-term emotional harm. Such experiences can exacerbate maladaptive behaviors, such as withdrawal from peer interactions, self-deprecating thoughts, and the internalization of aggression in the long term (Stubbs-Richardson et al., 2021). In particular, difficulties in emotional regulation and the expression of emotions can limit resources to effectively cope with victimization, thereby creating a blind spot in school-based mental health interventions (Garder et al., 2017).

In adulthood, occupational life and social responsibilities play a central role in daily life, often contributing to chronic stress and an increased risk of job burnout (Ahola et al., 2010). Burnout is accompanied by emotional exhaustion and a decline in physical functioning, ultimately leading to reduced quality of life and decreased productivity at the workplace (Maslach and Leiter, 2016). According to a survey conducted in South Korea, 55.1% of workers reported experiencing burnout. Furthermore, individuals with high levels of depression and anxiety were 83% and 69% more likely, respectively, to experience burnout (Kim, 2015). Modern adults tend to suppress or neglect their emotional states, even when experiencing emotional exhaustion. This tendency undermines self-awareness and impairs emotional regulation (Park et al., 2017). The lack of emotional expression not only deteriorates the quality of interpersonal relationships but also contributes to reduced daily motivation, sleep disturbances, and psychosomatic symptoms (Hallsten et al., 2005).

The rapid transition to an aging society is exacerbating challenges related to physical deterioration, cognitive decline, and emotional isolation among older adults (Cardona and Andres, 2023). In South Korea, approximately 20% of individuals aged 65 and older experience depression, a condition closely linked to rising suicide rates in this population (WHO, 2012). Depression and cognitive decline are often associated with reduced physical activity and contribute to heightened social isolation and increased negative emotions (Blazer, 2003). Notably, the loss of relationships—due to spousal death, retirement, or children becoming independent—reduces opportunities for emotional exchange. This, in turn, weakens older adults' ability to express their inner emotions and diminishes their responsiveness to external stimuli (Setoyama et al., 2016). Monotonous lifestyle patterns and low self-efficacy further perpetuate a cycle of depression. Addressing mental health issues in later life therefore requires an integrated approach (Mukku et al., 2018).

In South Korea, agro-healing refers to the "therapeutic use of agriculture" and is defined as a practice that promotes psychological, social, and physical well-being through the utilization of agricultural materials and products—such as plants and animals—or by engaging with rural environments and cultural experiences (Son et al., 2006; RDA, 2020). Similar practices are known in Europe and Japan as "care farming," "social farming," or "green care farming," all of which aim to facilitate psychological and emotional healing through agricultural activities (Park et al., 2012; Park et al., 2015). Agro-healing can be applied to diverse populations, including adults experiencing stress, individuals with physical or mental health conditions, and those with learning disabilities. Its reported benefits include emotional stabilization, enhanced self-es-

teem, and improved social communication skills (Park et al., 2014).

Recently, there have been efforts to integrate psychotherapy theories into agro-healing interventions to enhance their effectiveness. Among these, Acceptance and Commitment Therapy (ACT) has emerged as a notable and integrative approach. ACT is a psychotherapy technique that helps individuals to accept distressing thoughts and emotions without attempting to suppress or avoid them, while committing to actions aligned with their personal values (Hayes et al., 1999). ACT principles is to enhance psychological flexibility through six core processes: cognitive defusion, acceptance, present-moment awareness, values clarification, committed action, and self-as-context. Studies have reported the effectiveness of ACT in reducing symptoms of depression, anxiety, and stress, as well as in improving overall quality of life (Bond et al., 2011; Arch et al., 2012).

As such, agro-healing has been attracting increasing attention as a holistic intervention that comprehensively promotes mental, physiological, physical, and psychological well-being and has positive effects across multiple domains, including individual health, social integration, and environmental conservation. Accordingly, this study aims to propose a systematic approach for addressing psychological issues across various age groups—including children, adults, and older adults—by integrating agro-healing with ACT.

