Effects of Meditation on Cognitive Function Across Age Groups

Abstract

This study examines the effects of Dhyana Yoga, a meditative practice for mental discipline and inner tranquility, on memory performance across individuals aged 16–50. A randomized controlled trial (RCT) assigned participants to either a meditation group or a control group, with memory performance measured using the Digit Span Test. Results indicated that, despite differences in baseline memory levels, participants in the meditation group demonstrated modest improvements compared to the control group. While the two-week intervention limited the magnitude of observed effects, findings align with prior research on short-term meditation benefits. These results suggest that Dhyana Yoga may contribute to cognitive enhancement across different age groups, emphasizing the need for future studies with longer durations and robust designs to further explore meditation's impact on memory performance.

Background

Dhyana Yoga, also known as The Yoga of Meditation, is a form of yoga dedicated to meditation and mental discipline. It focuses on achieving inner tranquility and enhanced awareness. Similar research has shown significant results in improving cognitive functions through meditation. Other studies have demonstrated the Digit Span Test's sensitivity to cognitive changes and highlighted its effectiveness in capturing variations in memory performance across different age groups (Salthouse, 1992). These studies provide a robust foundation for examining the effects of meditation on cognitive functions.

Introduction

Meditation has been widely studied for its potential cognitive benefits, particularly in enhancing memory and attention. Dhyana Yoga, a specific form of meditative practice, has gained attention for its ability to improve cognitive function. This study explores how the effectiveness of Dhyana Yoga differs between teenagers and adults, addressing the question: Does Dhyana Yoga significantly improve memory performance, and does its impact vary across age groups?

Prior research suggests that meditation enhances neuro plasticity, leading to better cognitive function (Gothe et al., 2013). While adults often report improved focus and stress reduction, teenagers may experience enhanced learning retention due to their developing brains (Pragya et al., 2021). This study aims to build on existing literature by providing data on the differential effects of Dhyana Yoga across age groups.

Hypothesis

Meditation improves memory performance, and the effectiveness of meditation varies between teenagers and adults. Participants in the meditation group will show a statistically significant improvement in memory performance compared to participants in the control group, irrespective of age.

This hypothesis aligns with prior research indicating that meditation strengthens memory-related neural pathways, with studies like Gothe et al. (2013) and Zeidan et al. (2010) demonstrating improvements in working memory after mindfulness training. By measuring memory performance before and after a structured meditation intervention, this study aims to determine whether consistent practice of Dhyana Yoga enhances memory recall and retention over time.

Materials

- Informed consent forms
- Meditation guide for participants
- The Digit Span Test (for memory assessment)
- Data collection sheets or digital survey forms

Methodology

A randomized controlled trial (RCT) was conducted with participants aged 16–50, assigned to either a meditation (Dhyana Yoga) group or a control group. The Digit Span Test, validated in adults aged 18–65 and primarily in English-speaking populations (Salthouse, 1992), was used to measure working memory. While its sensitivity for younger participants aged 16–18 is less specified, the Digit Span Test remains a robust tool for evaluating cognitive changes. This test has also been utilized in studies examining age-related differences in memory performance (Salthouse, 1992) (Bopp & Verhaeghen, 2009) and its sensitivity to cognitive changes, providing a strong foundation for evaluating Dhyana Yoga's effects.

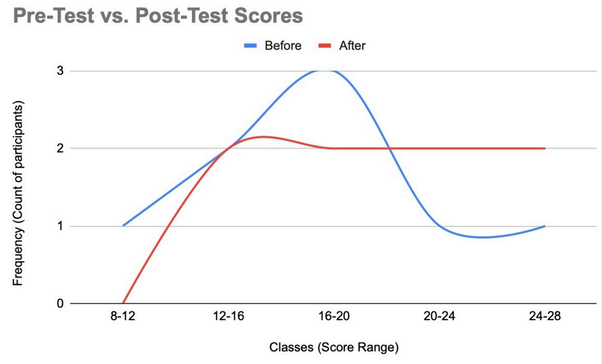
1. Recruit participants from a diverse sample in terms of age (16-50), gender, and background, and obtain informed consent forms.
2. The participants received the informed consent forms, and the signed forms were collected.
3. Participants filled out a Digit Span Test to assess baseline memory performance before the experiment.
4. Participants were randomly assigned to either the control group (no meditation) or the experimental group (meditation).
5. Participants in the experimental group were given a script to follow for Dhyana Yoga which included additional information about the meditation technique.

