



The effect of green tea consumption on depression

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Abstract

Introduction: Depression has become an epidemic disorder in the world, which according to the World Health Organization is the first debilitating factor in the world. There are different approaches to its treatment, including the use of complementary medicine and herbal medicines. In recent years, there have been reports about the protective role of tea consumption in reducing the risk of depression, especially in the elderly. This study aimed to determine the effect of tea consumption on depression by reviewing quality published studies in this regard.

Methods: To conduct a comprehensive review on the topic of tea and depression between 2005 and 2024, we used various search engines such as Persian language scientific resources SID and Magiran, as well as Google Scholar, Web of Science, PubMed, and Scopus. The search was conducted using the keywords "tea" and "depression" in combination.

Results: Out of 215 articles that were reviewed, the final analysis was conducted on 22 of them. Among these, 20 articles validated the correlation between tea consumption and a decrease in symptoms of depression. In most of these studies, it was highlighted that consuming at least three cups of tea daily had a positive impact.

Conclusion: The results of this study have verified the advantages of drinking over 3 cups of green tea per day. It is recommended to consume green tea in various groups, especially in populations with a high incidence of depression, such as the elderly living in boarding centers.

Keywords: Herbal therapy, Tea, Depression, Green tea

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Introduction

The world is facing a challenge as the population ages, particularly in developing countries where this issue is expected to be more significant in the years to come. The percentage of elderly people aged 60 and above has increased globally from 9% in 1994 to 12% in 2014 (1). This growth is predicted to be about 3.5 times by 2025, while the total population will also increase. The growth of the total population reaches (2). According to the general population and housing census of Iran in 2015, about 9.3% of the country's population is made up of elderly people over 60 years old (3). It is predicted that the percentage of Iran's elderly population will reach more than 12% in 2025 (4). Aging is a natural process and one of the stages of human growth and development. During this process, changes occur in the physiological, psychological and social aspects of people. This process is gradual and progressive and diet, environment, personal habits and genetic factors affect its severity and extent (5). These changes in homeostasis that occur during old age can lead to various diseases, including stroke, dementia, mental illness, and cardiovascular diseases (6).

At present, depression is one of the most common mental illnesses that has become a general problem and is widespread throughout the world (7). Depression includes a set of mental disorders that affect people's activity, behavior and thoughts (8). In depressed patients, the feeling of sadness and the decrease in the feeling of pleasure and interest leads to a decrease in personal and social functioning, which is accompanied by changes in sleep, nutrition, energy level and motivation (9). According to the report of the World Health Organization, depression is the most important debilitating factor worldwide (8). Depression is usually associated with other diseases. Such diseases may precede depression and cause depression or be its consequence and result. The priority of diagnosing and treating depression should remain consistent despite differences in people and conditions (10). Age is an independent and important variable that can affect the appearance of depression, its symptoms and its natural course. Generally, depression is a major cause of death worldwide, which is associated with a reduction in social, occupational, and interpersonal roles. As we age, this dreaded mental state is often exacerbated by

environmental and physical factors. In general, demographic characteristics (age, gender, place of residence, level of education, occupation, type of family, cohabitation with spouse, economic dependence), lifestyle (inactivity, disability in the areas of mobility and displacement, duties Home and family and social participation, nutritional status, having fun activities, cultural variables, religion, alcohol consumption, smoking) psychological variables (social acceptability and extroversion, duty orientation, dissatisfaction with personal income, loneliness, sadness) and sadness, perception of general health), physiological variables (average red blood cells, hemoglobin level or hematocrit values, degree of anemia, low weight, chronic diseases, sleep disorders, use of sleeping pills) are predictive factors. They cause depression in the elderly (11). These issues have caused mental problems to be observed in old age. About 15 to 25 percent of elderly people have important mental problems, which have a potential effect on their physical diseases (12). The feeling of depression is the most common problem that threatens mental health among the elderly, which is included in the category of mood disorders (13). Depression is associated with significant prevalence and mortality in the elderly (14). The prevalence of obvious clinical symptoms of depression among the elderly in the community is 8-15% and in the elderly living in nursing homes, it is about 30%. According to research findings, about 15% of the elderly suffer from depression (12).

