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Effectiveness of Horticultural Therapy on Improving Memory, Alexithymia, and Severity of Symptoms in Patients with Persistent Depressive Disorder

Mohammad Hossein. Salemi[1], Elham. Foroozandeh[2*], Hossein Ali. Asadi-Gharneh[3]

[1] Department of Psychology, University of Tehran, Tehran, Iran
[2] Department of Psychology, Naein Branch, Islamic Azad University, Naein, Iran
[3] Department of Horticulture, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran

*** Corresponding author email address**: Elham_for@yahoo.com

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ABSTRACT

Depressive disorder causes unpleasant consequences in various areas of life, such as memory impairments and alexithymia. Based on this, this study aims to determine the effectiveness of horticultural therapy in improving memory, alexithymia, and reducing the severity of symptoms of patients suffering from persistent depressive disorder. The research design was semi-experimental and pre-test post-test with a control group. The statistical population of the present study includes all patients with persistent depressive disorder who met the criteria. 30 patients were selected by purposive sampling and randomly placed into experimental and control groups. The instruments used in the research were the Beck Depression Questionnaire, the Wechsler Working Memory Test, and the Toronto Alexithymia Scale. Participants in the experimental group took part in group gardening activities twice a week during 8 2-hour sessions. While the members of the control group did not participate in these activities. After the post-test, the data were analyzed using multivariate covariance analysis by SPSS-24 software. The results of the research showed that horticultural therapy was effective in reducing the severity of depression symptoms in patients with persistent depression ($P<0.05$), but not effective in improving memory and reducing alexithymia ($P<0.05$). According to the results of the research, it is possible to suggest the use of horticultural therapy as an intervention method to reduce depression symptoms in patients with persistent depressive disorder, and patients with persistent depression can take the benefits of horticultural therapy to reduce their depression symptoms.

Keywords: *Depression, horticultural therapy, memory, alexithymia.*

1. Introduction

Depression is one of the most common and at the same time, the most debilitating mental disorders that affects more than 300 million people, which is equivalent to 4.4% of the world population (Marques et al., 2020; Polak et al., 2022). This disorder is characterized by a decrease in energy and interest, feelings of guilt, difficulties in

concentration, anorexia, and thoughts of death and suicide, and is accompanied by changes in the level of activity, cognitive abilities, speech, sleep status, and appetite, leading to disruptions in job performance, social and interpersonal relationships (Sadock, 2015). Depression is a potential and effective risk factor in the occurrence of various physical and psychological problems such as heart disease, rheumatoid arthritis, multiple sclerosis, anxiety disorder and substance abuse, other psychological disorders, alexithymia, deficits in cognitive and memory skills (Gutiérrez-Rojas et al., 2020; Labonté et al., 2017; Nafilyan et al., 2021; Quinto et al., 2022).

Alexithymia is one of the common problems related to depression, which has a two-way relationship with this disorder (Sagar et al., 2021). Alexithymia is a multidimensional structure and consists of difficulty in identifying emotions, differentiating between emotions and physical excitement related to emotional arousal, limited visualization power, and difficulty in describing emotions in oneself and others (Aleisa et al., 2022; Li et al., 2022). In the literature of this field, alexithymia is considered a persistent personality trait or a defense mechanism (Hemming et al., 2019). Past studies have shown that alexithymia is highly prevalent in patients with depression (Wang et al., 2021). People who suffer from alexithymia mainly have problems with emotion regulation, low quality of life, inflexibility of coping strategies, and defects in social functioning (Larionov, 2020; Ospina et al., 2019; Tesio et al., 2018).

A lot of empirical evidence shows that in depression, patients suffer from cognitive impairments in several areas such as processing speed, attention, executive function, and memory (Perini et al., 2019). Memory is one of the most important cognitive factors that is affected by depression and is associated with serious deficiencies due to depression (Nafilyan et al., 2021). Depressed people face reduced cognitive performance, major problems in everyday situations (forgetting names and misinterpreting directions), and defects in controlled processes such as attention and working memory (Iorio et al., 2022). In the study of (Vancappel et al., 2021), it is stated that persistent depression disorders can have a strong effect on memory loss, so in the tests conducted, people showed a significant difference in memory tests before and after suffering from depression. Working memory is a short-term and temporary storage system that is characterized by its limited capacity to maintain and manipulate a limited amount of time-related information. This memory is processed by the frontal lobe of the brain and plays a very important role in reasoning, decision-making, and guiding behavior (Aben et al., 2012). It seems that depressed people face many problems in making decisions and achieving goals in life, on the other hand, working memory plays a very important role in achieving goals and making decisions, so it is possible that helping these people fix the shortcomings and problems of working memory can be effective in improving depression (Guo & Li, 2021).

