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Research Article

The Effectiveness of Brogandi (A Combination of Broccoli and Centella Asiatica) on Cognitive Function Among Nursing Students

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Abstract

Aims: This study aimed to evaluate the effectiveness of Brogandi, a combination of Broccoli and Centella asiatica, in improving the cognitive function of nursing students.

Methods: A quasi-experimental pre- and post-test design was conducted involving 40 nursing students, who were divided into an intervention group (n = 20) and a control group (n = 20). Cognitive function was assessed using the Trail Making Test-B (TMT-B), Visual Recall, and Backward Digit Span. The intervention group received Brogandi supplementation at a dosage of 1000 mg twice daily for 14 days, while the control group did not receive any supplementation. Statistical analysis was performed to compare pre- and post-test results between the groups.

Results: The intervention group exhibited significant improvements in cognitive performance across all tests compared to the control group. TMT-B and Backward Digit Span scores in the intervention group improved significantly ($p < 0.001$), and Visual Recall also showed a significant enhancement ($p = 0.001$). In contrast, the control group did not demonstrate significant changes in any cognitive test ($p \geq 0.248$).

Conclusion: The bioactive compounds in Brogandi —sulforaphane, asiaticoside, vitamin C, and vitamin E—are believed to contribute to its neuroprotective and neuroplasticity-enhancing effects. These findings suggest that Brogandi is a promising nutritional intervention for improving cognitive function, particularly in college students with high academic demands. Further research with larger and more diverse samples is needed to confirm these results and explore potential mechanisms.

Keywords:

Broccoli, Centella Asiatica, Cognitive Function, Students

INTRODUCTION

Cognitive function is a critical aspect of an individual's intellectual ability to think, comprehend ideas, and learn. This ability plays a pivotal role in various life activities, particularly in academic achievement. Impaired cognitive function can result from suboptimal brain growth and development. The brain, as the central organ of the nervous system, regulates various responses such as vision, hearing, thinking,

and movement. One commonly used indicator of brain development in education is the Intelligence Quotient (IQ), which serves to assess an individual's potential for learning achievement. If left untreated, cognitive dysfunction can hinder individual development and negatively impact long-term quality of life, particularly in terms of intelligence and productivity (1).

In Indonesia, the use of traditional herbal plants to enhance cognitive function has

long been recognized. One such plant with significant potential is *Centella asiatica*. This plant thrives in tropical regions, including Indonesia, particularly in areas with altitudes up to 2,500 meters above sea level. Based on empirical research and experience, *Centella asiatica* is known for its various health benefits, including treating mouth ulcers, hypertension, diabetes, and anemia, as well as improving memory and concentration (1). The active compounds in *Centella asiatica*, such as asiaticoside and madecassoside, play a crucial role in enhancing nerve function and promoting brain plasticity (2).

A recent innovation combining *Centella asiatica* and broccoli (*Brassica oleracea*), known as Brogandi, has shown remarkable potential in improving cognitive function, particularly in the elderly population (3,4). Research has revealed that a mixture of dried extracts from these two plants, called Brogandi, can prevent memory decline and enhance overall cognitive performance. The effectiveness of this combination has been validated through clinical trials, which administered a dose of 500 mg twice daily for 14 week to elderly individuals with mild dementia. Positive outcomes were observed, including improvements in Mini Mental State Examination (MMSE) scores. Additionally, the bioactive compounds in *Brassica oleracea* and *Centella asiatica*, such as vitamin C, vitamin E, and amino acids, contribute to increased neurogenesis and protection against nerve cell damage, thereby supporting brain health in older adults.

However, research on the impact of Brogandi on younger populations, such as college students, remains limited. College students often face high academic demands, including rigorous theoretical learning, mastery of practical skills, and their application in clinical practice. This intensive learning environment frequently leads to mental fatigue, reduced concentration, and memory impairment.

Nursing students represent a unique population that requires optimal cognitive

function to meet the demands of their academic and clinical responsibilities. Unlike the elderly population, where cognitive interventions often target preventing or slowing decline, nursing students require cognitive enhancement to manage the rigorous curriculum effectively (5). The potential benefits of Brogandi as a nutritional intervention in this group extend beyond improving memory and concentration; they also support critical thinking, decision-making, and multitasking abilities essential for clinical practice. Conducting trials on nursing students allows researchers to assess Brogandi's impact on cognitive parameters directly relevant to high-pressure learning environments. This research could pave the way for implementing Brogandi as a practical and accessible strategy to enhance cognitive performance, ultimately contributing to the preparation of competent and skilled healthcare professionals.

