EFFECTS OF STEWED ONION ON ALZHEIMER'S DISEASE

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Abstract

Background: Alzheimer's disease is a progressive neurodegenerative disorder characterized by cognitive decline, memory impairment, and loss of daily functional abilities. Despite the widespread use of standard pharmacotherapy, including cholinesterase inhibitors and NMDA receptor antagonists, treatment outcomes remain limited. Natural products rich in antioxidants and neuroprotective compounds have attracted increasing scientific attention as potential adjunctive or alternative therapeutic approaches.

Objective: To evaluate the effectiveness of regular consumption of thermally processed (stewed) onion (*Allium cepa*) in patients with Alzheimer's disease and to compare its effects with those achieved through standard pharmacotherapy.

Methods: A comparative study was conducted involving patients diagnosed with Alzheimer's disease. Participants were divided into two groups: the first group received standard pharmacological treatment according to established clinical guidelines, while the second group regularly consumed thermally processed onion as a dietary intervention. Cognitive function, memory performance, daily living activities, and behavioral symptoms were assessed using standardized neuropsychological evaluation methods.

Results: Patients who consumed thermally processed onion demonstrated significant improvements in cognitive performance, memory retention, and behavioral stability compared with those receiving standard pharmacotherapy alone.

The observed effects may be associated with the antioxidant, anti-inflammatory, and neuroprotective properties of bioactive compounds present in onions, including quercetin, flavonoids, and sulfur-containing substances.

Conclusion: Regular consumption of thermally processed onion may represent a promising nutritional intervention for patients with Alzheimer's disease and could potentially provide greater benefits than conventional pharmacotherapy in certain clinical outcomes. Further randomized controlled trials with larger sample sizes are required to confirm these findings and clarify the underlying biological mechanisms.

Keywords: *Allium cepa, onion, neuroprotection, cognitive function, memory impairment, antioxidants.*

INTRODUCTION

Alzheimer's disease (AD) is the most common cause of dementia and represents a major global public health challenge due to the progressive decline of memory, cognition, and functional independence. The prevalence of AD continues to increase with population aging, leading to substantial social, economic, and healthcare burdens worldwide [1]. Neuropathologically, the disease is characterized by the accumulation of extracellular amyloid-β plaques, intracellular neurofibrillary tangles, synaptic dysfunction, neuronal loss, and progressive brain atrophy [2,3]. Oxidative stress, mitochondrial dysfunction, and chronic neuroinflammation are considered central mechanisms involved in the initiation and progression of neurodegenerative changes in AD [4,5]. These pathological processes ultimately contribute to cognitive impairment and deterioration of daily living activities.

Current pharmacological treatment of Alzheimer's disease mainly includes acetylcholinesterase inhibitors and N-methyl-D-aspartate (NMDA) receptor antagonists. Although these medications may temporarily improve cognitive symptoms and delay disease progression, their overall effectiveness remains limited, and they do not completely halt neurodegeneration [6,7]. Consequently, increasing

attention has been directed toward nutritional and phytotherapeutic approaches that may exert neuroprotective effects through multiple biological pathways [8].

Among plant-derived products, onion (*Allium cepa*) has attracted scientific interest due to its high content of biologically active compounds, including quercetin, flavonoids, organosulfur compounds, and various antioxidants [9,10]. Quercetin is one of the most abundant flavonoids found in onions and has demonstrated potent antioxidant, anti-inflammatory, and neuroprotective properties in experimental studies [11]. Research suggests that quercetin may reduce oxidative damage, inhibit neuroinflammatory responses, decrease amyloid-β aggregation, and modulate cholinergic neurotransmission, all of which are relevant to the pathophysiology of Alzheimer's disease [12,13].

Recent investigations have indicated that quercetin can activate endogenous antioxidant defense systems, including the Nrf2 signaling pathway, while suppressing the production of pro-inflammatory cytokines such as tumor necrosis factor-α (TNF-α) and interleukin-6 (IL-6) [14,15]. Furthermore, experimental evidence suggests that quercetin may enhance neurogenesis, improve synaptic plasticity, and support learning and memory functions in animal models of neurodegeneration [16,17].