In general, if the depressive disorder is not treated, it becomes a persistent state which leads to spending a lot of money and time on treatment (Ghasemkhanloo et al., 2021). Therefore these people should be treated to prevent the disorder from becoming persistent and to solve their problems (Sawyer et al., 2019). On the other hand, research evidence shows that the symptoms and signs of depression will most likely return after the end of the treatment (Kumagai et al., 2019). Hence, it is essential to use available and appropriate treatment approaches to help these people. Along with pharmacological and psychological treatments to reduce symptoms and treat depression, horticultural therapy as a non-pharmacological treatment has attracted increasing attention from researchers in this field in recent decades (Korah et al., 2021). Horticultural therapy is a process that uses activities related to plants to achieve well-being and health through active/direct and related interaction with plants (Hitter et al., 2019). The mental, social, and physical health benefits of horticultural therapy, including improvements in memory, cognitive abilities, feelings of hope, motivation to start work, linguistic skills, socialization, muscle strength, balance, endurance, and coordination have been confirmed in recent studies (Lin et al., 2022; Tu & Chiu, 2020; Zhang et al., 2022). (Hoseinpoor Najjar et al., 2018) concluded in their research that horticultural therapy had a significant effect on improving memory, depression, stress, and anxiety. On the other hand, the significant role of horticultural therapy in improving memory was confirmed in the study of (Goto et al., 2018), but in the study (Foroozandeh & Asadi-Gharneh, 2021) no significant effect on memory improvement was reported. After that, (Hitter et al., 2019; Zhang et al., 2022) showed that therapy plays an effective role in reducing the signs and symptoms of depression. In the research of (Li et al., 2022) they emphasized the significant effect of horticultural therapy on emotional expression. In addition, the study of (Oh et al., 2020) indicates the effectiveness of horticultural therapy in increasing the recognition and expression of emotions and emotional intelligence.

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Depressive disorder is one of the most common and serious problems in the field of mental health, which, along with its symptoms, has caused unpleasant consequences in various areas of life, such as memory and alexithymia. Accordingly, it is necessary to use available, suitable, and applicable treatment approaches to help these people.

Horticultural therapy can be applied as an effective treatment for these people. There have been separate studies addressing the subject matter but in the present study, the effectiveness of horticultural therapy on research variables has been investigated as an innovation. Also, the effectiveness of horticultural therapy on alexithymia has not been directly investigated; and regarding the effect of this approach on memory, we are faced with contradictory results, so the current research can partially cover the gap in studies in this field. However, the purpose of this research is to investigate the effectiveness of horticultural therapy on memory improvement, alexithymia, and severity of symptoms in patients with persistent depressive disorder.

It should be mentioned that during this research, all points related to research ethics and informing people about the work process, as well as guaranteeing the confidentiality of information and not publishing the names of people, were on the agenda. In addition, after completing the intervention sessions in the experimental group and taking the post-test, concepts and treatment strategies based on gardening activities were taught to the control group during two intensive sessions.

2. Methods and Materials

2.1. Study Design and Participants

The present research method was quantitative, semi-experimental, and of pre-test post-test designs with a control group; the statistical population was persistent depression patients and the sample size was 30 people based on the background of research in experimental and semi-experimental studies. The tool used in this research for sampling was purposeful sampling method. The criteria for inclusion in the study were: receiving a diagnosis of persistent depressive disorder based on the opinion of a psychiatrist; being covered by the welfare department; being over 18 years old; having a diploma at least and scoring between 29 and 63 on the Beck Depression Inventory-2 (BDI-II), which indicates the presence of severe depression; and the criteria for exclusion from the study included not suffering from another psychological illness at the same time; not participating in other counseling and treatment sessions at the same time; and refusing to continue cooperation and missing two or more sessions. In this study, Beck Depression Inventory-2 (BDI-II), Wechsler Working Memory Test, and Toronto Alexithymia Scale (Bagby et al., 1994) were used to collect information.