Research Methods

Participants

This study was conducted with participants from three age groups: children (9–13 years), adults (30–60 years), and older adults (65–80 years). The research team visited the respective institutions—children's centers, community centers, and senior welfare centers—to explain the study's purpose and procedures, obtain written informed consent, collect demographic information, and administer a preliminary survey. A plant-mediated agro-healing program was implemented once a week for eight weeks, with each session lasting 90 minutes. The children's group participated from April to July 2024, while the adult and older adult groups participated from May to August 2024. All procedures were approved by the Institutional Review Board (IRB) of Konkuk University (Approval Number: 7001355-202310-HR-709). The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

The children's group was recruited through H Center and S Center, both located in Seoul, with a total of 30 participants (15 males and 15 females). Participation was voluntary, and each child submitted an application form along with a consent form signed by a legal guardian. The adult group was recruited from Seoul and Gyeonggi-do, and the program sessions were conducted at an agro-healing farm in K City, Gyeonggi-do. A total of 21 adults (4 males and 17 females) participated. The older adult group was recruited through senior welfare centers in K City and local government websites, with 20 participants (5 males and 15 females) in total. All participants submitted both an application form and written informed consent prior to participation..

Plant-Mediated Agro-Healing Program

The plant-mediated agro-healing program was designed to enhance key aspects of mental health—such as emotional stability, self-acceptance, emotional expression, and restoration of life meaning—through sensory and physical interaction with nature and plants. The program also incorporated the use of specific herbs known for their stress-relieving and mood-enhancing properties, including peppermint, lemon balm, spearmint, lavender, and rosemary. Previous studies have reported that these plants contribute to emotional stability and regulation by alleviating symptoms of anxiety and depression, improving mood, and promoting cognitive function (Lee et al., 2021; Son et al., 2024), In particular, the scents of lavender, peppermint, and rosemary have been shown through brainwave analysis to promote psychological stability by increasing alpha wave activity (associated with relaxation and focus) and decreasing beta wave activity (associated with tension relief; Kim et al., 2022). Based on such scientific evidence,

this program intentionally selected plant resources that could maximize therapeutic outcomes.

This program was structured based on Acceptance and Commitment Therapy (ACT), as proposed by Steven C. Hayes (Wicksell et al., 2011). The sequence of activities was organized around the six core processes of ACT: acceptance, cognitive defusion, present-moment awareness, self-as-context, values clarification, and committed action (Hayes et al., 2006).

This theoretical framework was designed to promote mental health across various age groups—children, adults, and older adults—by applying psychological intervention strategies grounded in the six core processes of ACT to to each group. In particular, age-specific psychological goals and application strategies were developed based on the developmental characteristics and emotional needs of each group, with variations in the emphasis and implementation of ACT processes. For children's programs, the focus was placed on emotional recognition and expression, restoration of peer relationships, and enhancement of psychological resilience. Core ACT processes such as acceptance, present-moment awareness, and values clarification were implemented through emotionally engaging activities, including emotional verbalization exercises, herbal scent exploration, and plant care activities linked to emotions. Programs for adult groups were developed to enhance self-awareness and reassess life priorities through emotional acceptance and cognitive distancing, with the goal of addressing emotional difficulties related to job stress, burnout, and self-depletion (e.g., psychological resource depletion). To this end, core ACT (Acceptance and Commitment Therapy) processes—such as cognitive defusion, values clarification, and committed action—were comprehensively applied. Programs for older adults were designed to alleviate social isolation, restore self-esteem, and reconstruct life meaning. These objectives were pursued through sensory-based reminiscence, self-narrative organization, and creative emotional expression activities, enabling participants to experience ACT processes including self-as-context, acceptance, and committed action.

The program activities included sowing seeds, planting seedlings, pest control, harvesting herbs, and making herbal-scented products. Through these activities, participants were encouraged to connect with their emotions in a natural setting, cultivate present-moment awareness, recognize their self-worth, and engage in experiences that facilitate behavioral change. All sessions focused on enhancing psychological flexibility and strengthen emotional regulation skills, integrating the theoretical principles of Acceptance and Commitment Therapy (ACT) into practical applications (Table 1).

Assessments

To gain an in-depth understanding of participants' emotional experiences, we employed open-ended questions as the foundation for text analysis. In this study, three questions were developed to examine experiences related to emotional states during the past month.

The first question, "Please describe the emotions you experienced over the past month," was designed to comprehensively identify the full range of emotional experiences by allowing participants to freely express their feelings. The second question, "Please describe the positive emotions you experienced over the past month," was created to explore the content these emotions and their contextual background, with an emphasis on positive emotional states. The third question, "Please describe the difficult emotions you experienced over the past month," focused on capturing emotional responses related to negative emotions or psychological challenges, as well as analyzing the modes of expression and linguistic features associated with these emotions.

