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The Effect of Green Tea Drinking on the Depression of Elderly People

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A B S T R A C T

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The world's older population continues to grow at an unprecedented rate. Iran is 1 of the countries where the aging population is higher than the global average. Depression is 1 of the most common issues in older adults that can be managed by nonpharmacologic interventions such as the consumption of green tea. The aim of this study was to determine the effect of green tea consumption on depression in the elderly people. In this quasi-experimental study, 76 elderly people who were residents in a nursing home and met the inclusion criteria were selected through simple random sampling. Then, green tea in 3-g tea bags was brewed in 80°C water and half an hour after breakfast and lunch was given to the participants in a 5-week protocol. One day after the last time of brewing green tea, participants were assessed with a standard depression questionnaire. The obtained data were analyzed using SPSS Version 19 software (IBM Corp, Armonk, NY). The descriptive statistics and Wilcoxon statistical test analysis were also conducted at a significant level of $P < .05$. Based on the findings, the mean score of the participants' depression level decreased by 2.5 points after the intervention, which is statistically significant at a 99.9% confidence interval ($P = .001$). The findings also suggest that the severe depression decreased from 23.6% to 11.1%, moderate depression decreased from 45.8% to 26.4%, and mild depression increased from 30.6% to 45.8%; only severe and moderate depression cases were reduced ($P = .001$). The findings of the present study reveal that regular consumption of green tea can lead to a considerable reduction of depression in the elderly people. Accordingly, the consumption of this tea in the elderly people's diet is recommended, especially those who are resident in the care centers.

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Aging is a critical period of human life in which human beings are more exposed to potential threats such as chronic diseases, loneliness, and isolation, and because of physical and mental disabilities, their personal independence is often threatened.¹ The growth of the elderly population will be about 3.5 times the total population growth until 2025.² According to the general population and housing census of the Islamic Republic of Iran in 2016, about 9.3% of the population is aged 60 years or over.³ The percentage of the elderly population of Iran is projected to reach more than 12% in 2025.⁴ About 15% to 25% of older people have crucial psychological problems that can exert a potential influence on their physical illness.⁵ Depression is 1 of the most common mental health problems among the elderly people, which falls into the category of mood disorders,⁶ and is closely associated with the level of mortality in the elderly.⁷ The prevalence of obvious clinical signs of depression among the elderly in the community is 8% to 15%, and in the elderly living in nursing homes, it is about 30%.

According to the findings from previous studies, about 15% of the elderly suffer from a depressive mental disorder.⁵ Depression has devastating consequences.⁸ It affects the daily functioning and independence of individuals and reduces engagement in activities and attitudes toward personal hygiene.⁹ Depression in the last

period of life is not a natural part of elderly people's features, but it is a transient mood.⁵ Conditions such as depression, dementia, and anxiety exert a negative influence on decision making about managing physical illness at home and the ability to take care of oneself and perform daily activities. As the consequence of these problems, because of the imposed physical and psychological pressures, the other family members have to leave the elderly in care centers despite the high cost of care in these services.¹⁰ Various methods and techniques, such as medication, have been used to cope with depression.¹¹ Selective serotonin reuptake inhibitors, tricyclic antidepressants, and monoamine oxidase inhibitors are the instances of major medications prescribed to treat depression in the elderly. However, taking these drugs has side effects such as decreased bone mass, syncope, hyponatremia, fatigue, heart problems such as hypotension, dyskinesia, digestive problems, tremors, irritation, insomnia, postural hypotension, headache, palpitations, chest pain, sweating, nausea and vomiting, and a prolonged QT interval.⁹ In addition, because of the fact that the elderly usually take a lot of drugs due to various problems, the use of nonpharmacologic methods can be considered.¹¹