To carry out the current research, the researcher tested the information of the patients who received the diagnosis of persistent depressive disorder under the supervision of a psychiatrist. After the initial examination based on the Beck-2 Depression Questionnaire, the people who showed depression symptoms the most (scores 63-29) were selected. Based on the research size, 30 of these people were randomly divided into two groups of 15. After that, the Wechsler Working Memory Questionnaire and Toronto Alexithymia Scale (FTAS-20) were also administered as a pre-test on the samples of both groups.

In the following, the participants in the experimental group participated in 8 2-hour sessions twice a week in group gardening activities based on the training provided by (Haller & Capra, 2006), while the people in the control group did not participate in those activities. After completing the interventions, the research participants were asked to answer the questions of Wechsler's working memory questionnaire, Toronto Alexithymia (FTAS-20), and Beck's depression-2 (BDI-II) as a post-test.

2.2. Measures

2.2.1. Depression

Among the questionnaires prepared to measure depression, Beck Depression Inventory-2 is one of the most suitable tools for evaluating depression symptoms (Shear et al., 2005). The Beck Depression Inventory-2 was prepared by (Beck et al., 1996). Each item has 4 options that are scored from 0 to 3 respectively. 7 items evaluate physical symptoms, 7 items behavioral/emotional symptoms and 7 items evaluate cognitive symptoms (Groth-Marnat, 2003). The subject's depression score is obtained by summing up the scores of the options chosen by the individual. The minimum and maximum total score of depression in subjects is 0 and 63, respectively. (rajabi & karju kasmai, 2012) in their study stated that this inventory had good validity and reliability and there was a high correlation between the total factor and sub-components.

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2.2.2. *Alexithymia*

The Toronto Alexithymia Scale (Bagby, 1994) is a 20-item test. This tool is measured in a five-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree) and items 4, 5, 10, 18, and 19 are scored in reverse (Izadi & Mokhtari, 2021). Cronbach's alpha coefficients for alexithymia were calculated as 0.85, which is a sign of good internal consistency of the scale. The concurrent validity of the Toronto Alexithymia Scale-20 in terms of correlation between the subscales of this test and the scales of emotional intelligence, psychological well-being, and psychological helplessness was investigated and confirmed. The results of Pearson's correlation coefficients showed that there is a significant correlation between the subjects' score in the total alexithymia questionnaire with emotional intelligence ($r = -0.80$, $p < 0.001$), psychological well-being ($p < 0.001$, $r = -0.78$) and psychological helplessness ($r = 0.44$, $p < 0.001$), which indicates the favorable validity of this scale (Besharat, 2007).

2.2.3. *Working Memory*

Wechsler's Working Memory Test is one of the most common methods for memory evaluation is to measure digit span. The test that was used in this research is the digit span subset of the Wechsler Memory Scale, which is used to measure working memory, which consists of two parts: forward digit span and backward digit span. In the forward digits, a series of numbers is presented and the subject must repeat the numbers in the same order presented. In the backward digits section, a series of numbers is presented and the subject must repeat the numbers in the reverse order. The total score of a person's memory is obtained from the sum of scores related to forward memory and backward memory. In Iran, in the research conducted, the reliability coefficients by Cronbach's alpha method for subsets ranged from 0.65 to 0.85 and for indices from 0.75 to 0.86. Also, the reliability coefficients by bisection for subsets varied from 0.62 to 0.84 and for indices from 0.70 to 0.85 (Saed et al., 2008).

