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Effect of Anti-Aging Standard Forest Healing Program With Multiple Visits to a Forest Facility on Cognition in Older Age Patients

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ABSTRACT

Background and purpose: The anti-aging standard forest healing program (ASFHP), which uses forest therapy, was reported to be effective in improving psychological, physical, and cognitive functions. However, there are several challenges to directly visiting the forest. This study aimed to investigate the impact of multi-session ASFHP with forest visit on the mental and physical health of the older people with visits to forest facilities and compared them with those of the same program conducted indoors.
Methods: Individuals aged over 70 years with concerns about cognitive decline were recruited at dementia relief centers and divided into control and experimental groups. A total of 33 people were administered ASFHP under the supervision of a forest therapy instructor. The control group stayed indoors, while the experimental group visited a forest healing center and repeated the program 20 weeks.
Results: The multiple-session ASFHP positively affected cognitive impairment screening test (CIST) total scores (p=0.002), memory (p=0.014), Korean version of the Repeatable Battery for the Assessment of Neuropsychological Status total scores (p<0.001), immediate recall (p=0.001), visuospatial/construction (p<0.001), language (p<0.001), forest healing standard questionnaire total scores (p=0.002), and cognitive function (p=0.019), regardless of location. The forest visits during the ASFHP showed positive effects on orientation (p=0.035), delayed recall (p=0.042), emotional stability (p=0.032), physical activity (p=0.005), and health (p=0.022). The CIST scores of the memory domain were the strongest indicator of the multiple-session ASFHP effects.
Conclusions: The 20-week multi-session ASFHP with forest visit showed effects on cognitive improvement and physical and emotional stability compared to indoor education.

Keywords: Anti-Aging Standard Forest Healing Program; Forest Therapy; Non-Pharmacological Treatment; Cognitive Decline; Forests

Table 4. Effect of the multiple-visit anti-aging standard forest healing program on K-RBANS

K-RBANS	Group	Scores at baseline	Scores at 12-week	Scores at 20-week	Effects of multiple visits (V)	Effects of group (G)	G×V
Total scores	IE	70.3±15.0	75.9±11.4	83.6±12.4	27.698*±0.000	1.867±0.182	0.058±0.944
	VF	64.0±15.9	68.6±17.7	76.3±17.8			
Attention	IE	88.1±13.0	90.1±11.1	92.0±12.8	2.748±0.072	0.271±0.606	0.092±0.913
	VF	85.2±11.1	88.2±13.8	90.8±14.8			
Immediate recall	IE	80.2±14.4	82.5±10.7	89.4±15.6	7.451**±0.001	1.204±0.281	0.043±0.958
	VF	75.7±13.9	78.5±15.7	84.0±13.8			
Delayed recall	IE	79.4±12.4	83.0±16.4	81.2±14.0	0.742±0.480	4.489***±0.042	0.690±0.505
	VF	70.4±13.6	70.5±16.4	74.1±15.4			
Visuospatial/ construction	IE	73.6±12.2	74.7±12.8	88.2±9.4	14.013*±0.000	1.629±0.211	0.518±0.599
	VF	69.4±15.5	71.4±15.0	80.0±18.1			
Language	IE	78.4±16.1	87.1±10.3	91.3±13.2	20.680*±0.000	0.057±0.813	0.093±0.911
	VF	78.1±14.4	85.5±11.9	90.0±14.5			

Variables are presented as the means ± standard error.
K-RBANS: the Korean version of the Repeatable Battery for the Assessment of Neuropsychological Status, IE: indoor education, VF: visit forest.
**p*<0.05, ***p*<0.01, and ****p*<0.001.