In summary, these questions were designed to categorize participants' emotional experiences in greater detail and to provide a foundation for examining psychological flexibility, emotional regulation skills, and stress responses through natural language-based analysis.

Data collection and analysis

In this study, the Data Evaluation Unified System (DEUS), a Korean text analysis system developed by the Konkuk Research Institute for Multilingualism and Multiculturalism, was employed. DEUS is a robust system capable of analyzing a wide range of Korean texts based

Table 1. Agro-healing program activities by session and age group

Session (Durations)	Age Group	Agro-Healing Activities	ACT Process
1 (90')	Children	Explaining and observing seeds; Preparing trays and sowing seeds	Self-as-Context
	Adults	Removing weeds and leveling soil; Sowing herb seeds in jiffy pellets	Self-as-Context
	Older adults	Clearing the garden; Adding base fertilizer; Sowing seeds	Being Present
2 (90')	Children	Learning about seedlings; Preparing for planting; Planting seedlings	Self-as-Context
	Adults	Designing garden plots; Planting herb seedlings and watering	Cognitive Defusion
	Older adults	Introducing crops; Planting seedlings and watering	Acceptance
3 (90')	Children	Learning about environmental stress; Exploring herb scents and choosing a preferred scent	Acceptance
	Adults	Weeding; Watering; Making and applying calcium fertilizer	Acceptance
	Older adults	Designing an herb garden; Planting herbs and installing supports	Self-as-Context
4 (90')	Children	Learning about digital farming and Arduino; Using smart agricultural tools	Cognitive Defusion
	Adults	Weeding; Watering; Decorating pots and transplanting seedlings	Self-as-Context
	Older adults	Weeding; Planting lavender	Being Present
5 (90')	Children	Managing plants; Transplanting; Managing emotions	Being Present
	Adults	Weeding; Watering; Creating egg yolk oil	Values Clarification
	Elders	Drawing a life graph; Cooking with herbs	Acceptance
6 (90')	Children	Making herb pots; Gifting	Values Clarification
	Adults	Weeding; Watering; Using Arduino for irrigation; Harvesting herbs	Committed Action
	Older adults	Herb propagation	Self-as-Context
7 (90')	Children	Choosing herb scents; Making potpourri	Being Present
	Adults	Weeding; Watering; Harvesting; Making scented sachets	Committed Action
	Older adults	Adding top-dressing; Making scented sachets	Values Clarification
8 (90')	Children	Observing; Harvesting; Creating and presenting action plans	Committed Action
	Adults	Weeding; Watering; Harvesting; Making aromatherapy products	Committed Action
	Older adults	Weeding; Making herbarium	Committed Action

on diverse linguistic metrics. As the system only supports text files in the .txt format, all responses recorded by participants for the three survey questions under investigation were converted into .txt files and subsequently analyzed using DEUS (Ryu and Jeon, 2020).

The primary linguistic measures analyzed in this study using DEUS are as follows. First, indicators of surface-level text structure include the number of words, number of sentences, average word length, and average sentence length. Second, with regard to lexical frequency, the log-transformed frequency of both the total vocabulary and content words was analyzed. Third, lexical diversity was assessed using the type-token ratio (TTR) of content words. Fourth, referential coherence was measured by examining noun repetition both between adjacent sentences and across all sentences. Fifth, syntactic complexity was measured using several indicators, including the ratio of modifiers, the ratio of sentence components, and the number of attributive clauses. Sixth, patterns of pronoun usage were analyzed by counting the total number of pronouns, as well as first-, second-, and third-person pronouns separately. Seventh, the usage of conjunctive adverbs was analyzed by categorizing into four functional types: causal, temporal, descriptive, and adversative. Eighth, the Korean Standard Lexical Level Measure includes lexical metrics categorized into six grades (with higher grades representing more difficult vocabulary), providing type and token counts for each grade. Finally, two indicators of the mental lexicon were measured: average lexical reaction time and the number of meanings per word (Jang and Jeon, 2024).

Demographic data were analyzed using descriptive statistics with Excel (Microsoft Office 2018; Microsoft Corp.,

Redmond, WA). A paired *t*-test was conducted to compare the results of self-reported surveys administered before and after the agro-healing activities. The significance level for all analyses was set at 5% (p = .05). Statistical analyses were performed using Statistical analyses were performed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA).