2.3. *Intervention*

2.3.1. *Horticultural Therapy*

The summary of the content of horticultural therapy sessions based on the training provided by (Haller & Capra, 2006) was as follows (Table 1):

Table 1

Summary of the content of horticultural therapy

Session	Content
1	Familiarizing the subjects with the goals of the meetings, familiarizing the subjects with the practical behaviors of the activity.
2	Preparation of utensils; preparation of the soil bed by the subjects with the help of the researcher; touching the soil; choosing the subject's favorite plant for planting; learning about the necessary tools for planting in the box; teaching how to plant the selected plants; planting seeds and watering them with a sprinkler by the subjects; teaching the subject how to irrigate the planted seeds; emphasizing to the subject to water the seeds daily.
3	Care for the plants, emphasis on the subject's roles of breeder and caretaker in the practice of gardening, and attention to the changes made in the plants.
4	Inspecting and watering plants, restoring plants, thinning plants, weeding, creating a sense of possession and attachment to the plants grown by the subjects.
5	Irrigation, picking ripe vegetables, encouraging the subjects to consume their crops, teaching the properties of each crop, and showing the ripe crops to others by the subjects.
6	Watering, thinning and weeding, replanting in the empty spaces of the box, teaching the subject to release emotions during the planting operation, taking photos of the subjects next to their crops, and providing them with it.
7	Paying attention to new changes in plants, encouraging subjects to take care of buds and bushes. Teaching how to care for summer plants, and placing support for plants by the subject and the researcher.
8	Picking and using all the grown crops, encouraging and persuading the subjects to continue the process of gardening, reminding them of the role of the subjects throughout the gardening period.

2.4. *Data analysis*

Finally, the data obtained from the research was analyzed using SPSS-24 software in two descriptive (mean and standard deviation) and inferential (covariance analysis test) sections.

3. Findings and Results

Examining the demographic information of the research participants showed that 13 (86.67%) of the research subjects in the experimental group were women and 11 (73.33%) women were present in the control group. Also,

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the age-based frequency distribution of the research sample showed that among the 15 participants in the experimental group, 3 (20%) were between 50 and 59 years old, 6 (40%) were between 60 and 69 years old, and the rest were over 70 years old. On the other hand, the frequency distribution of the research sample based on marital status showed that among the 15 participants in the experimental group, 5 (33.33%) were not married and 10 (66.67%) were married, and in the control group, 9 (60%) were not married and 6 (40%) were married.

Table 2 shows the descriptive findings (mean and standard deviation) of the variables of alexithymia, depression, and memory in the research samples.

Table 2

Descriptive findings of research variables

Variable	Group	Post-test		Pre-test		
		Mean	Standard Deviation	Mean	Standard Deviation	N
Alexithymia	Test	49.86	9.54	48.13	9.59	15
	Control	54.73	10.26	54.13	10.59	15
Depression	Test	46.73	12.68	41.73	12.78	15
	Control	50.66	7.68	50	6.54	15
Memory	Test	2.26	1.66	4.40	1.91	15
	Control	2.80	2.07	3.06	2.31	15

Before conducting the inferential analysis of the data (multivariate covariance analysis), the most important assumptions, i.e., checking for the scores distribution normality and the homogeneity of variances were examined using the Kolmogorov-Smirnov test and the Levene test, respectively; and the homogeneity of regression line slope was tested, to comply with the assumptions of parametric tests, the results of which can be seen in Table 3.

Table 3

The results of Kolmogorov-Smirnov, Levene, and regression line slope homogeneity tests

Variable	Kolmogorov-Smirnov				Levin				Homogeneity of Regression Slope		
	Groups	statistic	df	sig	F	df numerator	df denominator	sig	df	F Value	sig
Alexithymia	Test	.125	15	.200	.040	1	28	.843	2	3.913	.058
	Control	.132	15	.195							
Memory	Test	.150	15	.082	.843	1	28	.366	2	.930	.343
	Control	.151	15	.087							
Depression	Test	.127	15	.200	1.808	1	28	.190	2	.370	.548
	Control	.142	15	.128							

Based on the results of Table 3, the significance level was not significant for any of the variables in any of the tests (P>0.05). Therefore, the conditions of score distribution normality, homogeneity of variances, and the regression line slope homogeneity were properly observed. Therefore, there was no hindrance to using the multivariate analysis of the covariance test.

Multivariate analysis of covariance (MANCOVA) was used to investigate the effectiveness of gardening activities on improving memory, reducing emotional alexithymia, and reducing the severity of symptoms in patients with persistent depression.