Table 5. Effect of the multiple-visit anti-aging standard forest healing program on FHSQ scores

FHSQ	Group	Scores at baseline	Scores at 12-week	Scores at 20-week	Effect of multiple visits (V)	Effect of group (G)	G×V
Total score	IE	13.64±3.12	20.36±3.36	20.21±3.72	12.770*±0.002	3.810±0.051	0.158±0.924
	VF	9.05±1.43	13.11±2.17	12.50±2.05			
Cognitive function	IE	9.07±1.69	12.07±2.07	11.64±2.05	7.911**±0.019	2.315±0.128	0.129±0.937
	VF	6.63±1.05	8.74±1.46	8.06±1.43			
Emotional state	IE	3.56±1.03	5.25±0.70	5.18±0.70	4.525±0.104	4.616±0.032	3.305±0.192
	VF	2.78±0.54	3.57±0.58	2.69±0.48			
Physical activity	IE	4.00±1.41	3.20±0.87	3.17±0.90	0.111±0.946	7.952*±0.005	1.804±0.406
	VF	1.33±0.27	2.00±0.24	1.88±0.48			
Physical health	IE	2.82±0.67	3.08±0.45	3.81±0.94	1.629±0.443	5.220**±0.022	3.421±0.181
	VF	1.84±0.29	2.33±0.41	1.68±0.36			

Variables are presented as the means ± standard error.
FHSQ: forest healing standard questionnaire, IE: indoor education, VF: visit forest.
**p*<0.05, ***p*<0.01.

Table 6. Effects of the multiple-visit anti-aging standard forest healing program on sGDS scores

sGDS	Group	Scores at baseline	Scores at 12-week	Scores at 20-week	Effect of multiple visits (V)	Effect of group (G)	G×V
Score	IE	4.50±1.25	7.10±1.47	6.89±1.51	3.584±0.167	5.107*±0.024	2.263±0.323
	VF	3.50±0.51	4.15±0.68	3.45±0.49			

Variables are presented as the means ± standard error.
sGDS: geriatric depression scale, short form, IE: indoor education, VF: visit forest.
**p*<0.05.

sGDS

The effect of the multiple-visit ASFHP between the two groups on sGDS was shown in **Table 6** and **Supplementary Fig. 1.** sGDS scores were significantly affected by the group (Wald's χ^2: 5.107, p=0.024). The scores in the multiple-visit ASFHP VF group (3.50 [0.51] to 3.45 [0.49]) showed a positive effect on emotion compared to the IE group (4.50 [1.25] to 6.89 [1.51]).

DISCUSSION

This study was conducted at community dementia relief and targeted individuals over 70 years of age who were not diagnosed with dementia but with concerns about cognitive decline. Several studies have investigated the effectiveness of an ASFHP as a nonpharmacological treatment for cognitive decline and reported positive effects on mood, immune system, stress levels, and physical health.[7,10,11,19] In a meta-analysis, forest-based intervention showed a significant effect on overall mental health.[20] In a previous study, similar ASFHP conducted on MCI patients showed positive effects on psychological, physiological, and physical health.[11] In addition, it was reported that the forest healing program affects the autonomic nervous system, such as heart rate variability or electroencephalography, and alleviates depression symptoms and controls physical risk factors.[21,22] The alleviation of depressive symptoms observed in our study is thought to be due to relieving the participant's psychological burden through the various experiences provided by the physical forest environment. In the physiologic aspect, forest therapy was linked with an increase in neurotransmitters such as serotonin and a decrease in stress hormones such as cortisol.[23,24] Walking in the forest environment is a physical activity and is expected to improve overall physical health, including cardiovascular functions.[24-26] In our study, the VF group showed significant positive effects on physical health than the IE group. These results could be explained by the fact that ASFHP conducted in the forest affected physiologic and physical health by engaging in more than usual outdoor activities under the supervision of an instructor. Previous research also demonstrated that guided forest therapy had more positive effects on emotional change and social interaction.[27] The ASFHP was developed by the FOWI as a program that strengthens cognitive, emotional, and physical activities under the supervision of qualified forest therapy instructors rather than visiting a mountain like mountain climbing, hiking, or forest bathing. While the ASFHP is a standardized program, it was not clear whether people who have difficulty accessing forest welfare facilities for various reasons could participate in the program from other locations and achieve the same results.