Optimizing cognitive function is essential to ensure students' academic success. This study aims to investigate the effects of Brogandi consumption on cognitive function among nursing students, focusing on memory, concentration, and processing speed. The findings of this study are expected to provide a scientific basis for developing nutritional strategies to support university students' academic performance while mitigating the adverse effects of heavy academic workloads.

METHODS

Study Design

This study utilized a pre- and post-test research design with control group to determine the effect of Brogandi on cognitive function among nursing students.

Sample

The sample size was calculated using G-Power (Effect size $d = 0.8$, $\alpha = 0.05$, Power = 0.95). The inclusion criteria were students aged 18 to 21 years, without a history of serious illness, and who had not used any

brain stimulant drugs in the two weeks prior to the study. The participants were randomly divided into two groups of 20 students each: an intervention group and a control group.

Procedure

The intervention group received Brogandi at a dose of 2x1000 mg/day for 14 days, while the control group did not receive any intervention. Brogandi was prepared using a standardized process to produce a high-quality, dried Brogandi extract, which was encapsulated for oral administration. Compliance with the intervention was monitored using a checklist reviewed by researchers to ensure adherence.

The data collection process was divided into three stages:

1. **Pretest:** Participants' baseline cognitive function was assessed using TMT-B, Visual Recall, and Backward Digit Span.
2. **Intervention:** The intervention group received Brogandi capsules (2x1000 mg/day) for 14 days. The control group did not receive any intervention. Compliance was monitored frequently, and any adverse effects or concerns were documented and addressed.
3. **Posttest:** After 14 days, cognitive function was reassessed using the same instruments to identify any changes or improvements.

Instruments

The cognitive function of participants was assessed using the *Academic Potential Test (TPA)*, which includes three components:

1. **Trail Making Test (TMT-B):** This test evaluates cognitive flexibility and processing speed. Participants connect alternating circles containing numbers (1-12) and letters (A-L) in sequential order (e.g., 1-A-2-B-3-C), requiring efficient cognitive shifting and mental agility.
2. **Visual Recall:** This measures visual memory by assessing participants'

ability to retain and recall visual information after brief exposure.

3. **Backward Digit Span:** This test evaluates working memory by asking participants to repeat a sequence of numbers in reverse order, challenging their capacity to store, manipulate, and retrieve information.

These instruments collectively provide a comprehensive assessment of cognitive function.

Data Collection

This study was approved by the Health Research Ethics Committee of the University of Muhammadiyah Purwokerto (No. KEPK/UMP/66/X/2024). Written informed consent was obtained from all participants after explaining the study objectives, procedures, and potential risks or benefits.

Ethical Considerations

The study adhered to ethical guidelines, including obtaining informed consent from all participants. Participants were informed about the study objectives, procedures, potential risks, and benefits of Brogandi supplementation. The cognitive benefits of Brogandi are attributed to its bioactive compounds, including sulforaphane from broccoli (*Brassica oleracea*) and asiaticosides from *Centella asiatica*. Sulforaphane is known for its neuroprotective properties, as it activates the Nrf2 signaling pathway, which combats oxidative stress and enhances neurogenesis. Asiaticosides, on the other hand, promote synaptic plasticity and repair neuronal damage by modulating brain-derived neurotrophic factors (BDNF) and enhancing axonal regeneration. These synergistic mechanisms are hypothesized to improve cognitive function, particularly memory, processing speed, and concentration. All participants had the right to withdraw from the study at any time without repercussions. No adverse effects related to Brogandi were reported during the intervention period.

Data Analysis

The data were analyzed using the paired sample t-test to determine the effectiveness of Brogandi intervention in improving cognitive function. Pretest and posttest results from the intervention group were compared to identify significant changes in cognitive abilities, while comparisons between the control and intervention groups were made to account for external variables.

RESULTS

Table 1 presents the demographic characteristics of the respondents in the intervention and control groups. The

characteristics of the respondents in both the intervention and control groups were largely similar. Both groups consisted entirely of female nursing students, with comparable ages, weights, heights, and semester enrollments. The majority of participants in both groups exercised once per week, and there were no significant differences in exercise frequency. Regarding disease history, the two groups had similar proportions of participants with digestive diseases and other health conditions. These findings suggest that the groups were well-matched in terms of baseline characteristics, minimizing the potential for confounding variables in the study results.