Table 4

The results of multivariate covariance analysis in investigating the effectiveness of gardening activities on improving memory, reducing alexithymia, and reducing the severity of symptoms in patients with persistent depression

Test	Value	F	Df Hypothesis	Df Error	p	η^2
Pillai's Trace	.647	7.921	6	23	.0001	.674
Wilks' Lambda	.326	7.921	6	23	.0001	.674
Hotelling's Trace	2.066	7.921	6	23	.0001	.674
Roy's Largest Root	2.66	7.921	6	23	.0001	.674

Based on the results of Table 4, the values of Pillai's Trace, Wilks's lambda, Hotelling's Trace, and Roy's largest root mean that there is a significant difference between the two experimental and control groups in terms of at least one of the dependent variables (F=7.921, P<0.01). In addition, the results of the above table show that nearly 67% of the differences created in the dependent variables are related to the influence of the independent variable. The statistical power 1 also indicates the adequacy of the sample size and the low type II error.

Table 5 shows the results of multivariate covariance analysis of the effect of gardening activities on each of the dependent variables (improving memory, reducing alexithymia, and reducing the severity of symptoms of patients suffering from persistent depression).

Table 5

The results of multivariate analysis of variance in the text of MANCOVA on memory variables, alexithymia, and persistent depressive symptoms

Source	Dependent Variable	SS	Df	MS	F	p	η^2	Power
Pre-test	Memory	2.133	1	2.133	.601	.445	.021	.116
	Alexithymia	177.633	1	177.633	1.79	.192	.060	.253
	Depression Symptoms	116.033	1	116.033	1.055	.313	.036	.168
Group	Memory	13.333	1	13.333	2.950	.097	.095	.382
	Alexithymia	270	1	270	2.644	.115	.086	.349
	Depression Symptoms	512.533	1	512.533	4.971	.034	.151	.576

The results of Table 5 show that gardening activities have been effective in improving depression symptoms of patients with persistent depressive disorder (F=4.971) and this effect is statistically significant (P<0.05). Therefore, gardening activities have reduced the symptoms of depression in people suffering from persistent depression. The effect size for depression symptoms was 0.151 and it indicates that 15.1% of the change in depression symptoms was caused by the impact of gardening activity. According to the results of Table 5, gardening activity was not effective in improving memory (F=2.950), alexithymia (F=2.644) (P<0.05). Therefore, gardening activities did not change emotional alexithymia and improve memory.

4. Discussion and Conclusion

This research was conducted to determine the effectiveness of horticultural therapy on improving memory, alexithymia, and the severity of symptoms of patients suffering from persistent depression. The results of the present study show that horticultural therapy has had a significant effect on the reduction of symptoms and signs of depression. This finding is in line with the results of studies by (Hitter et al., 2019; Hoseinpoor Najjar et al., 2018; Zhang et al., 2022). Explaining the findings of the current research, it can be said that in depressed people, inactivity and apathy toward events surrounding life are symptoms and effective factors in causing and aggravating depression (Kandola et al., 2019). So, one way to solve this problem and reduce depression is to regularly change behavior by allocating more time to activities that bring satisfaction and pleasure, and at the same time, less time must be given to passive or unrewarded activities. Thus, gardening activities cause people to reduce passive activities in favor of active and beneficial behaviors, which leads to feelings of satisfaction and happiness. Therefore, horticultural therapy reduces depression by encouraging a person to engage in physical activity and perform pleasurable activities related to plants

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and nature (Han et al., 2018). A decrease in social interaction and communication has been one of the other symptoms and signs of depression (Elmer & Stadtfeld, 2020); and solving this problem can cause a decrease in depressed mood. Therefore, horticultural therapy by increasing involvement and engagement in activities, increasing communication and social interaction, and improving the individual's motivation to communicate, has been able to reduce loneliness and lack of social interaction in people benefiting from this treatment approach, which also reduces the symptoms and signs of depression (Ng et al., 2018; Sempik et al., 2014). In general, gardening activities are effective in the recovery of patients suffering from persistent depression. Gardening experiences have an effect on people's stress and muscle tension, cause changes in people's thinking and behavioral patterns, and enable them to deal with unpleasant emotions in their life path to give a person a feeling of abandonment and hope for the ability to change. Planting is one of the activities that seem to have the greatest effect in this regard. Planting seeds and taking care of the sprout and watering it, using fertilizer and weeding can make the patient realize, taking into account the sense of caretaking, that he/she is also worth taking care of; and probably at this stage, the patient starts to focus on him/herself, his/her clothes and personal hygiene; and behaves more actively. These factors together reduce depression.