Results and Discussion

Demographic information

This study was conducted with three groups of participants: children, adults, and older adults. The demographic information for each group is as follows: The children's group consisted of 30 elementary school students in grades four to six, including 15 males (50%) and 15 females (50%). The adult group included 21 participants, 4 (19%) of whom were male and 17 (81%) of whom were female. The older adult group comprised 20 participants, including five males (25%) and 15 females (75%; Table 2).

Children

A comparison of the pre- and post-test measurements revealed significant decreases in the total number of words, average sentence length, and the type and token values for both Grade 1 and Grade 2 vocabularies (p < .05). These findings indicate that the overall complexity of the text—as well as sentence length and total text length—decreased in children's emotional expressions. Such changes suggest that, after the intervention, children's emotional expressions became more concise and simplified, which may be closely associated with increased emotional stability (Cho and Lee, 2012; Cho et al., 2023).

Table 2. Demographic characteristics: age distribution by group

Group	AGE
	Mean ± SD
Children (n = 30)	10.36 ± 0.61
Adults (n = 21)	41.29 ± 11.59
Older adults (n = 20)	70.1 ± 2.7

In the expression of negative emotions, both the total number of words and the number of verbs used decreased significantly (p < .05). This suggests that children tended to reduce unnecessary elaboration and focus more on the core content when expressing negative emotions (Shipkova et al., 2025). These changes indicate that the agro-healing program contributed to improving children's emotional stability and emotion regulation abilities (Tausczik and Pennebaker, 2010; Jeong et al., 2023).

On the other hand, in the expression of positive emotions, the total number of words increased, whereas the average sentence length, verb usage, and the type and token values for Grade 2 vocabulary significantly decreased (p < .05). These findings suggest that children adopted a more intuitive and concise approach to expressing positive emotions, while simultaneously making greater efforts to describe their emotions with specificity (Garcia et al., 2012). Notably, the increase in adverb usage indicates a tendency to express positive emotions in greater detail (Coffey et al., 2023).

The decrease in the use of conjunctive adverbs and the increase in the use of general adverbs observed in the post-test suggest that children focused more on expressing specific emotions rather than maintaining structural coherence in their narratives. These linguistic changes indicate that the agro-healing program contributed to supporting children's psychological stability and fostering positive emotional states (Oh and Kang, 2021).

The decreased frequency of Grade 2 vocabulary indicates a reduction in the semantic complexity and a simplification of emotional expression. This appears to reflect a deliberate effort to reduce the use of unnecessarily advanced vocabulary and to communicate core emotions more effectively (Park and Park, 2024). Such linguistic simplification is associated with enhanced self-expression and emotional stability, suggesting that participation in the program has facilitated these changes (Eisenberg et al., 2005).

Meanwhile, no statistically significant differences were observed in certain indicators, such as average word length and number of meanings per word (p > .05). This indicates that the agro-healing program had a clear effect on the content of children's emotional expressions, but brought about relatively limited changes in the structural or seman-

tic complexity of their expressions. Therefore, while agro-healing appears effective in enhancing children's emotional stability and self-expression, changes in linguistic structure or semantic depth may require additional intervention or a longer period of engagement.

These results demonstrate that the agro-healing program brought about significant changes in children's patterns of emotional expression, contributing to their improved psychological stability and expressive ability by reducing the excessive expression of negative emotions and enhancing the clarity and detail of positive emotional expressions (Lu et al., 2023; Table 3).

Adults

A comparison between pre- and post-test results revealed that the type-token ratio of Grade 1 vocabulary used by adults to express positive emotions significantly decreased ($p < .05$) following participation in the agro-healing program, whereas the type-token ratio of Grade 2 vocabulary significantly increased ($p < .05$). These findings suggest that adult participants' emotional expressions shifted from the use of simple and basic vocabulary to more semantically complex and detailed language. The decrease in the type-token ratio of Grade 1 vocabulary indicates a reduced reliance on simple and basic expressions, whereas the increase in the type-token ratio of Grade 2 vocabulary reflects a greater tendency to use more sophisticated and detailed language that is semantically more complex (Pennebaker and King, 1999). These results indicate that the agro-healing program contributed to strengthening emotional stability and psychological flexibility in adults,

Table 3. Analysis of children's emotional expression before and after participation in an agro-healing program