Table 1. Respondent Characteristics

Variable	Brogandi (n=20)	Control (n=20)	p-value
Age, mean (SD)	19.45 (0.75)	19.30 (0.80)	0.42
Weight, mean (SD)	52.19 (9.39)	51.80 (8.95)	0.68
Height, mean (SD)	158.32 (5.02)	158.10 (4.95)	0.78
Sex, n (%)			
Woman	20 (100%)	20 (100%)	1,00
Man			

Table 2 showed pre- and post-test results of cognitive function for both the Brogandi and control groups which has significant improvements in the Brogandi group. In the Trail Making Test-B (TMT-B), the Brogandi group showed a significant reduction in completion time from pre-test (50.00) to post-test (37.65) ($p < 0.001$), while the control group had no significant change ($p = 0.277$). Similarly, the Backward Digit Span test demonstrated a significant increase in the Brogandi group's score from 5.4 to 7.05 ($p < 0.001$), while the control group did not show any significant change ($p = 0.248$). The Visual Memory test also revealed significant improvement in the Brogandi group, with scores increasing from 5.80 to 8.45 ($p = 0.001$), while the control group showed no significant change ($p = 0.619$). These results suggest that Brogandi had a significant positive effect on cognitive function, particularly in memory and cognitive flexibility, compared to the control group.

Table 2. The effect of Brogandi after 14 days intervention

Cognitive Function	Brogandi (n=20)	Control (n=20)
TMT-B		
Pre	50.00 (8.97)	54.50(10.85)
Post	37.65 (9.83)	51.85 (7.88)
p-value	<0.001*	0.277
Backwards Digit Span		
Pre	5.40 (1.90)	5.10 (1.92)
Post	7.05 (0.99)	4.60 (1.27)
p-value	<0.001*	0.248

Visual Memory		
Pre	5.80 (3.24)	5.95(2.59)
Post	8.45 (1.05)	6.25 (1.52)
p-value	0.001*	0.619

DISCUSSION

The Brogandi as combination of Broccoli and Centella asiatica has shown significant potential in improving cognitive function. Research by Smith and Johnson & Lee states that regular consumption of these two ingredients can improve memory, concentration, and speed of thinking in individuals with mild cognitive decline (2,6). In the context of students, this study showed that Brogandi supplements provided a significant improvement in the results of cognitive tests, such as TMT-B (Trail Making Test), Visual Recall, and Backward Digit Span. This reflects improvements in speed and cognitive flexibility that are essential for students to face complex academic demands.

Statistically, Brogandi's administration to 20 students showed a significant effect on all cognitive parameters measured, with a p-value of 0.012 (<0.05). This shows that Brogandi is able to effectively support the improvement of students' cognitive performance. Broccoli (*Brassica oleracea*) is known to be rich in sulforaphane and vitamin C, two components that function as powerful antioxidants to protect the brain from oxidative stress and inflammation (7). Research by Yuan et al. reveals that a diet rich in *Brassica oleracea* can slow cognitive decline in the elderly, while vitamin K in broccoli is linked to improved memory and nerve cell integrity (8). Non-enzymatic bioactive compounds in *Brassica oleracea*, like polyphenols, flavonoids, carotenoids, and anthocyanins, make it highly antioxidant in nature. This helps reduce oxidative stress, making it a key subject of research in this study for its activity in improving memory.

Moreover, *Centella asiatica* also contains asiaticosides and madecassosides that support neuronal regeneration and increase

blood flow to the brain (9). The synergistic effect of this combination strengthens neuroplasticity and improves cognitive function (6). *Centella asiatica* contains B vitamins, vitamin C, minerals, and the main active ingredients in the form of triterpenoid glycosides consisting of Asiaticoside, Asiatic acid, madecassoside, madecassic acid, sitosterol, polyacetylene compounds, and kaempferol. Triterpenoid saponins (asiaticoside) in *Centella asiatica* are known to improve cerebral blood circulation (1).

Broccoli and *Centella asiatica* are two plants that have long been known for their benefits in supporting brain and cognitive function. In this study, the combination of the two ingredients, known as Brogandi, was shown to be effective in improving various aspects of cognitive function such as memory, concentration, and cognitive flexibility. Below is a review of the mechanism of action for each plant in supporting cognitive function.

Broccoli contains a variety of bioactive compounds such as sulforaphane, polyphenols, vitamin C, vitamin K, and flavonoids. Sulforaphane is a key compound that provides protection against oxidative stress and inflammation in the brain. Oxidative stress is known to be one of the main causes of neuronal damage and cognitive decline. Sulforaphane helps increase neurogenesis, which is the formation of new neurons that play an important role in memory and learning (7,8). Vitamin K in broccoli contributes to the improvement of the integrity of neuronal membranes, which is important for the transmission of nerve signals. In addition, vitamin C functions as a powerful antioxidant that protects the brain from free radicals and helps regenerate damaged brain tissue. This combination of nutrients

supports brain executive functions, such as rapid information processing and problem-solving (10).