Antidepressants, psychosocial interventions, and in severe cases, shock therapy are used to treat depression (9). Although many drugs are available for the treatment of psychiatric disorders, including depression, researchers and psychiatrists believe that a large number of patients have not recovered after taking these drugs, and some are also able to tolerate the side effects of these drugs (15). Today, non-drug treatments and treatments with fewer side effects have received much attention in the control of some psychiatric syndromes, one of which is the use of medicinal plants (16), which has led researchers and psychiatrists to use of non-invasive and low-complication methods such as the use of medicinal plants (17). Throughout history, medicinal plants have established their place in human life as medicinal and

therapeutic agents and are used in various forms such as tablets, capsules, and ointments (18).

Tea (*Camellia Sinensis L*) is one of the oldest drinks in the world, which was first discovered by the ancient Chinese, and then other countries also learned how to produce it (19). Tea is one of the oldest drinks in the world, which was first discovered in ancient China. This plant is cultivated well in tropical and semi-tropical areas that have sufficient annual rainfall, proper drainage and acidic soil (20). After water, tea is the most popular and consumed drink in the world (21). Green tea is one of the plants that has received a lot of attention, and it is generally considered a common tea drink all over the world (18). Green tea strengthens and stimulates the activity of brain cells, especially in the parts related to memory. Also, by drinking green tea, the body becomes more resistant and calms the nerves and relieves nervous tension. Since many diseases are directly related to stress and the nervous system, drinking this tea can be considered beneficial for many diseases (22). Various studies have been conducted on the relationship between tea consumption and depression. However, the findings in this field are often contradictory. Therefore, we decided to conduct a comprehensive review to summarize the various findings. Table 1 provides an overview of key information related to tea, specifically focusing on its historical significance, cultivation requirements, popularity, the importance of green tea, its potential benefits for brain function and stress relief, and the connection between tea consumption and depression.

Table 1. The essential details about tea, include its origins, cultivation conditions, global popularity, the significance of green tea, potential cognitive and stress-relief benefits, and the research on tea's association with depression.

Topic	Information
Tea (<i>Camellia Sinensis L</i>)	- One of the oldest drinks in the world. - First discovered by ancient Chinese
Tea Cultivation	- Thrives in tropical and semi-tropical areas. - Requires sufficient annual rainfall, proper drainage, and acidic soil
Popularity	- Second most popular and consumed drink in the world after water
Benefits of Green Tea	- Strengthens and stimulates brain cell activity, particularly related to memory. - Increases resistance and promotes relaxation, relieving nervous tension. - Potentially beneficial for various diseases related to stress and the nervous system.

Methods

The current review study was conducted to investigate the effect of tea consumption on depression in the elderly. To find articles and studies related to the topic, search engines of Persian language scientific resources SID, Magiran and English language Google Scholar, Web of Science, PubMed, and Scopus were used. The keywords tea and depression were used in combination. The study period was between 2005 and 2024. The inclusion criteria for this study were all original Persian and English articles and reviews whose full text was available. Initially, two researchers conducted a search using selected keywords across all relevant databases. The articles found were then saved. In the second step, both researchers reviewed the saved articles and agreed to exclude any that were not related to the subject of the study. In the next step, duplicate and similar articles were removed. The steps of selecting the articles are shown in Figure 1.

