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# Development and Effectiveness of an Agro-Healing Program Utilizing Rural Resources to Relieve Stress in Adults

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**Abstract:** The purpose of this study was to develop an agro-healing program using rural resources for stressed adults and to measure its effectiveness. A one-day agro-healing program was developed using the resources of a care farm located in Cheongju, South Korea. A total of 37 adults in their 20s to 50s who were experiencing mild or more severe stress participated in the agro-healing program. Analysis of stress-related psychological and emotional indicators of the agro-healing program revealed that post-treatment stress, anxiety, and depression indicators of the healing program significantly decreased ($p < 0.05$). Furthermore, mood state, vitality, and resilience indicators increased significantly, which demonstrated effectiveness in improving the mental health of participants with mental health issues. A Pearson correlation analysis between each psychological and emotional variable after the program found that stress had a significant correlation with all variables. Subjective vitality had a full mediating effect on the relationship between stress and resilience. Finally, the one-day agro-healing program was found to help relieve symptoms in adults with stress.

**Keywords:** care farming; sustainability of agriculture; plant-mediated activities; animal-assisted activities; mediated effect



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## 1. Introduction

Owing to the rapid development of modern society, environmental problems, various stresses caused by intensified competition, and socioeconomic side effects caused by pressure to increase productivity are widespread across our society. Recent interest in these problems has focused on therapeutic agriculture, which promotes psychological, social, cognitive, and physical health through convergent approaches like agriculture and social welfare [1–3]. In European countries, various terms such as care farming, social farming, green care farming, and farming for health have been used. Essentially, it implies using farming to provide care [4,5].

In South Korea, according to the Act on Research, Development, and Promotion of Agro-healing, the term "agro-healing" is defined as "an industry that creates social or economic added value through the use of various agricultural and rural resources and related activities to restore, maintain, and improve the health of people." Agro-healing, which promotes the psychological, social, physical and cognitive health of all citizens through agriculture, rural resources (plants, animals, rural environment, and rural culture), or related activities and products, is a theoretical and practical development through joint research with experts in related fields. After discussion and agreement on the concept and advanced cases, it was first used in 2013 [6].

People living in modern society experience more mental stress than those living in rural environments, and if unresolved stress continues for a long period, it leads to psychological

exhaustion [7–9]. Therefore, to avoid overload, we seek the natural environment to achieve recovery effects for both the mind and body [10]. Rural areas and communities have been the subject of research over the years with their unique characteristics, development gaps, existence of rural resources, socioeconomic development, and need for sustainable development [11–14].

Orians [15] argued for the savannah hypothesis that humans are instinctively drawn to environments similar to the savannah grasslands, where they have lived for millions of years. Furthermore, this is supported by the stress recovery theory, which states that people exposed to external stressors recover when exposed to the natural environment [16]. Natural environments are less complex and have lower arousal levels than urban environments; therefore, one recovers from stress more quickly [17]. According to Kaplan and Kaplan [18], when "Being Away," "Extent," "Fascination," and "Compatibility" are felt in a specific space, users within that space gain a fatigue recovery effect. In other words, the theory states that exposure to the natural environment effectively restores an individual's attention [18,19].

As a result of conducting a 12-session mindfulness-based agro-healing program twice a week for college-age adults in a high-risk group of stress, the participants experienced significant reductions in stress, depression, and anxiety and improved self-efficacy [20]. Elderly people reduced depression and stress, improved cognitive function, etc. It has been reported to have effects such as increasing life satisfaction [20].