In recent years, special attention has been paid to complementary medicine in the treatment of diseases, in particular the

treatment of chronic diseases. Depression is 1 of the diseases for which researchers and psychiatrists have adopted various medical and nonpharmacologic methods for treatment. The use of group counseling, meaning therapy¹²; music therapy¹³; the use of Quranic sound¹⁴; and the use of herbal medicines such as licorice,¹⁵ lemon balm,¹⁶ and saffron¹⁷ as nonmedicinal methods are studied by researchers. The role of regular consumption of green tea has also been investigated in some studies in which the positive effects on reducing depression have been confirmed. The results of Farajzadeh et al,¹⁸ Li et al,⁷ and Pham et al¹⁹ revealed the effectiveness of tea consumption in reducing depression. Green tea stimulates the activity of the brain cells, especially in the memory-related areas, and increases the body resistance as well as calms the nerves and avoids stress. Consumption of this tea can be considered beneficial for many diseases because a large portion of diseases are directly related to stress and the nervous system.²⁰ In general, it can be expressed that studies have shown the positive effects of green tea extracts and green tea polyphenols on the proliferation and activity of bone cells,²¹ so catechins are hypothesized to help protect against these diseases by contributing, along with antioxidant vitamins (ie, vitamins C and E) and enzymes (ie, superoxide dismutase and catalase), to the total antioxidant defense system.²² On the other hand, there is evidence that epigallocatechin gallate of green tea extract is cytotoxic, and higher consumption of green tea can exert acute cytotoxicity in liver cells, a major metabolic organ in the body.²³

Guilan, a northern province in Iran, has the largest number of elderly and is 1 of the agricultural hubs in the production of tea and green tea. Furthermore, taking the tendency of Guilan people to consume tea, its availability to the public, and the positive effect of this tea on depression into account, it can be affordable for the elderly. Because of the importance of this issue, the present study was designed and conducted to determine the effect of green tea consumption on depression in the elderly residents in the Rasht Elderly Center in 2019.

Materials and Methods

The present study is a quasi-experimental clinical investigation that was performed in 2019 after receiving approval by the Research Ethics Committee of Guilan University of Medical Sciences with ethics code IR.GUMS.REC.1399.056. The sample study was 76 people from the Rasht Elderly Center selected based on simple random sampling. During the study, 3 of the participants withdrew,

and, unfortunately, 1 of them died. The study ended with 72 participants. The inclusion criteria were age 60 years and older; a score of 8 or higher on the Abbreviated Mental Test short cognitive test; mild, moderate, or severe depression according to the Geriatric Depression Scale (GDS); no history of hospitalization in psychiatric wards; the ability to tolerate green tea; not taking more than 3 cups of green tea a day; and not taking warfarin.

At first, the elderly with a depression score of 5 and above were selected by distributing the GDS and analyzing it. For intervention, with the coordination of the National Tea Research Center, green tea was prepared in 3-g packages after microbial tests. Because studies of synthetic pharmacologic reports and animal toxicology have shown that the consumption of concentrated extracts of green tea on an empty stomach will have adverse effects,²⁴ like other studies, it was decided to be consumed half an hour after breakfast and lunch.²⁴ The water is first heated to boiling (100°C) to destroy any microbes, then the temperature is lowered to 80°C and the tea is added to ensure the preservation of vitamins and amino acids in the leaves.²⁵ The time when the water reached the temperature of 80°C was applied at all times of brewing green tea. Green tea was brewed with the help of a center staff member, and the cups were standardized so that all the elderly drank the same volume and concentration of tea. The volume of each cup was 200 mL. In the absence of personnel, the second person, who had received the necessary training and was in the process of performing the work, cooperated in the intervention.

Zhang et al²⁴ and Dietz et al²⁵ suggested dietary restrictions for the participants to avoid distortion of the obtained results. These restrictions include nonconsumption of foods and beverages containing alcohol and herbal supplements during the study and also nonconsumption of foods and beverages containing caffeine from 4 hours before the measurement of variables. One day after the last time of consuming green tea, participants were evaluated with the GDS.²⁴

Research Questionnaires

Three tools were used in this study. The first instrument was a questionnaire of demographic information and clinical history. These tools include age, sex, marital status, number of children, level of education, income level, ability to tolerate green tea, daily consumption of green tea, underlying disease, physical defects such as blindness, history of high and low blood pressure, drug use, and disease. The second instrument was the Abbreviated Mental Test to assess the cognitive status of the elderly.