	VarianceQuestions	Pre	Post	t	*p*-value
		Mean ± SD			
Research Question 1	Number of Words	10.77 ± 6.49	4.50 ± 3.10	4.491	0.000***
	Average Sentence Length	8.33 ± 6.88	3.60 ± 2.00	3.506	0.001**
	Grade 1 Type	0.73 ± 0.94	0.23 ± 0.50	2.715	0.011*
	Grade 1 Token	0.73 ± 0.94	0.27 ± 0.64	2.454	0.020*
	Grade 2 Type	0.97 ± 1.03	0.47 ± 0.68	2.186	0.037*
	Grade 2 Token	1.00 ± 1.11	0.47 ± 0.68	2.237	0.033*
Research Question 2	Number of Words	10.23 ± 4.75	6.10 ± 3.99	4.133	0.001**
	Average Sentence Length	7.46 ± 3.45	5.51 ± 3.62	1.950	0.018*
	Log TF Word Frequency for All Words	6.10 ± 1.00	4.86 ± 2.62	1.238	0.025*
	Log TF Word Frequency for Content Words	6.21 ± 1.06	4.72 ± 2.59	1.491	0.009**
	Ratio of Constituents	0.81 ± 0.09	0.61 ± 0.36	0.193	0.008**
	All Conjunctive Adverbs	2.62 ± 5.48	0.53 ± 2.03	2.087	0.019*
	Adverbs	13.54 ± 9.59	29.54 ± 33.37	-16.006	0.018*
	Verbs	8.05 ± 13.15	2.10 ± 4.94	5.951	0.009**
	Grade 2 Type	0.90 ± 0.96	0.40 ± 0.56	0.500	0.030*
	Grade 2 Token	1.00 ± 1.11	0.40 ± 0.56	0.600	0.019*
	Mean HIT	98.26 ± 1.84	80.23 ± 36.75	18.026	0.013*
	Number of Consonants and Vowels	4.99 ± 0.94	4.01 ± 2.05	0.981	0.026*
Research Question 3	Number of Words	9.07 ± 4.50	5.43 ± 4.13	3.633	0.002**
	Verbs	7.81 ± 8.90	3.51 ± 7.57	4.300	0.047*
	Average Word Length	3.06 ± 0.84	1.33 ± 1.32	0.794	0.283^{NS}
	Average Sentence Length	6.11 ± 4.11	4.43 ± 2.67	1.916	0.065^{NS}
	Number of Meanings per Word	2.67 ± 2.13	1.95 ± 1.47	1.596	0.121^{NS}

NS, nonsignificant at $p > .05$ *, significant at $p < .05$; **, significant at $p < .01$; ***, significant at $p < .001$ by paired t-test.

supporting more refined and expressive communication of positive emotions (Kim et al., 2020).

Horticultural therapy interventions have been shown to enhance self-efficacy and interpersonal skills in patients with mental illness, as well as to reduce perceived stress (Liu et al., 2024). Agro-healing programs have also demonstrated positive effects on the mental health of middle-aged adults (Xu et al., 2023). These programs strengthens psychological stability and emotional openness in adults, facilitating more nuanced and complex emotional expression through language (Kim et al., 2022).

When expressing negative emotions, the use of nouns significantly decreased ($p < .05$), suggesting that adults became more inclined to convey concise and essential content. This reduction in noun usage reflects an intentional shift toward minimizing excessive detail in emotional descriptions, thereby emphasizing core emotional states. These linguistic changes indicate that the agro-healing program contributed to simplifying emotional expression and promoting more direct and explicit language use (Spano et al., 2020).

Meanwhile, no statistically significant differences were observed in certain indicators, such as the total number of words, average number of sentences, sentence length, and average word length ($p > .05$). This suggests that while the agro-healing program affected the content of emotional expressions and lexical choices, it brought relatively limited changes to structural and quantitative aspects of language use.

Participation in the program likely helped adults develop the ability to regulate negative emotions and express them in a more concise and clear manner (Zhong et al., 2020; Wang et al., 2022). This indicates that the agro-healing program played an important role in promoting emotional stability and regulating emotions, thereby contributing to improved psychological well-being and the capacity to express positive emotions among participants (Yoo et al., 2024; Table 4).