In South Korea, plant-mediated therapy, forest healing, and animal-mediated therapy have been introduced since the 1990s, and the effectiveness of agro-healing has been proven through research using various resources. Agro-healing service refers to "systematically carrying out education or designed programs using agro-healing resources, agro-healing facilities, etc. to restore and improve psychological, social, and physical health" (Healing Agriculture Act). The agro-healing program is not only physical activity but also includes activities using crops, and it is a planned program that can reduce anger, depression, and fatigue and increase self-efficacy and self-esteem [5,21]. Agro-healing programs appear to be mainly focused on horticultural therapy, and there is a lack of healing programs that utilize various agricultural and rural resources of healing farms. The design and development of various agro-healing programs is necessary [6]. Through this research, it is expected that programs utilizing various resources will be implemented in the future [21,22]. Several studies have reported that agro-healing has a positive impact on people's psychological, social, cognitive, and physical health [23,24]. In 2021, the perceived stress rate among adults in Korea was 26.2%, and in Cheongju (North Chungcheong Province) it was 27.2%, an increase of 1 percentage point compared to the previous year, which was the highest among 17 cities and provinces (KDCA, 2021). Depression, anxiety, and stress have increased since COVID-19, and countries of the Global North are prioritizing mental health as well as physical health and are pursuing policies, so various psychological support systems are needed [20]. However, there is a lack of research on healing mechanisms through agricultural activities and environmental resources, which are the core of agro-healing. In this study, we extracted various agricultural and rural healing resources and developed and operated a healing program to investigate the healing mechanisms of agro-healing and mental health improvement. It was designed to provide basic psychological and emotional data on agro-healing intervention activities by investigating the effects, correlations, and mediating effects of stress-related indicators. Therefore, this study was performed to develop an agro-healing program using rural resources for stressed adults and to measure its effectiveness.

## 2. Materials and Methods

### *2.1. Research Participants*

Promotional materials were attached to apartment management offices and universities around a D Care Farm located in C City. We recruited adult men and women aged over 20, suffering from stress symptoms in their daily lives, who wanted to voluntarily

participate in the agro-healing program. Before participating, the study's purpose and precautions during work activities were explained, and informed consent was obtained only from adults who agreed to participate in the study. Among the 41 people who wanted to participate in the healing agricultural program, 37 (90%) were under mild or high stress. Those who did not agree to participate in the study; those with a history of cardiovascular diseases such as high blood pressure, unstable angina, heart attack, or heart surgery; those with diseases related to olfactory function, allergies, or respiratory diseases; those with insomnia; and pregnant or lactating women were excluded from the study. This study was approved by the Institutional Review Board (IRB) of Konkuk University (7001355-202206-HR-556).

### *2.2. Agro-Healing Program Development*

This study was conducted according to the agro-healing program development process (Figure 1). The program steps were 1. discovery of healing resources (extraction of healing resources and composition of healing activities), 2. program design (selection of subjects, session, time, goal setting, purpose setting, program selection, evaluation tool selection, and pilot test), 3. program implementation (pre-activity operation inspection and program operation), and 4. evaluation (program evaluation and goal achievement evaluation). The subjects completed a preliminary questionnaire before starting the agro-healing program. The morning program included (1) my own garden resembling nature, (2) herb garden for the five senses, (3) vegetable harvesting, and (4) *Big Vegan* cooking, and lunch was served as a result of the program. The afternoon program included (5) decorating a water garden, (6) communicating with fish, (7) taking a walk on the farm, and (8) meditating in the forest followed by a post-questionnaire survey.