The third instrument was the GDS. The Iranian version of the 15-item questionnaire was used to assess depression in the elderly. In items 2, 3, 4, 6, 8, 9, 10, 12, 14, and 15, the “yes” answers are given 1 point, and in items 1, 5, 7, 11, and 13, the “no” answer is given 1 point; otherwise, they are given a point of 0. Based on the obtained scores in the questionnaire, the participants were classified into 4 categories: scores of 0 to 4, nondepressed; 5 to 8, mild depression; 9 to 11, moderate depression; and 12 to 15, severe depression. The Abbreviated Mental Test with 10 questions was first extracted by Hodkinson in 1972 from the 37-item Roth-Hopkins test, which had a good correlation score with pathological brain diseases at autopsy. This questionnaire has acceptable validity and reliability in different countries and has been standardized in our country by Bakhtiyari et al.²⁶ The internal reliability of the Persian version with a Cronbach alpha coefficient of 0.76 and its external reliability with an intergroup correlation coefficient of 0.89 were obtained, which indicate the acceptable reliability and validity of this version. The GDS questionnaire was first developed by Yesavage et al in 1986. The psychometric properties of GDS in Iran have been investigated by Malakouti et al.²⁷ According to Farajzadeh et al,¹⁸ the reliability

Table 1
The Frequency of the Participants' Demographic Characteristics

Variable		%	Frequency
Sex	Male	40.3	29
	Female	59.7	43
Marital status	Married	19.4	14
	Widow	63.9	46
	Divorced	2.8	2
	Single	13.9	10
Number of children	No child	27.8	20
	1 child	5.6	4
	2 children	12.5	9
	3 children	20.8	15
	4 children	16.7	12
Level of education	5 children or more	16.7	12
	Uneducated	50	36
	Under diploma	44.4	32
Monthly income	Diploma	5.6	4
	Under 10 million rial	68.1	49
	10-20 million rial	27.8	20
	30 million or more rial	4.2	3

Table 2
The Results of the Paired Sample *t* Test Before and After the Intervention

	Before Intervention	After Intervention	<i>t</i> Test
Mean score of the depression scale	2.765 ± 9.71	2.796 ± 7.24	<i>P</i> = .001

analysis of the Elderly Depression Questionnaire was conducted, and the Cronbach alpha was 0.79, which is within an acceptable range.¹⁸

Finally, using SPSS software Version 19 (IBM Corp, Armonk, NY), the obtained data were analyzed through descriptive statistics such as the mean, standard deviation, frequency, and percentage and parameter (in case of normal distribution) or nonparametric (in case of abnormal distribution) statistical tests. The significance level was considered less than .05.

Findings

This study was conducted by the participation of 76 elderly people, 3 of whom withdrew during the study, and, unfortunately, 1 also died. Therefore, the study ended with 72 participants. The mean age of the participants was 75 ± 9.79 years. The oldest participant was 100 years old, and the youngest was 60. The median age was 73 years, and the mode was 60 years; 40.3% (29 people) were male participants, and the majority of participants were widows (63.9%). Other demographic characteristics of the participants are listed in Table 1.

The results of the paired sample *t* test showed that the difference between the mean scores of the depression scale before and after the intervention with a confidence level of 99.9% (*P* = .001) was significant. In fact, after the intervention, the mean score of depression decreased by 2.5 points, which was statistically significant. This means that the consumption of green tea significantly reduced the rate of depression (Table 2).

The severity of depression decreased after the intervention. Severe depression decreased from 23.6% to 11.1%; moderate depression from 45.8% to 26.4%; and mild depression, which was 30.6% before the intervention, reached 45.8%. As shown in Table 2, the rate of severe and moderate depression was reduced. These differences were examined by the nonparametric Wilcoxon test. The findings revealed these results are statistically significant at a confidence interval of 99.9% (*P* = .000001, Table 3).