Older adults

A comparison of pre- and post-test results revealed a significant increase in the use of relative clauses ($p < .05$). Relative clauses, which modify nouns and thereby provide additional information—such as the Korean expressions "~한" and "~하는"—are syntactic structures that facilitate more precise and elaborate descriptions of thoughts and experiences (Pennebaker and Francis, 1996). Their usage tends to increase naturally when individuals attempt to

Table 4. Analysis of adults' emotional expression before and after participation in an agro-healing program

Questions	Variance	Pre	Post	t	*p*-value
		Mean ± SD			
Research Question 1	Number of Words	8.00 ± 5.25	7.86 ± 5.23	0.133	0.896^{NS}
	Number of Sentences	1.19 ± 0.40	1.19 ± 0.51	0.000	1.000^{NS}
	Average Word Length	2.97 ± 0.50	3.01 ± 0.58	-0.333	0.743^{NS}
	Average Sentence Length	6.97 ± 4.10	5.57 ± 3.49	0.401	0.693^{NS}
	Word Frequency for All Words	6.97 ± 4.10	6.57 ± 3.49	1.452	0.162^{NS}
Research Question 2	Grade 1 Type Ratio	0.10 ± 0.09	0.05 ± 0.05	2.332	0.030*
	Grade 1 Token Ratio	0.11 ± 0.09	0.06 ± 0.06	2.190	0.041*
	Grade 2 Type	0.57 ± 0.67	1.19 ± 1.40	-2.146	0.044*
	Grade 2 Type Ratio	0.04 ± 0.05	0.09 ± 0.09	-2.232	0.037*
	Grade 2 Token Ratio	0.04 ± 0.05	0.09 ± 0.09	-2.181	0.041*
Research Question 3	Nouns	61.62 ± 16.36	51.94 ± 17.00	2.243	0.036*
	Number of Words	13.48 ± 8.92	13.52 ± 9.32	-0.26	0.979^{NS}
	Number of Sentences	1.24 ± 0.53	1.24 ± 0.53	0.000	1.000^{NS}
	Average Word Length	2.94 ± 0.36	2.99 ± 0.45	-0.491	0.628^{NS}
	Average Sentence Length	11.19 ± 6.97	10.60 ± 5.78	0.551	0.588^{NS}

NS, nonsignificant at $p > 0.05$ *, significant at $p < 0.05$; **, significant at $p < 0.01$; ***, significant at $p < 0.001$ by paired t-test.

convey complex situations or emotions, thus enabling more nuanced and contextually rich emotional expression. The increased use of relative clauses allows for more detailed descriptions of emotional states and contextual experiences and improves textual coherence (Stirman and Pennebaker, 2001). This indicates a more mature and sophisticated development in emotional expression among older adults (Pennebaker et al., 1990; Pennebaker, 1997).

There was also a significant increase in the use of verbs ($p < .05$). This suggests that older adults are increasingly inclined to express positive emotions through descriptions that involve actions and states, rather than relying solely on simple expressions (Sonnenschein et al., 2018). Verbs enhance emotional expression by adding vividness and specificity, and their increased use reflects a deliberate effort by older adults to communicate emotions more clearly (Mehl et al., 2017). In particular, this rise in verb usage may enrich the linguistic diversity needed to convey positive emotions and contribute to more nuanced and meaningful emotional communication with others (Robertson and Murachver, 2006; Lee, 2016).

A significant increase in the use of nouns was observed following the intervention ($p < .05$). This suggests that older adults exhibited a stronger tendency to convey more specific and concrete content when expressing difficult emotions (Rude et al., 2004). Nouns play a crucial role in articulating specific objects, states, or situations, and their increased usage contributes to greater specificity and structural organization in emotional expression (Kahn et al., 2007). Furthermore, this pattern reflects an intention to provide a more nuanced and comprehensive depiction of specific contexts and situations during the process of conveying emotions (Neuman et al., 2012).

Meanwhile, no statistically significant changes were observed in several linguistic indicators, including average sentence length, number of sentences, number of word meanings, and adverb usage ($p > .05$). This suggests that while the agro-healing program positively affected the depth and contextual richness of emotional expression among older adults, it did not lead to short-term changes in the overall quantity of expression, syntactic complexity, or vocabulary diversity.

Participation in the agro-healing program altered the verbal expression of emotions among older adults, resulting in richer and more detailed language use. This shift appears to have contributed positively to improvements in emotional stability and psychological flexibility (Son et al., 2012; Kim et al., 2020; Table 5).