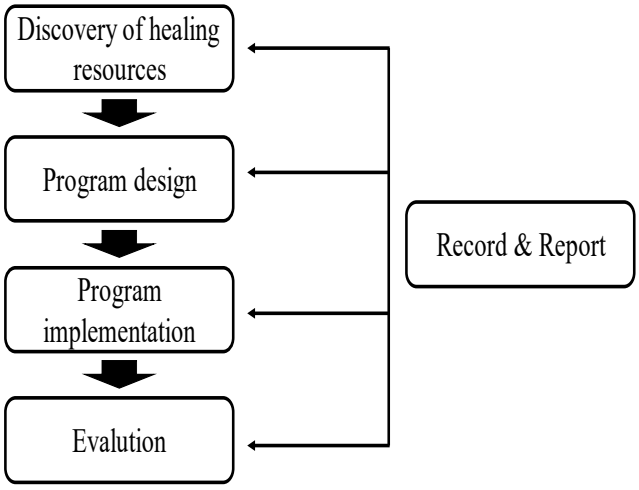


**Figure 1.** Agro-healing program development process.

### *2.3. Measurements*

The farm-type agro-healing program was an eight-session full-day program aimed at improving mental health, which included a garden that resembled nature, vegetable harvesting, *Big Vegan* cooking, herb garden for the five senses, decorating a water garden, communicating with fish, walking on the farm, and meditating in the forest. The study was conducted from June to July 2022. The participants visited the farm once and participated in the program from 10:30 a.m. to 5 p.m. The evaluation tool was a self-reporting survey conducted twice before and after the program. The program was conducted by a welfare horticulture supervisor, and six welfare horticulturalists participated as assistant facilitators. Psychological and emotional indicators were measured before and after the program.

The Perceived Stress Scale-K (PSS-K) is a 5-point Likert scale to ascertain current stress level and the Cronbach's $\alpha = 0.819$ of this study [25]. The Profiles of Mood States (POMS) was developed by McNair et al. [26] and is used to identify the relationship between exercise

and mood states. This is an abbreviated version of the first version, comprising 30 questions on a 5-point Likert scale. The total mood disorder score is calculated by adding the scores of the five sub-domains of tension, depression, anger, fatigue, and confusion and subtracting the sub-domain score of vigor. The higher the score, the worse your mood. In this study, Cronbach's $\alpha$= 0.906. The Spielberger State Anxiety Scale is a 20-item 4-point Likert scale. There are 10 positive questions and 10 negative questions. The higher the score, the higher the instability. In this study, Cronbach's $\alpha$ = 0.908. We used Beck's [27] self-reporting questionnaire adapted from Han et al. [28]. The questionnaire includes 21 questions on a 4-point Likert scale and the Cronbach's $\alpha$ = 0.929 for this study. The Subjective Vitality Scale (SVS) was developed by Ryan and Frederick [29]. It measures the individual's current level of agreement regarding vitality using 7 questions on a 7-point Likert scale. In this study, Cronbach's $\alpha$ = 0.827. The Korean version of the Connor–Davidson Resilience Scale (CD-RISC) includes a total of 25 questions on a 5-point Likert scale. The higher the total score, the higher the recovery. In this study, Cronbach's $\alpha$ = 0.962. Agro-healing satisfaction was assessed using a self-developed questionnaire.

### *2.4. Data Analysis*

The demographic data of the participants were analyzed using SPSS (Version 25 for Windows; IBM Corp., Armonk, NY, USA), and descriptive statistics were calculated using the mean, standard deviation, and percentage for each item. To analyze the effects before and after the implementation of the agro-healing program, normality was tested using SPSS (Version 25 for Windows; IBM Corp., Armonk, NY, USA) and analyzed using a *t*-test at a significance level of $p < 0.05$. Pearson's correlation analysis was performed to verify the correlation between the variables. To investigate the mediating factors of stress, the mediating effect was analyzed according to the three-step procedure suggested by Baron and Kenny [30]. It was reviewed using Sobel's (1982) mediation effect analysis [31].

## 3. Results

### *3.1. Demographic Characteristics*

The 37 study participants were adults in their 20s or older (48.91 $\pm$ 11.31 years) (Table 1). Most participants (43.3%) were in their 50s, and the highest level of education was college graduation or higher (73%). Most participants (78.4%) had jobs, and 70.3% were married.

**Table 1.** Descriptive characteristics of participants (N = 37).

| Variable | Categories | Frequency (n) | Percent (%) |
|---|---|---|---|
| Age | Adults in their 20s or older | 37 | 100 |
| Gender | Male | 6 | 16.2 |
| | Female | 31 | 83.8 |
| Marital status | Married | 26 | 70.3 |
| | Single | 11 | 29.7 |
| Job | Working | 29 | 78.4 |
| | Not working | 8 | 21.6 |

### *3.2. Development of Agro-Healing Program to Reduce Stress*

D Care Farm is a typical rural village located on the outskirts of the city. We conducted three preliminary field trips and interviews with business owners to investigate key resources, such as plant, animal, and non-agricultural resources, that could be utilized in the program (Table 2). Considering the balance of core resources, detailed activities that could be used in a one-day healing program were extracted (Table 3). A well-balanced eight-session program was developed by integrating and reorganizing detailed activities for each core resource: my own garden resembling nature, vegetable harvesting, *Big Vegan* cooking, herbal garden for the five senses, decorating a water garden, communicating with fish, walking on the farm, and meditating in the forest (Table 3).