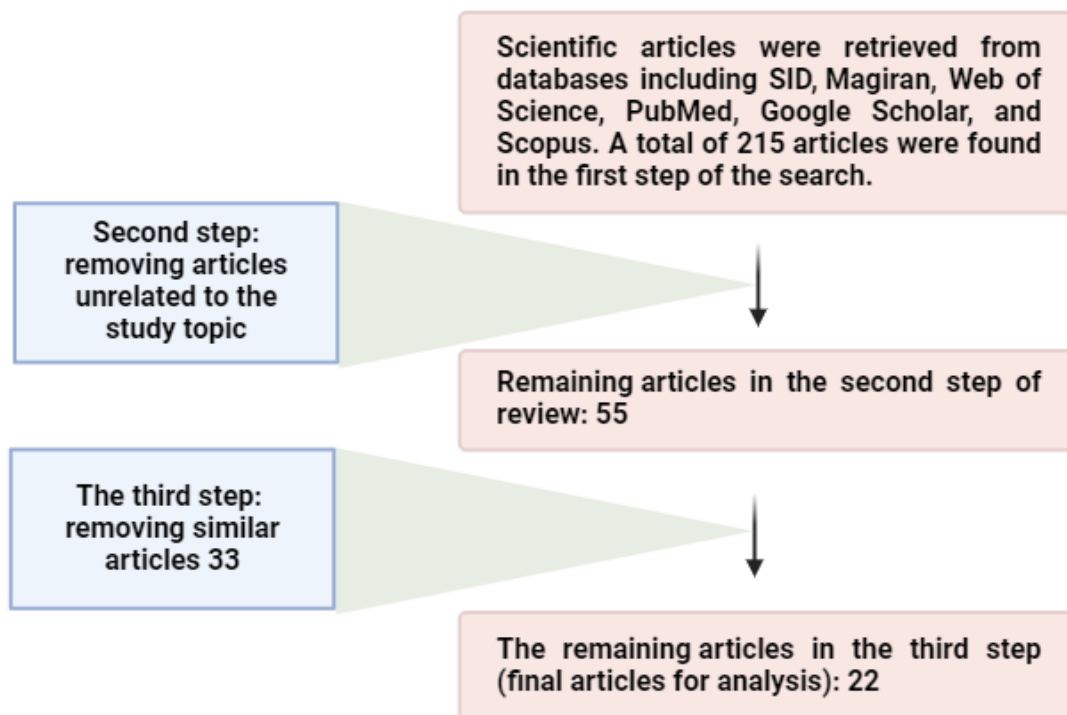


Figure 1. The steps and description of selecting the articles.

Results

A significant portion of this research was published in 2021. In the first step of the present study, 215 articles with the desired keywords were found, after which 160 were removed, and then the similar articles were left out so that the final analysis was done with 22 articles. One article was published in Farsi and 21 studies were published in English. The year of publication of the articles was between 2005 and 2024. The target population of these studies includes; They were elderly, middle-aged, diabetic and cancer patients. studies in terms of research type; four articles, it was a systematic review and meta-analysis, and the other articles were cross-sectional and cohort analysis, and only one article was a control case. The findings of 19 articles provide evidence that regular tea consumption (green and black) reduces the risk of depression symptoms, but 5 articles did not report a significant relationship between tea consumption and depression risk reduction. The results of two articles out of three review and meta-analysis studies show that tea consumption reduces the risk of depression. In this regard, Dong et al. found that consuming 3 or more cups of tea per day reduces the

risk of depression (23). Farajzadeh et al. found that those who drank tea had a 35% lower risk of depression symptoms than those who did not (24). On the other hand, Grosso et al. reported that the relationship between green tea consumption and the risk of depression is insignificant (25). In general, 19 articles confirmed the relationship between tea consumption and reducing the risk of depression, and in most of these studies, daily consumption of at least three cups was emphasized. Some studied green tea, some black tea, and some studied both types of tea. Of the 22 articles that investigated the effects of tea, 3 articles (13%) did not report a significant relationship between tea consumption and the risk of depression, but another 19 articles (86%) confirmed the positive and significant effect of tea on reducing the risk of depression. Of the articles that specifically investigated the effects of green tea, 2 articles reported that green tea consumption does not affect reducing depression. These results are detailed in Table 2.

Table 2. Information on selected articles on the relationship between green tea consumption and depression

Author(s)	Year	Title	Target Group	Study Type	Intervention/Independent Variable	Key Findings	Final Conclusion
Farajzadeh & et al	2017	Does tea consumption reduce the chances of depression in the elderly? Case-control study	Iranian elderly	Case-control	Daily tea consumption	Elderly individuals who consume more than 3 cups of tea per day have a 66% lower chance of depression compared to those who consume less (p=0.001).	Tea consumption reduces the risk of depression in the elderly
Pham & et al	2014	Green tea and coffee consumption is inversely associated with depressive symptoms in a Japanese working population	Japanese men and women (68-20 years old)	Cross-sectional, analytical	Daily green tea and coffee consumption, estimated caffeine intake	Individuals who consume 4 or more cups of green tea per day have a 51% lower prevalence of depressive symptoms compared to those who consume less than 1 cup (p=0.01).	Coffee and green tea consumption may have a protective role against the development of depressive symptoms
Niu & et al	2009	Green tea consumption is associated with depressive symptoms in the elderly	Japanese elderly	Cross-sectional, analytical	Green tea consumption status through a self-administered questionnaire	Elderly individuals who consume 4 or more cups of green tea per day have a 56% lower prevalence of depressive symptoms compared to those who consume a maximum of 1 cup (p=0.001).	Increased consumption of green tea leads to a decrease in depressive symptoms
Grosso & et al	2016	Coffee, tea, caffeine and risk of depression: A systematic review and dose-response meta-analysis of observational studies	Published articles from January to June 2015	Meta-analysis	Investigation of the relationship between tea consumption and the occurrence of depressive symptoms	A weak association between tea consumption and the risk of depression was observed.	The results of this meta-analysis indicate an insignificant relationship between tea consumption and the risk of depression.
Ruusonen & et al	2010	Coffee, tea and caffeine intake and the risk of severe depression in middle-aged Finnish men: the Kuopio Ischemic Heart Disease Risk Factor Study	Middle-aged Finnish men	Cohort study	Categorization of individuals based on daily tea and coffee consumption into 4 groups	No association was found between tea consumption and the risk of developing depressive symptoms.	Coffee consumption may reduce the risk of depression, while no association was found for tea and caffeine consumption.
Chen & et al	2010	Exercise, Tea Consumption, and Depression Among Breast Cancer Survivors	Chinese women with breast cancer (stage 0-3)	Cohort (April 2002 to December 2006)	Assessment of tea consumption in the past 18 months through interviews	Regular tea consumption (100 grams of dried tea leaves per month) leads to a reduction in the occurrence of depression.	Regular tea consumption reduces the risk of developing depression.
Park & Moon	2015	Coffee and depression in Korea: the fifth Korean National Health and Nutrition Examination Survey	South Korean population (97-20 years old)	Cross-sectional, analytical	Assessment of daily coffee and tea consumption through a questionnaire	A weak association was found between green tea consumption and the risk of depression.	Green tea consumption has no significant effect on the occurrence of depression.