Thermal processing of onions may increase the bioavailability of certain phytochemicals while maintaining significant antioxidant activity, making stewed onion a practical dietary intervention for elderly individuals [18]. However, despite growing evidence regarding the neuroprotective potential of onion-derived compounds, comparative studies evaluating the effectiveness of regularly consumed thermally processed onion versus conventional pharmacotherapy in patients with Alzheimer's disease remain limited [19,20].

Therefore, the present study aimed to compare the effects of regular consumption of thermally processed onion (*Allium cepa*) with standard pharmacotherapy on cognitive and clinical outcomes in patients with Alzheimer's

disease. The study hypothesized that the neuroprotective and antioxidant properties of onion-derived bioactive compounds may provide measurable benefits in slowing cognitive decline and improving overall patient functioning.

MATERIALS AND METHODS

Study Design and Participants

This comparative prospective study was conducted among patients diagnosed with Alzheimer's disease according to established clinical diagnostic criteria. The study included a total of 60 patients who were recruited from outpatient and inpatient neurological and psychiatric healthcare facilities. The participants were divided into two equal groups consisting of 30 patients each.

The control group received standard pharmacological treatment for Alzheimer's disease, including acetylcholinesterase inhibitors and/or N-methyl-D-aspartate (NMDA) receptor antagonists according to current clinical guidelines. The intervention group consumed thermally processed (stewed) onion as a dietary intervention throughout the study period.

Inclusion Criteria

- Patients aged 60 years and older.
- Clinically diagnosed Alzheimer's disease.
- Mild to moderate cognitive impairment.
- Ability to consume oral nutrition independently or with minimal assistance.
- Written informed consent obtained from the patient or legal representative.

Exclusion Criteria

- Severe Alzheimer's disease requiring total dependence.
- Other forms of dementia.
- Serious hepatic, renal, cardiovascular, or oncological diseases.
- Known allergy or intolerance to onion or onion-containing products.

- Participation in another clinical trial during the study period.

Intervention Protocol

Patients in the intervention group consumed 100 grams of thermally processed (stewed) onion daily for 24 weeks. The onion was prepared by slow cooking without deep frying in order to preserve its bioactive compounds, including quercetin, flavonoids, and sulfur-containing antioxidants. Participants were instructed to maintain their usual dietary habits throughout the study.

The control group received standard pharmacotherapy alone and did not receive any onion-based dietary supplementation.

Clinical Assessment

Baseline evaluations were performed before the initiation of treatment and repeated after 24 weeks. Cognitive and functional status were assessed using standardized clinical instruments:

- Mini-Mental State Examination (MMSE)
- Montreal Cognitive Assessment (MoCA)
- Alzheimer's Disease Assessment Scale – Cognitive Subscale (ADAS-Cog)
- Activities of Daily Living Scale (ADL)

Behavioral and psychological symptoms were additionally evaluated through caregiver interviews and clinical observation.

Outcome Measures

The primary outcome measure was the change in cognitive performance as assessed by MMSE and MoCA scores.

Secondary outcome measures included:

- Memory performance
- Attention and executive functioning
- Daily living activities
- Behavioral and psychological symptoms

- Overall clinical improvement

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics software (Version 26.0). Continuous variables were expressed as mean ± standard deviation (Mean ± SD). Differences between groups were analyzed using the independent samples t-test, while within-group comparisons were performed using the paired t-test. Categorical variables were analyzed using the chi-square test.

A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. The study protocol was reviewed and approved by the institutional ethics committee of Andijan State Medical Institute. Written informed consent was obtained from all participants or their legal representatives before enrollment in the study.

RESULTS

A total of 60 patients completed the study, with 30 participants in the standard pharmacotherapy group and 30 participants in the thermally processed onion group. No serious adverse effects were reported during the study period. Mild gastrointestinal discomfort was observed in two participants from the onion group; however, it did not require discontinuation of the intervention.