**Table 2.** Investigating core resources of care farms.

| Variable | Core Resources |
| --- | --- |
| Plant resources | Vegetables: lettuce, chicory, peppers, spinach, kohlrabi, beets, leafy vegetables, herbs (mint, rosemary, sage, arugula, dill), asparagus<br>Flowers: native plants, bulbs (iris, hyacinth), myrtle, zinnia, snapdragon, lily, pansy, viola, verbena, crowbar, flower begonia, huggera, sedge, juniper, succulent (pheasant's amaranth), arrow tree, hydrangea, horseradish, rose, birch, pine, magnolia, bamboo shoots, maple, golden locust, arborvitae (golden arborvitae), blue angel, tricolor willow<br>Fruit trees: blueberries (available for experience), berries, aronia, currants, grapes, cherries, apples, pears, figs<br>Medicinal uses: Schisandra chinensis, Myeongnamul, Aralia, bee tree (liver function, leaf tea), Nungae Seungma (side dish), yam |
| Animal resources | Angel dog (planned), fish, parrot, rabbit, dog, chicken, insect, bee, cow, pet, birdsong, butterfly, cricket |
| Cultural and environmental resources | Experience dish: flower bibimbap, salad, tea, extract (vinegar, oil), green onion pancake, flower pancake<br>Arts and crafts: coloring natural objects, coloring plant boxes, coloring tires and wooden chairs, artificial flowers, decorating clay pots, napkin art, pressed flowers<br>Farm story: four seasons garden experience, family management story<br>Facilities: indoor training center (2 locations, 30-person capacity), piano, cart, sand playground, photo zone, farm hut (accommodates for 4 people), compost field, farm equipment shed, flatbed, movable deck, plant box, farm walkway, foot bath, shade canopy |

**Table 3.** Selection of agro-healing programs by key farm elements.

| Variable | Core Resources |
| --- | --- |
| Plant-mediated activities | My own garden resembling nature<br>Herb garden for the five senses<br>Dodam Dodam vegetable harvesting<br>BB *Big Vegan* cooking |
| Animal-assisted activities | Decorating a water garden<br>Communicating with fish |
| Other activities | Taking a walk on the farm<br>Meditating in the forest |

### *3.3. Healing Effect of Agro-Healing Program to Reduce Stress*

Participants experiencing stress in their daily lives arrived at the farm at 10 a.m. and participated in the program until 5 p.m. Ten to fifteen participants participated in the program per session. To evaluate the healing effects in those who participated in the agro-healing program, stress-related psychological and emotional indicators were analyzed. The stress, anxiety, and depression indicators after the healing program decreased significantly ($p < 0.001$) (Table 4). Mood state, vitality, and resilience indicators increased significantly, which had a positive effect on the mental health of those with mild or severe stress problems ($p < 0.001$).

**Table 4.** Psychological effects of agro-healing programs.

| Variable | N | M (SD) [z] | | *p* Value [Y] |
| --- | --- | --- | --- | --- |
| | | Pre-Test | Post-Test | |
| Stress (PSS-K) | 37 | 20.95 (5.26) | 13.95 (4.75) | 0.000 *** |
| State Anxiety (STAI) | 37 | 45.65 (9.78) | 29.54 (5.98) | 0.000 *** |
| Depressed (BDI) | 37 | 12.81 (9.35) | 2.51 (3.99) | 0.000 *** |
| Mood State (POMS) | 37 | 23.03 (20.57) | 5.32 (7.83) | 0.000 *** |
| Subjective Vitality (SVS) | 37 | 25.68 (6.54) | 34.81 (4.67) | 0.000 *** |
| Resilience (CD-RISC) | 37 | 54.21 (17.02) | 70.49 (14.57) | 0.000 *** |

[Z] Mean (SD). *** Significant at $p < 0.001$. [Y] Statistical significance as determined using paired *t*-test. Korean Perceived Stress Scale: PSS-K; State Anxiety Inventory: STAI; Beck Depression Inventory: BDI; Profile of Mood States: POMS; Subjective Vitality Scale: SVS; Korean version of Connor–Davidson Resilience Scale: CD-RISC.