Author(s)	Year	Title	Target Group	Study Type	Intervention/Independent Variable	Key Findings	Final Conclusion
Dong & et al	2015	Tea consumption and the risk of depression: A meta-analysis of observational studies	Published articles from the beginning to August 2014	Meta-analysis	Investigation of the relationship between tea consumption and the occurrence of depressive symptoms	Consuming 3 or more cups of tea per day reduces the risk of depression.	Tea consumption leads to a decreased risk of developing depressive symptoms.
Guo & et al	2014	Sweetened Beverages, Coffee, and Tea and Depression Risk among Older US Adults	US adults aged 50 to 71 years	Prospective cohort study	Tea consumption assessed through the National Health and Nutrition Examination Survey	No association was found between tea consumption and the risk of depression.	Tea consumption does not influence the occurrence of depression.
Omagari & et al	2014	Coffee consumption is inversely associated with depressive status in Japanese patients with type 2 diabetes	Japanese patients with type 2 diabetes	Cross-sectional, analytical	Green tea, black tea, and coffee consumption assessed through a questionnaire	Coffee consumption was associated with a reduction in depression, but green tea and black tea consumption did not affect depression in patients with type 2 diabetes.	Green tea consumption did not have an effect on reducing depression.
Feng & et al	2013	Tea Consumption and Depressive Symptoms in Older People in Rural China	Older people in rural China	Cross-sectional, analytical	Tea consumption assessed through interviews	After adjusting for cardiovascular diseases, regular tea consumption was associated with a reduction in depressive symptoms in older people in rural areas.	Tea consumption reduces the risk of depression in older people.
Himtikka & et al	2005	Daily tea drinking is associated with a low level of depressive symptoms in the Finnish general population	Finnish general population	Cohort study	Daily tea consumption assessed through a questionnaire	Regular daily tea consumption is associated with a lower occurrence of depressive symptoms.	Tea consumption reduces the occurrence of depression.
Akinori Yaegashi & et al	2022	Green Tea Consumption and Risk of Depression Symptoms: A Systematic Review and Meta-Analysis of Observational Studies	-	Meta-analysis	Association between green tea consumption and the risk of depression symptoms	High consumption of green tea is inversely associated with depression symptoms.	Green tea consumption reduces the risk of depression symptoms.
Ratani & Malik	2022	Therapeutic Properties of Green Tea: A Review	-	Review	Therapeutic properties and various compounds in green tea	Strong evidence suggests that daily consumption of green tea, due to its antioxidant properties, may be used as a preventive measure for various types of cancer and other diseases.	Green tea consumption reduces the risk of depression and various types of cancer.