Methodology

5. The experimental group practiced Dhyana Yoga meditation daily over the course of 2 weeks.
6. he control group did not practice meditation but followed the same testing schedule.
7. After 2 weeks, participants took the Digit Span Test again to assess post-test memory performance.
8. Results from the pre-test and post-test were recorded for both groups to assess memory improvement.
9. A dependent t-test was conducted to analyze changes in memory performance between the two groups.
10. Additional factors such as age, baseline cognitive function, and meditation practice consistency were considered as potential confounding factors in the analysis.

Results/Data Analysis

After reviewing the collected data and analyzing the results, it was observed that participants in the experimental group showed improvements in memory performance after two weeks of meditation. This observation is further supported by the graphical representation of the data, which highlights the trend of improved memory scores in the experimental group, demonstrating the positive impact of Dhyana Yoga. The graph visually reinforces the findings that Dhyana Yoga had a positive effect on memory performance, as seen by the overall shift toward higher scores.



A dependent t-test was conducted with an alpha value of 0.05, a commonly used threshold in similar research on meditation and cognitive function. A study in 2021, *Effects of Combining Meditation Techniques on Short-Term Memory, Attention, and Affect in Healthy College Students*, used a paired t-test with an alpha value of 0.05 (Pragya et al., 2021). This value balances sensitivity and specificity, ensuring a 5% risk of Type I error while maintaining statistical reliability. Our critical value was 1.895.

$$\frac{\text{abs}(-18)}{\sqrt{\frac{8(50)-(-18)^2}{7}}} = 5.462792808$$

With our t-value greater than the critical value, we rejected the null hypothesis and accepted the alternative hypothesis that Dhyana Yoga improves memory performance across age groups. While variations in memory performance were observed between different age groups, the meditation group consistently showed improvements in memory, as measured by the Digit Span Test. These results suggest that meditation has a significant positive impact on cognitive function, particularly memory in this case, regardless of age. However, potential factors such as individual differences in meditation practice and cognitive baseline levels could have influenced the results.

After that, an independent T test was conducted to compare our control group with our experimental group. An independent *t*-test was conducted to compare the mean improvement in digit span scores between the experimental and control groups. The results revealed a statistically significant difference, $t(14) = 4.3609$, $p < 0.05$, with the experimental group showing greater improvement than the control group. The critical *t*-value for $df = 14$ at $\alpha = 0.05$ was 1.761, meaning the observed *t*-value exceeded the threshold required for statistical significance.

$$\frac{|1.75|}{\sqrt{\left(\frac{1}{16}\right)\left((1.357142857)^2+(0.8571428571)^2\right)}} = 4.360942763$$

These findings suggest that the experimental condition had a meaningful effect on digit span performance. Since the observed *t*-value is significantly greater than the critical *t*-value, we can reject the null hypothesis, indicating that the change in scores was not due to random variation.This supports our claim that regular meditation could help improve memory to a certain extent.

Conclusion

This study suggests that Dhyana Yoga may improve memory performance, with notable age-related variations, aligning with prior research by Bopp & Verhaeghen (2009) and Salthouse (2012). While both younger (16–25 years) and older (26–50 years) participants exhibited cognitive benefits, the slightly greater improvements observed in younger individuals may reflect their heightened neuroplasticity. However, the measurable gains in middle-aged participants indicate that meditation could be a valuable tool for cognitive preservation and enhancement at any stage of life.

These findings contribute to the growing body of research on meditation's role in cognitive health, yet they also highlight the need for longer-duration studies with more rigorous methodologies. The results suggest potential benefits but should be interpreted with caution due to the study's limitations, including its lack of statistical power. Future research should focus on adequately powered RCTs with robust study designs and long-term follow-ups to further investigate the mechanisms underlying meditation's effects on cognitive functions, building on prior evidence from studies such as those by Gard et al. (2014).