### *3.4. Correlation between Variables in the Agro-Healing Program*

As a result of a Pearson correlation analysis between each psychological and emotional variable after the farm-type healing program, stress was found to be significantly correlated with all variables (Table 5). The PSS showed a positive correlation with POMS (r = 0.477,

$p$ = 0.003), and SVS (r = −0.634, $p$ = 0.000) and CD-RISC (r = −0.480, $p$ = 0.003) showed a negative correlation. Additionally, the POMS-STAI (r = 0.652, $p$ = 0.000), POMS-BDI (r = 0.620, $p$ = 0.000), and SVS-CD-RISC (r = 0.759, $p$ = 0.000) scores were 0.001, which indicated a high correlation at this level.

**Table 5.** Correlation of each variable in the agro-healing programs (N = 37).

| | Stress (PSS-K) | State Anxiety (STAI) | Depressed (BDI) | Mood State (POMS) | Subjective Vitality (SVS) | Resilience (CD-RISC) |
|---|---|---|---|---|---|---|
| Stress (PSS-K) | 1 | | | | | |
| State Anxiety (STAI) | 0.382 * | 1 | | | | |
| Depressed (BDI) | 0.415 * | 0.404 * | 1 | | | |
| Mood State (POMS) | 0.477 ** | 0.652 *** | 0.620 *** | 1 | | |
| Subjective Vitality (SVS) | −0.634 *** | −0.315 | −0.332 * | −0.356 * | 1 | |
| Resilience (CD-RISC) | −0.480 ** | −0.367 * | −0.453 ** | −0.390 * | 0.759 *** | 1 |

* $p$ < 0.05, ** $p$ < 0.01, *** $p$ < 0.001 by Pearson's correlation analysis.

Positive correlations were observed in the following order: SVS-CD-RISC (r = 0.759), POMS-STAI (r = 0.652), POMS-BDI (r = 0.620), PSS-POMS (r = 0.477), STAI-BDI (r = 0.404), PSS-BDI (r = 0.415), and PSS-STAI (r = 0.382). Negative correlations appeared in the following order: PSS-SVS (r = −0.634), PSS-CD-RISC (r = −0.480), BDI-CD-RISC (r = −0.453), POMS-CD-RISC (r = −0.390), STAI-CD-RISC (r = −0.367), BDI-SVS (r = −0.332), POMS-SVS (r = −0.356), and STAI- SVS (r = −0.315).

### *3.5. Analysis of Mediating Factors for Stress*

Analysis of the mediating effect between the independent variable, stress, and dependent variable, resilience, was performed according to the three-step procedure proposed by Baron and Kenny [30] (Table 6). Hierarchical regression analysis was performed in three steps: [Model 1] is the effect of the independent variable on the mediator, [Model 2] is the effect of the independent variable on the dependent variable, and [Model 3] is the effect of the independent variable and mediator on the dependent variable. The mediating effect among stress, vitality, and resilience, which had a high correlation, was also analyzed. As a result of the regression coefficient test of [Model 1], β = −0.634, $p$ = 0.000, the independent variable was negatively significant to the parameter. In [Model 2], β = −0.480, $p$ = 0.003, the independent variable was negatively significant to the dependent variable. In [Model 3], the independent variable was not significant to the dependent variable at β = 0.002, $p$ = 0.987, and the mediating variable was statistically significant to the dependent variable at β = 0.761, $p$ = 0.000, showing a full mediation effect. In addition, the results of Sobel's (1982) mediation effect significance test (Z =−3.53, $p$ = 0.000) were found to be statistically significant [31].