Author(s)	Year	Title	Target Group	Study Type	Intervention/Independent Variable	Key Findings	Final Conclusion
Min Luo & et al	2021	Effects and Mechanisms of Tea on Parkinson's Disease, Alzheimer's Disease and Depression	Narrative review	-	Tea consumption and its effects on Parkinson's disease, Alzheimer's disease, and depression	Tea consumption had protective effects against Parkinson's disease, Alzheimer's disease, and depression.	Tea can be used for the prevention and treatment of Alzheimer's disease and depression.
Xinrong Dong & et al	2022	Green tea consumption and risk of depressive symptoms: Results from the TCLSIH Cohort Study	Participants aged 25 to 90 years	Cohort study	Green tea consumption and its association with depressive symptoms	During a follow-up period of 14,661 person-years (with an average follow-up of 2.0 years), 1,064 cases of depressive symptoms occurred.	The prospective study showed that regular green tea consumption is associated with a reduced risk of depressive symptoms in the general population of China.
Zhenyu Wan & et al	2023	Long-Term Consumption of Green Tea Can Reduce the Degree of Depression in Postmenopausal Women by Increasing Estradiol	Postmenopausal women	Case-control study	Long-term green tea consumption and its effects on inflammation, endocrine glands, and depression	Significant differences in insomnia, degree of depression, BMI, SII, and estradiol levels were found between the intervention and control groups.	Long-term green tea consumption can reduce the risk of depression in postmenopausal women by reducing inflammation and increasing estradiol levels.
Ke Shen et al	2019	Association between tea consumption and depressive symptoms among Chinese older adults	Chinese adults aged over 65 years	Longitudinal study	The impact of tea consumption on depressive symptoms	Regular and continuous tea consumption has an effect on depressive symptoms among older adults, with a greater effect reported in very old male adults compared to younger female adults.	Regular and continuous green tea consumption is an effective and cost-effective method for reducing depressive symptoms in older adults.
Yao Yao et al	2021	Type of tea consumption and depressive symptoms in Chinese older adults	Chinese adults aged 65 to over 100 years	Case-control study	The influence of different types of tea on depressive symptoms in older adults	Consuming 1 to 2 cups of green tea per day reduces the chance of developing depressive symptoms by 50%. Age, gender, and type of tea have an impact on depressive symptoms in older adults, and further clinical trials are needed.	-

Discussion

Depression has become a global pandemic in recent years. The elderly are more vulnerable to depression due to several reasons such as suffering from chronic diseases like diabetes, living alone, losing their loved ones or spouse, losing their independence in carrying out daily tasks, reduced social participation, and living in nursing homes. As a result, the prevalence of clinical symptoms of depression among the elderly in the community ranges from 8-15%, while it's about 30% for those living in nursing homes (12).

In order to control this pandemic, there are different ways of changing lifestyles, reducing environmental factors, identifying patients in the early stages and treating them using chemical drugs, psychological techniques and complementary medicine. Complementary medicine and the use of herbal medicines as part of it have a special place in modern nursing. Currently, nurses play a more supportive role than before and make double efforts to promote self-care behaviors. Complementary medicine can be one of the appropriate tools to play the supportive role of nurses due to its popularity among people and its non-invasive nature. The treatment of depression, as a chronic disease, certainly needs to improve the patient's self-care behaviors, and a comprehensive nurse should try in this direction by playing a supportive role. Tea is one of the popular drinks among different strata of people, which has a high consumption in Iran as well. It is cultivated as a strategic agricultural product in the north of the country and is available to everyone at a cheap price. There are reports on its favorable effects in reducing depression symptoms, which shows its protective role against depression. In the present study, the available evidence in this field was reviewed. And finally, 22 completely related articles that met the inclusion criteria were analyzed in this connection.

These articles included review, meta-analysis, cohort, cross-sectional, and case-control studies with different target groups. The terms tea and green tea were used in the title of this article. The findings of the studies are mainly in favor of the positive effect of drinking tea on reducing the risk of depression, so 67% of the 15 articles (10 articles) have confirmed the positive effect

of tea on reducing the risk of depression. In this regard, the chance of depression in the elderly who consume more than 3 cups of tea per day is 66% lower than those who consume less than 3 cups of tea per day ($P=0.001$) (26). Esmailpour-Bandboni et al. also emphasized that regular consumption of green tea significantly reduces depression in the elderly (27). Li et al reported that drinking black tea reduces depression, but green tea has no effect (14). Farajzadeh et al found that people who drank tea had a 35% lower risk of depressive symptoms compared to those who did not drink tea (24). Chen et al also reported that regular consumption of tea (at the rate of 100 grams of dry tea leaves per month) reduces the incidence of depression (28). In this regard, the study of Dong et al showed that consuming 3 or more cups of tea per day reduces the risk of depression (23). The findings of the study by Feng et al in China also revealed that after adjusting for the effects of cardiovascular diseases, it was found that regular consumption of tea reduces depression in the elderly living in rural areas (29). Hintikka et al, one of the oldest studies in this field, confirmed the effects of regular daily consumption of tea on reducing the incidence of depression symptoms (30).