Centella asiatica is rich in asiaticosides and madecassosides, two triterpenoid compounds that support blood flow to the brain and repair neuronal damage. This content also increases synaptic plasticity, which allows the brain to adapt and establish new connections, particularly in individuals experiencing academic or mental stress. Research by Kumar et al. shows that *Centella asiatica* is able to improve memory and concentration through a mechanism of increasing neuroplasticity. In addition, *Centella asiatica* contains B vitamins, vitamin C, and various minerals that support brain metabolism (9). The anti-inflammatory and anti-free radical activity of *Centella asiatica* helps protect the brain from chronic inflammatory conditions that often occur due to an unhealthy lifestyle. Furthermore, *Centella asiatica* has several active components that are believed to be anti-inflammatory. The results showed that *Centella asiatica* can improve mitochondrial expression, antioxidant responses in the brain and liver, as well as synaptic expression in the hippocampus and frontal cortex, leading to cognitive improvement in healthy mice (11).

The combination of Brogandi provides a synergistic effect that strengthens brain health (3). This combination can reduce inflammation and oxidative stress in the brain, as well as increase blood flow to important areas involved in memory and attention. Pathologically, this combination increases neuroplasticity and aids in the recovery of decreased cognitive function. Students as individuals experience maturity in various aspects, especially cognitive development. Early adulthood, which follows adolescence, is a period when individuals are still developing, even after reaching physical and social maturity. Cognitive development continues throughout life (11).

For nursing students, the improvement in cognitive function is crucial as they are often required to retain and process complex information rapidly, especially during clinical practice and examinations. Enhanced memory, cognitive flexibility, and problem-solving abilities directly contribute to their effectiveness as future healthcare providers. Moreover, nursing students are constantly faced with high-stress situations, both academically and clinically, which makes interventions like Brogandi particularly beneficial.

Research by Kim et al. showed that the TMT-B test is sensitive in measuring changes in processing speed and cognitive flexibility. In subjects taking Brogandi supplements, there was a significant increase in the speed of completion of TMT-B tasks, which was associated with improved executive function (12). A study by Zhang et al. (2020) showed that visual recall improved after broccoli consumption, which was attributed to antioxidant effects that protect visual neurons and support visual memory. In research by Patel et al. (2019), the Backward Digit Span test showed an increase in working memory capacity, which is important for attention and information processing. Brogandi's consumption favors this increase in capacity, helping nursing students process and recall information more effectively, improving their overall clinical performance (13).

In addition, the high cognitive demands placed on nursing students make it essential for them to maintain optimal brain function throughout their academic and professional careers. Cognitive enhancements gained from Brogandi supplementation could help students better handle the cognitive load of complex clinical tasks, such as patient assessment, treatment planning, and decision-making (14). These skills are fundamental for ensuring high-quality patient care, especially in high-stakes environments such as emergency departments, intensive care units, and

surgical settings, where rapid thinking and accurate judgment are required (15,16).

As the healthcare system becomes increasingly complex, nursing students will also need to adapt quickly to new technologies, updated protocols, and interdisciplinary team approaches (17,18). A sharp cognitive function will not only help them stay competitive in their education but also be better prepared for the challenges of a dynamic healthcare environment. In this light, the benefits of Brogandi could be extended beyond academic settings, enhancing their professional capabilities and mental resilience as future healthcare providers (19,20). Overall, these findings support that Brogandi, with a combination of antioxidant-rich natural ingredients and essential nutrients, could be a promising nutritional intervention to improve cognitive function in populations with high cognitive needs, such as college students, teachers, or researchers. For nursing students, Brogandi could serve as an effective supplement to support their demanding cognitive tasks. More research is needed to explore its impact on a broader population and over the long term.

CONCLUSION

In conclusion, the combination of Broccoli and *Centella asiatica* (Brogandi) has proven to be an effective supplement in enhancing cognitive function, particularly in memory, concentration, and cognitive flexibility. The synergistic effects of these two plants, rich in antioxidants and bioactive compounds, offer significant benefits in reducing oxidative stress, improving neuroplasticity, and supporting neuronal regeneration. For nursing students, who face high cognitive demands during their academic journey and clinical practice, Brogandi supplementation may improve cognitive performance, memory retention, and the ability to process complex information more effectively. This intervention could ultimately enhance their clinical decision-

making, problem-solving skills, and overall ability to deliver high-quality patient care. Further studies are needed to explore its long-term effects and broader applicability in different populations.

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Conflict of Interest

The authors state no conflict of interest.

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