**Table 6.** Mediating effect of the mediating variable (vitality) between the independent variable (stress) and the dependent variable (resilience).

| Model | Variable | B | SE | $\beta$ | t($p$) | F($p$) | $R^2$ | adj. $R^2$ |
|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 43.526 | 1.893 | | 22.990 *** | 23.582 *** | 0.403 | 0.385 |
| | Independent variable → Parameter variable | −0.625 | 0.129 | −0.634 | −4.856 *** | | | |
| 2 | (Constant) | 91.031 | 6.692 | | 13.603 *** | 10.489 ** | 0.231 | 0.209 |
| | Independent variable → Dependent variable | −1.341 | 0.455 | −0.480 | −3.239 ** | | | |
| 3 | (Constant) | −12.094 | 20.217 | | −0.598 | 23.122 *** | 0.576 | 0.551 |
| | Independent variable → Dependent variable | 0.007 | 0.443 | 0.002 | 0.017 | | | |
| | Parameter variable → Dependent variable | 2.369 | 0.450 | 0.761 | 5.267 *** | | | |

**, *** significant at $p$ < 0.01 and 0.001 by Baron and Kenny mediating effect analysis.

### *3.6. Satisfaction with Agro-Healing Programs to Reduce Stress*

Satisfaction with the healing program activities was surveyed in the following order: BB *Big Vegan* cooking (25.6%), herb five senses garden (21.5%), walking (17.3%), and my own garden resembling nature (13.2%) (Figure 2). The overall satisfaction level with the healing agricultural activity program was positive (100%); 36 people responded that it was satisfactory (97.3%), and one reported it to be average (2.7%) for a total of eight implementation periods. Furthermore, the responses (100%) indicated that they were satisfied with 60 min of activity time per session and they were satisfied with the activity occurring once a week (100%), and the overall willingness to recommend it to acquaintances was positive (100%).

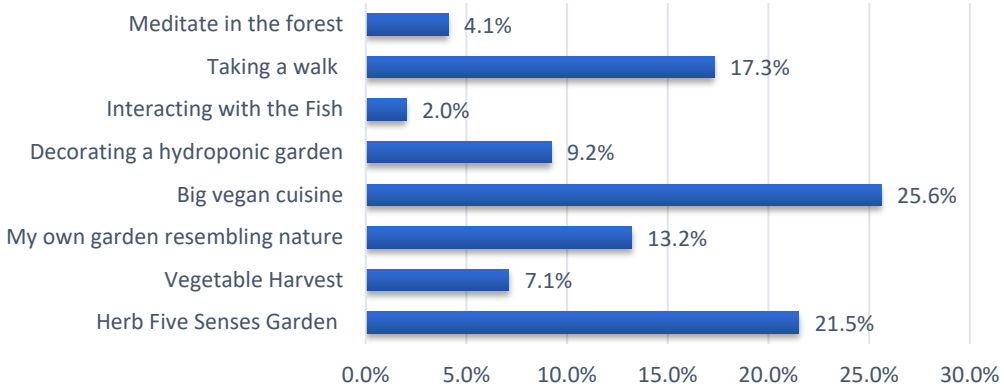


**Figure 2.** Satisfaction of the participants for the agro-healing program.

## 4. Discussion

Recently, as the public's demand for physical and psychological healthcare has spread to agro-healing activities, and agro-healing, which uses agricultural work to mediate the healing needs of individuals, has received adequate attention [7]. Depending on the purpose, agro-healing can be divided into healing-centered, employment-centered, and education-centered agro-healing. The purpose of healing-centered agro-healing is to provide healing services to people in need of healing, and the purpose of employment-centered agro-healing is to link employment and the labor market and generally provide professional education and training to the socially disadvantaged. Education-centered agro-healing is divided into educational farms for regular school students and educational farms to meet special educational needs [32]. Healing farm operators provide agricultural activities according to the needs of participants. Loue [33] defined a care farm as a space for user recovery via services provided by experts and rural resources. Adults in their 20s and 30s with symptoms of stress were found to wish for forest healing, horticultural therapy, animal-assisted therapy, and agro-healing, all of which are possible through therapeutic agricultural activities [34].