A research was conducted to investigate the potential of green tea in improving mood similar to depression, using an animal model in an experimental setting. The study's findings revealed that the stress-reducing effects of green tea were influenced by the ratio of caffeine to epigallocatechin gallate (CE/TA). When mice were administered green tea components with CE/TA ratios ranging from 2 to 8, it resulted in the suppression of depression-like behavior, adrenal hypertrophy, and brain inflammation. Furthermore, mice with a CE/TA ratio of 4 exhibited sustained expression of Npas4, a protein associated with reduced stress response in anxiety and depression. In clinical trials, green tea with CE/TA ratios of 3.9 and 4.7 demonstrated a decrease in susceptibility to subjective depression (31).

Research carried out in Japan examined the potential link between consuming green tea and experiencing depressive symptoms. The study involved 1987 employed individuals, of which 916 initially did not exhibit any depressive symptoms. To assess green tea

consumption, participants completed a reliable diet history questionnaire, while depression symptoms were evaluated using the CES-D scale. Multiple logistic regression was utilized to estimate the odds ratio of depressive symptoms based on the intake of green tea. The findings indicate that, contrary to previous cross-sectional and prospective studies suggesting an inverse association, there is no evidence of a connection between consuming green tea and experiencing depressive symptoms among the Japanese population (32).

A study was conducted to examine the impact of consuming green tea over an extended period on levels of inflammation, endocrine function, and depression among postmenopausal women. The research involved 386 postmenopausal women residing in a village known for tea production. The findings revealed a notable distinction between the two groups in relation to insomnia, depression, BMI (body mass index), SII (systemic immune-inflammation index), and estradiol levels. The consumption of green tea demonstrated the potential to decrease the risk of depression by mitigating inflammation and increasing estradiol levels. As a result, this study suggests that promoting green tea consumption as a healthy lifestyle habit is beneficial for postmenopausal women (33).

On the other hand, in the study of Grosso et al, a weak relationship between tea consumption and the risk of depression was observed (25). Ruusunen et al also did not observe a relationship between tea consumption and the risk of depression symptoms in their study (34). The findings of the study by Guo et al also did not show a relationship between tea consumption and the incidence of depression (35).

Concerning green tea consumption, Pham et al reported that people who drank 4 cups or more of green tea per day had 51% less depressive symptoms than those who drank less than 1 cup of green tea per day ($P=0.01$) (36). The study by Niu et al also revealed that the elderly who drink 4 or more cups of green tea per day show 56% fewer symptoms of depression than those who drink up to 1 cup of green tea per day. $P = 0.001$ (37). Kim et al also found that those who drink at least 3 cups of green tea per week had 21% less depressive symptoms than those who did not drink green tea at all (38). Another study observed a weak relationship

between green tea consumption and the risk of depression. The findings of the study of Omagari et al also showed that coffee consumption is related to reducing depression, but green tea and black tea consumption does not affect depression in patients with type 2 diabetes (39). Today, along with human studies, veterinarians recommend green tea consumption to reduce depression symptoms in animals. In an animal model of depression that was created by administering lipopolysaccharides (LPS) in mice, it was observed that daily consumption of green tea products reduced the intensity of depression symptoms in the animal and gradually cured the depression. Some studies have examined the combined and comparative consumption of black tea, coffee, and green tea in the elderly and middle-aged population, the result of which was the positive and significant effect of green tea consumption in reducing depression symptoms, especially in the elderly population. The little contradiction that was observed in the results of some studies can be related to the type of tea preparation, amount, time, and volume consumed as well as the number of cups per day, so in one study the researchers believed that the method of tea preparation in the actualization of its properties is effective (26). The type of study, the target group, and the amount of tea consumed during the day have also been reported as reasons for the difference in the findings of some studies.

Conclusion

The results of this study confirm that drinking three or more cups of tea per day has beneficial effects, particularly in populations with high rates of depression, such as the elderly residing in boarding centers. It is recommended to prepare green tea using water at 80 degrees Celsius and to drink it half an hour after each meal, including breakfast, lunch, and dinner.

Conflict of interest

The authors declare no conflicts of interest for this research.

Authors contributions

MEB performed the analysis and wrote the paper, and **AZT**, **PR**, and **ZS** contributed to some parts of the manuscript and collected data.

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