The independent sample *t* test was conducted to determine the difference between the mean scores of the depression scale between the sexes. The results indicated that at a 95% confidence interval and with normal distribution of the depression scale score before and after the study in the sexes, there was no statistically significant difference between their depression scores before (*P* = .831) and after the intervention (*P* = .623). A summary of the results is demonstrated in Table 4.

The results of the chi-square test also indicated that before and after the intervention the severity of depression in the sexes was not statistically significant. Furthermore, the results of the Wilcoxon test showed that the severity of depression in each sex before

and after the intervention was statistically significant at a confidence interval of 99.9%. These results are shown in Table 5.

Discussion

As the findings of this study suggest, consuming green tea twice a day after breakfast and lunch for 5 weeks can lead to a significant decrease of depression severity in the elderly (*P* < .05). After the intervention, the number of severe cases was reduced, and the number of moderate and mild cases was increased. In the present study, the results were not significantly different between the sexes, and, in fact, the positive effect of green tea consumption was the same in older men and women. In this regard, Farajzadeh et al¹⁸ also found that green tea consumption is associated with a reduction in depression level in the elderly. In a systematic study and meta-analysis, Grosso et al²⁸ found that tea consumption has a protective effect against depression. According to the findings of Pham et al¹⁹ in the Japanese context, the higher the consumption of green tea, the less depressive symptoms will be observed. In their study conducted in South Korea, Kim and Kim²⁹ found that those who drank at least 3 cups of green tea a week showed 21% less depressive symptoms than those who did not drink green tea at all. Niu et al³⁰ who examined the relationship between green tea consumption and the reduction of depressive symptoms in the elderly in Japan, found that when an older person drank 4 or more cups of green tea a day, they had 56% fewer depressive symptoms than those with the maximum consumption of 1 cup a day. Teng et al³¹ studied the effects of gamma aminobutyric acid in green tea on depression and found that this substance led to a reduction of depressive symptoms in mice. These studies all indicate the protective role of green tea against depression, which is in line with the results of the present study and confirm its findings.

In the large number of studies, the significance and value of green tea have been attributed to the presence of flavonoids, the most important of which are flavanols, or more precisely catechins.³² Catechins are antioxidants that can exert highly beneficial influences on the body. The biological properties of tea such as antioxidant,^{33,34} antimicrobial,^{34,35} anticancer,^{34,36} and antimutation³⁴ are considered to be related to catechins. Free radicals can have destructive effects on cells, especially DNA, proteins, and lipids, and by lipid peroxidation can eventually lead to apoptosis.³⁷ Catechins have been shown to have free radical scavenging properties and to act as biological antioxidants.³⁸ Catechins can inhibit superoxide and hydroxyl radicals.^{39,40} In addition to the direct antioxidant effects of catechins, they can indirectly increase the androgenic antioxidants of the body.³⁸ In a study by Nelson and Sharpless,⁴⁰ it was found that mice receiving green tea extract had increased levels of internal antioxidants, such as glutathione peroxidase, reductase, superoxide

Table 3
The Test Results for Differences in the Severity of Depression Before and After the Intervention

Variable	Level	Before Intervention		After Intervention		The results of the Wilcoxon Test Before and After Intervention
		Frequency	Percentage%	Frequency	percentage	
Depression severity	Lack of depression	0	0	12	16.7	<i>P</i> = .001 <i>z</i> = -5.938))
	Moderate	22	30.6	33	45.8	
	Mild	33	45.8	19	26.4	
	Sever	17	23.6	8	11.1	

Table 4
The Test Results for the Difference Between the Mean Scores of the Depression Scale Before and After the Intervention by Sex