This study examines a mental health-improvement agro-healing program that investigates the core resources of care farms and selected healing activities. The participants were people suffering from stress in nearby areas, who could visit the site on the same day. We conducted an analysis of prior studies (seven domestic and fourteen international) on the mediating factors affecting agro-healing-related stress. Six psychological and emotional indicators were selected as stress-related health indicators: stress, state anxiety, depression, mood, subjective vitality, and resilience.

After the agro-healing program, all psychological and emotional health indicators showed significant results. This was similar to the results of previous studies, which showed that providing resources such as nature and urban green spaces provided recovery effects and mental benefits for participants and had an effect on promoting recovery and psychological and emotional factors, including stress [20,35–43]. A study on mental healing effects [38] demonstrated the effect of reducing the stress of firefighters through

agro-healing activities. Kim et al. [43] reported similar results, showing that gardening activities for housewives living in urban areas relieved physiological stress. Additionally, psychophysiological studies have shown that olfactory stimulation using natural aromas lowers systolic blood pressure in adult women and has a stress-reducing effect [44]. Mothers who participated in a parent–child communication program that integrated agro-healing were effective in improving their mental health by improving resilience and communication skills and reducing depression [45].

Furthermore, psychological and emotional indicators were correlated with stress, and subjective vitality (negative correlation) and mood state (positive correlation) showed the strongest correlation. In a study targeting veterans with PTSD, anxiety and stress were correlated, and a plant-mediated healing program resulted in a reduction in mood symptoms and suicidal thoughts [46].

The results of analyzing the mediating effect of subjective vitality to determine the effect of stress on resilience of participants revealed that the effect of stress on resilience disappeared, and only subjective vitality had a complete mediating effect on resilience. This shows that it is effective in reducing stress and restoring health by strengthening the subjective vitality factor. Vitality is related to satisfaction of basic needs. The greater the autonomy, competence, and relatedness, the higher the level of vitality. Appropriate exercise also increases vitality. Bielinis et al. [47] reported that, as a result of a healing program using the forest, negative mood indicators of negative emotions decreased, and positive emotions, including recovery and vitality, increased, resulting in psycho-emotional effects. Horticulture, gardening, and farming promote mental health and promote recovery in individuals with mental health problems [5]. In environmental psychology, it has been reported that "the natural environment promotes recovery from stress and restores ability by concentrating attention when fatigued" [19]. Agro-healing activities maintain and promote health by providing exercise and psychological and emotional support to participants.

However, in this study, the analysis was conducted only on people experiencing local stress. Therefore, there were limitations in recruiting subjects. In future research, we suggest applying this method to various regions and individuals to study healing mechanisms.

## 5. Conclusions

The resources utilized for agro-healing are in the following order: plants (100%), agricultural workshops (59.6%), rural environment and landscape (53.2%), processed agricultural products (40.4%), and animals (16.5%). Rural resources, plants, and animals can all be used as agro-healing resources [6]. In this study, we extracted the healing resources possessed by D Care Farm, established a system for developing agro-healing programs, and verified the effect of improving mental health through the provision of expert services. If agro-healing is linked to rural tourism and leads to a systematic and sustainable business, it is believed that it will attract young people through the creation of new jobs, prevent rural extinction, and contribute to rural sustainability. Moreover, it is believed that increasing physical activity, as well as psychological and emotional vitality through therapeutic agricultural activities, will contribute to improving mental health and creating functional value in agricultural and rural areas.

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**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Konkuk University (protocol code 7001355-202206-HR-556).

**Informed Consent Statement:** Informed consent was obtained from all participants involved in the study.

**Data Availability Statement:** The datasets generated for this study are available upon request from the corresponding author.

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**Conflicts of Interest:** The authors declare no conflicts of interest.

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