In this study, the ASFHP showed significant effects on various (CIST total score/memory, K-RBANS total score/immediate recall/visuospatial-construction/language, and FHSQ total score/cognitive function) tests following multiple visits (**Tables 3-5**). This means that when the ASFHP is repeated for 20 weeks, regardless of the location, memory, visuospatial, and language functions are positively affected. Differences between the FV group and the IE group were found in the CIST orientation, K-RBANS delayed recall, sGDS, FHSQ emotional state, physical activity, and physical health, with the FV group showing more significant effects than the IE group (**Tables 3-6**). A positive effect was seen on orientation, delayed recall, emotional stability, physical activity, and health when the ASFHP was implemented by physically visiting a forest facility. As shown in **Table 1**, the IE group underwent the same program that included physical activity and meditation; however, there was meaningful emotional and physical effects in the FV group compared with the IE group c.

Managing risk factors is essential to prevent cognitive decline. Psychological anxiety, physical activity, and social interaction have been identified as modifiable risk factors for cognitive function.[28] In addition, in the FINGER study, multidomain interventions, including nutritional counseling, cognitive training, metabolic and vascular risk factor management, as well as physical activity, were performed on an at-risk elderly population to improve or maintain cognitive function.[3,4] The ASFHP, which includes physical, emotional, and social interaction could help control the risk factors, and is; therefore, an alternative nonpharmacological treatment for cognitive decline. Previous studies have also reported the effects of forest therapy on emotional and physical health, including cognitive function.[11,29] The difference between ASFHP and the recreational use of forest or forest bathing is that ASFHP includes qualified forest therapy instructors who conduct and supervise the program. This could be one of the reasons ASFHP showed positive results similar to the FINGER study.

In our opinion, the important aspects of nonpharmacological treatment for cognitive decline are adherence and guidance from qualified instructors. A multidomain dementia prevention study using digital therapeutics also showed differences in cognitive function and brain cortical thickness in a facility-based group under supervision. Similarly, in our study, the program was conducted under the supervision of a qualified forest therapy instructor.[30,31] In terms of adherence, seven people dropped out of this study, resulting in a dropout rate of 15.9%. Although this dropout rate included the IE group, the largest percentage was from the FV group, which reflects the challenges of visiting a forest facility due to a wide range of reasons including time and geography.

This study had several limitations. The 20-week ASFHP had to be conducted at a community dementia relief center or forest facility, there were difficulties in recruiting participants for practical reasons. Because the sample size affects the meaningfulness of the study, research with a larger number of participants is needed in the future. Because this study was not hospital-based, the participants were not randomized for practical reasons. Also, since the dementia relief centers were designated as an IE group or a VF group, the influence of the participants' socioeconomic status, living environment, and quality of life, which were not investigated in this study, cannot be ruled out. In addition, because the subjects were limited to older people over 70 years old who had not been diagnosed with dementia at the hospital, most of the participants had normal cognitive function according to the CIST test at the dementia relief center. When adjusted for age and education, all participants in the IE group were normal (14/14). In the VF group, 4 out of 19 participants were below the cut-off value, but the difference was not critical, and the overall mean CIST score between IE and VF groups was not statistically significant. Therefore, there are limitations in applying the results of this study to all types of cognitive decline, including dementia.

Despite these limitations, this study demonstrated that conducting the ASFHP by visiting the abundant and familiar forest resources in Korea could improve psychological stability, physical activity, and health and the effects were more significant compared to conducting the program indoors. Therefore, it could be said that conducting ASFHP by visiting a forest facility with a qualified instructor had an advantage compared to conducting the program indoors.

SUPPLEMENTARY MATERIALS

Supplementary Table 1

Detailed schedule of 20-week anti-aging standard forest healing program

Supplementary Fig. 1

Graph of score changes in CIST and sGDS between IE and VF groups.

Supplementary Fig. 2

Graph of score changes in K-RBANS between IE and VF groups.

Supplementary Fig. 3

Graph of score changes in FHSQ between IE and VF groups.

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