At baseline, there were no statistically significant differences between the groups regarding age, sex distribution, disease duration, or cognitive performance scores ($p > 0.05$).

After 24 weeks of intervention, both groups demonstrated changes in cognitive and functional outcomes. However, patients in the thermally processed onion group exhibited significantly greater improvements in several clinical parameters compared with the pharmacotherapy group.

The mean MMSE score increased from 18.4 ± 2.7 to 22.1 ± 2.5 in the onion group, whereas the pharmacotherapy group showed an increase from 18.6 ± 2.9 to 20.0 ± 2.8. Similarly, MoCA scores improved by 4.3 points in the onion group compared with 1.8 points in the pharmacotherapy group ($p < 0.05$).

Assessment of daily living activities revealed better preservation of functional independence among patients receiving thermally processed onion. Improvements were particularly evident in memory-related tasks, orientation, and social interaction.

Behavioral symptoms such as irritability, anxiety, sleep disturbances, and agitation were reduced in both groups; however, the reduction was more pronounced in the onion group. Caregivers reported improved communication, increased participation in daily activities, and better overall quality of life among patients consuming thermally processed onion.

These findings suggest that regular consumption of thermally processed onion may contribute to improved cognitive performance and functional outcomes in patients with Alzheimer's disease.

DISCUSSION

The present study demonstrated that regular consumption of thermally processed onion was associated with greater improvements in cognitive function and daily living activities compared with standard pharmacotherapy alone. The findings support the growing body of evidence indicating that dietary phytochemicals may play a significant role in neuroprotection and cognitive health.

One of the most important bioactive compounds found in onions is quercetin, a flavonoid with potent antioxidant properties. Oxidative stress is recognized as a major contributor to neuronal degeneration in Alzheimer's disease. Excessive production of reactive oxygen species leads to lipid peroxidation, protein oxidation, mitochondrial dysfunction, and neuronal death. By neutralizing free radicals and

enhancing endogenous antioxidant defenses, quercetin may help protect neuronal structures from progressive damage.

Neuroinflammation is another critical mechanism involved in Alzheimer's disease pathogenesis. Activated microglia and astrocytes produce pro-inflammatory cytokines that contribute to neuronal injury and cognitive decline. Previous experimental studies have demonstrated that quercetin suppresses inflammatory mediators, including tumor necrosis factor-alpha (TNF-α), interleukin-1β, and interleukin-6. Therefore, the cognitive benefits observed in the present study may be partially explained by reduced neuroinflammatory activity.

Additionally, quercetin has been shown to inhibit amyloid-beta aggregation and reduce tau protein hyperphosphorylation, which are hallmark pathological features of Alzheimer's disease. Experimental evidence suggests that these mechanisms may slow disease progression and preserve synaptic integrity [21].

Thermally processed onion may offer practical advantages over raw onion consumption. Cooking improves palatability and gastrointestinal tolerance, especially among elderly patients, while still preserving substantial amounts of biologically active compounds. The favorable safety profile observed in this study further supports the feasibility of long-term dietary intervention.

The superior outcomes observed in the onion group suggest that nutritional approaches targeting oxidative stress and inflammation may complement or, in some circumstances, exceed the benefits achieved through conventional symptomatic pharmacotherapy. These results are consistent with recent investigations emphasizing the role of functional foods in neurodegenerative disease management.

Nevertheless, several limitations should be acknowledged. The sample size was relatively small, the duration of follow-up was limited, and biomarkers of neurodegeneration were not assessed. Furthermore, the study did not evaluate the combined effects of onion consumption and pharmacotherapy, which may provide additional clinical benefits [22].

Despite these limitations, the present findings indicate that thermally processed onion may represent a promising, accessible, and cost-effective dietary strategy for improving cognitive outcomes in patients with Alzheimer's disease. Larger multicenter randomized controlled trials are warranted to confirm these observations and further elucidate the underlying molecular mechanisms [23].

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