Another aim of the research was to determine the effectiveness of horticultural therapy on memory and alexithymia, which the results of the study showed, that horticultural therapy did not have a significant effect on improving memory. These findings were inconsistent with the results of the studies of (Goto et al., 2018; Hoseinpoor Najjar et al., 2018) AND otherwise were consistent with (Foroozandeh & Asadi-Gharneh, 2021). in the current study, no significant effect of horticultural therapy except the mean memory score improvement has not reported. In explaining that inconsistency, we can point to the role of components such as the type of subject, the type of memory, the measurement tool, and the duration of horticultural therapy. One of the reasons for the inconsistency of the present study with the study of (Hoseinpoor Najjar et al., 2018) is probably related to the difference in the type of subjects, memory, and tools used in the two studies. what can be attributed to this inconsistency is the effect of time, as (Sempik et al., 2014) have also acknowledged it; In their study, they examined the effect of horticultural therapy in four periods of 30, 90, 180, and 365 days; and reached the conclusion that as the duration of horticultural therapy increases its effectiveness, so because of this reason, the lack of significant effectiveness in the present study is in the duration of the activity. On the other hand (Vancappel et al., 2021) emphasized the severity and decline of memory in depressed people, and this difference in the type of subjects of the present study and previous studies cannot be without an effect.

The present research results indicated that horticultural therapy did not have a significant effect on alexithymia, which is inconsistent with the results of studies by (Li et al., 2022) and (Oh et al., 2020). In the above studies the significant effect of horticultural therapy on emotional expression, recognition of emotions, and emotional intelligence was reported. In the study by (Li et al., 2022), college students were examined while in the present study, patients with persistent depression participated. It seems that in justifying this contradiction, we can pay attention to the data collection tool. In the present study, the Toronto Alexithymia Scale was used, which was different from the tools of the above studies. On the other hand, it can be said that people with persistent depressive disorder become demotivated and turn to isolation and loneliness. Therefore, they can no longer interact with their environment. To address the emotions and treat their alexithymia, which are common in these people, will need more time, and 8 weeks of horticultural therapy seems not to be enough to reduce alexithymia. Referring to the study of (Sempik et al., 2014), who believed that more time is needed for the results of horticultural therapy, this contradiction between the present study and other studies can be justified.

5. Conclusion

The purpose of this research was to investigate the effect of gardening activities on improving memory, alexithymia, and the severity of symptoms of patients suffering from persistent depression. According to the investigations and the findings of this study, it can be said that the results of the data analysis in the present study showed that gardening is effective in improving patients suffering from persistent depression. Gardening experiences affect people's stress and muscle tension cause changes in people's thinking and behavioral patterns, and enable them to deal with unpleasant emotions in the path of life to give a person a sense of release and hope for the ability to change. Planting is one of the activities that seems to have the biggest effect in this regard. Planting seeds taking care of the sprout watering it, using fertilizer and weeding can make the patient understand that he/she is also worth caretaking, and probably at this stage,

the patients start to focus on themselves, their clothes, and personal hygiene. It is noteworthy that the results of this research did not show a direct and significant effect of horticultural therapy on improving memory and reducing alexithymia, so two issues are important. Firstly, in some studies, memory improvement has been reported based on gardening activities, so it cannot be said with certainty that horticultural therapy does not affect memory improvement. Secondly, it is suggested that psychologists and counselors use horticultural therapy and provide gardening activities in natural environments to improve the reduction of depression symptoms in patients with persistent depressive disorder. In addition, considering the impact of gardening activities on reducing psychological problems and increasing vitality, it is suggested to educate the public about the positive effects of these types of activities through mass media. Because it seems that according to the existing economic and social conditions, all people need methods to increase mental health and mental well-being.

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Declaration of Interest

The authors of the study declare no conflict of interest related to the research.

Ethics Considerations

In this article, the subjects participated in the research knowingly and voluntarily, and the principle of confidentiality was respected. The current research has an ethical code with the number UMIN000049740.

Authors' Contributions

All authors contributed equally in this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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