Table 5. Analysis of older adults' emotional expression before and after participation in an agro-healing program

Questions	Variance	Pre	Post	t	*p*-value
		Mean ± SD			
Research Question 1	Ratio of Relative Clauses	1.92 ± 3.24	5.48 ± 5.84	-2.279	0.034*
	Verbs	5.98 ± 9.74	12.42 ± 8.60	-2.407	0.026*
	Nouns	61.48 ± 23.45	55.08 ± 17.86	0.878	0.391^{NS}
	Raio of Constituents	0.83 ± 0.10	0.83 ± 0.58	0.126	0.901^{NS}
	Number of Sentences	1.45 ± 0.88	1.50 ± 0.82	-0.188	0.853^{NS}
Research Question 2	Verbs	5.98 ± 9.74	12.42 ± 8.60	-2.407	0.026*
	Adverbs	14.59 ± 12.55	13.73 ± 9.48	0.256	0.800^{NS}
	Number of Words	10.60 ± 6.03	10.30 ± 8.03	0.209	0.837^{NS}
	Number of Meaning per Word	2.49 ± 1.25	2.22 ± 1.59	0.741	0.468^{NS}
	Average Sentence Length	8.08 ± 3.91	6.44 ± 2.20	1.994	0.061^{NS}
Research Question 3	Nouns	41.49 ± 23.59	61.50 ± 35.58	2.149	0.045*
	Verb	13.09 ± 14.52	7.36 ± 12.57	1.386	0.182^{NS}
	Number of Sentences	1.15 ± 0.48	1.10 ± 0.44	0.326	0.748^{NS}
	Adverbs	31.12 ± 24.97	23.86 ± 21.52	1.123	0.276^{NS}
	Number of Words per Word	8.85 ± 8.37	7.65 ± 7.48	1.145	0.266^{NS}

NS, nonsignificant at $p > .05$ *, significant at $p < .05$; **, significant at $p < .01$; ***, significant at $p < .001$ by paired t-test.

Conclusion

This study aimed to examine the effects of agro-healing programs on psychological stability and emotional expression, based on the emotional characteristics and developmental needs of age groups of children, adults, and older adults. In response to the growing need for integrated interventions to address issues such as social isolation, emotional suppression, and psychological instability, this study explored the potential of programs that combines agro-healing with acceptance and commitment therapy (ACT) as an alternative approach.

As a research method, emotional language data were collected through an open-ended survey and analyzed quantitatively using the DEUS Korean text analysis system to identify patterns of emotional expression. An 8-week program was implemented with three groups—children (ages 9–13), adults (ages 30–60), and older adults (ages 65–80)—and their psycholinguistic changes were statistically examined through pre- and post-test comparisons.

As a result, the children's group showed increased brevity in emotional expression as well as greater detail in positive emotional expressions. The adult group exhibited a shift from simple language to more complex and structured emotional articulation. The older adult group's emotional expressions became more contextually grounded and specific. These changes support the psychological efficacy of agro-healing interventions, as participants engaged in recognizing, accepting, and expressing their emotions in alignment with the six core processes of Acceptance and Commitment Therapy (ACT).

This study differs from existing qualitative research in two notable ways. First, it systematically analyzed changes in emotional expression by integrating psychotherapy theory into an agro-healing program. Second, it sought to identify the structural characteristics of language-based emotional expression through quantitative text analysis. These contributions suggest the potential of this approach to provide empirical data that reinforces the theoretical foundation of agro-healing and supports the objective validation of its effectiveness.

This study has several limitations. In terms of research design, it did not include a control group, the sample size was limited, and participant recruitment was confined to Seoul and Gyeonggi-do, which restricts the generalizability of the findings. Although the study was initially designed to include four groups—children, adolescents, adults, and older adults—to reflect the continuity of the life cycle, the adolescent group was excluded from the final analysis due to recruitment challenges at the outset. This exclusion introduced limitations in terms of developmental comparability and theoretical consistency.

In addition, this study analyzed the statistical significance of pre- and post-test differences within each group (children, adults, and older adults), but did not perform between-group comparisons. This decision was based on the differing language expression styles and baseline language characteristics across age groups, as well as the unequal sample sizes, which made conditions unsuitable for direct comparison or correlation analysis. Furthermore, the use of self-reported emotional expression may have been influenced by participants' subjective perceptions and reporting styles. Since only temporary changes following short-term interventions were analyzed, a cautious approach is required when interpreting the sustainability of program effects and the long-term impact of the interventions.

Future studies should more rigorously verify the empirical validity and scalability of the psychological effects of agro-healing programs by incorporating control group designs, expanding the sample to include diverse age groups and cultural backgrounds, conducting long-term follow-up assessments, and employing multifaceted evaluation tools.

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