		Man	Woman	Independent Sample t Test
Depression scale scores	Before intervention	2.9 ± 9.62	2.64 ± 9.7	0.831
	After intervention	2.89 ± 7.03	2.75 ± 7.37	

dismutase, and catalase. Laboratory studies as well as animal samples have confirmed the beneficial effects of green tea on depression. Zhu et al⁴¹ found that polyphenol in tea had antidepressant properties in a study of mice. Kakuda et al⁴² and Nathan et al⁴³ reported that L-theanine in green tea regulates concentrations and volumes of many neurotransmitters in the brain (dopamine, serotonin, and norepinephrine). Pham et al¹⁹ also found that folate (a substance with antidepressant properties found in tea) was higher in the serum of people who drank tea than people who did not drink tea. On the other hand, studies contrary to the findings of the present study and the previously mentioned research reported that regular consumption of green tea has no effect on reducing depressive symptoms. For example, Li et al⁷ found that depressive symptoms are reduced in black tea consumers, but drinking green tea and other types of tea does not have any antidepressant effect. Also, a study by Shen et al⁴⁴ showed that the consumption of black tea is associated with better cognitive function among the elderly aged 60 and older in China, whereas green tea had nothing to do with it. In the study by Shimbo et al,⁴⁵ after controlling for age, place of residence, and lifestyle, it was found that the consumption of green tea is not associated with mental health, including the reduction of depression.

The role of nurses in the control and treatment of chronic diseases such as depression is obvious, and the importance of this function is highlighted when the patient is someone who is not capable to care for him- or herself. The elderly is 1 of the age groups who need support and help to control their problems and diseases. Nursing is changing to meet the demands of individuals, society, and new health, and nurses can play a major role in providing community-based health services.⁴⁶ However, changes in the health care system, such as early discharge from the hospital and the prevalence of chronic diseases, have doubled the families' responsibility in terms of elderly caring, which means that nurses must play a supportive role in helping the family.⁴⁷ In recent years, it has been apparent that the people, especially the elderly, have a special attitude toward the use of complementary medicine in the treatment of diseases, and the use of herbal medicines and common drinks in the treatment of diseases is more pleasant for many elderly people than the consumption of chemical drugs. The use of green tea in the treatment and control of depressive symptoms provides an opportunity for caregivers and nurses of the elderly

with depression to work more closely with them in the treatment process and keep patients away from side effects of chemical drugs.

On the other hand, Guilan Province is 1 of the tea production hubs in the country and even in the Middle East, and this product is easily available to everyone, which makes the elderly more likely to consume tea. However, the results of both studies are significant, but what can be determined is that the consumption of green tea has many benefits, and the recommendation to consume it in the elderly can be more emphasized. Because of the antidepressant and energizing properties of green tea, the authors of this article advise the elderly to drink green tea before exercising and social activities.

Limitations of the Study

One of the limitations of this study is the lack of a control group to compare and control the role of confounding variables, so it is suggested that this limitation be removed in other studies.

Conclusion

The ever-growing population of the elderly in the Iranian society alongside with all over the world necessitates emergent attention to the problems of the elderly. Depression is 1 of the most common problems in old age that can be controlled with multiple medications. One of the things that helps to control depression is the use of traditional medicine and supplements, which are also very popular among the elderly in our country. The present study showed that regular consumption of green tea can significantly reduce the rate of depression in the elderly, so daily and balanced consumption of green tea in the elderly who are not contraindicated can be an effective strategy to reduce depression, and it can be incorporated into the diet in a nursing home.

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Table 5
The Results of the Differences Between Depression Severity Before and After the Intervention

Variable	level	Man		Woman		Results of the Chi-Square Test	
		Frequency	Percentage	Frequency	Percentage		
Depression level	Before intervention	No depression	0	0	0	0.279	
		Mild	11	37.9	11		25.6
		Moderate	10	34.5	23		53.5
		Severe	8	27.6	9		20.9
		Total	29	100	43		100
	After intervention	No depression	5	17.2	7		16.3
		Mild	15	51.7	18		41.9
		Moderate	5	17.2	14		32.6
		Severe	4	13.8	4		9.3
		Total	29	100	43		100
Nonparametric Wilcoxon test		$P = .001$ $z = -4.735$		$P = .001$ $z = -3.626$			

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