Original Article

The Effect of Ramadan Fasting on Cognition in Young Adults

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Abstract

Background: Fasting has been practiced for centuries and has gained popularity in recent years for its potential health benefits. During Ramadan, Muslims fast from sunrise to sunset for several days, which may impact various bodily functions, including cognition. Previous research has explored the effects of fasting on cognition, however, these studies often overlook mild cognitive dysfunctions that may not be immediately apparent but could influence daily functioning.

Objectives: This study aimed to investigate the impact of Ramadan fasting on cognitive function in young adults, specifically evaluating changes in cognition before and during fasting.

Materials and Methods: A quasi-experimental design was utilized with 24 students from Rawalpindi Medical University. Cognitive performance was assessed using the Montreal Cognitive Assessment (MoCA) before and during Ramadan fasting. Data were analyzed using paired-sample t-tests and Wilcoxon-Signed Rank tests.

Results: Significant reductions in cognitive scores were observed during fasting (24.3 ± 2.2) compared to non-fasting (28.4 ± 0.9), with a p-value of 0.009. Short-term memory scores decreased significantly during fasting (11.4 ± 2.9) versus non-fasting (14.9 ± 0.4, p = 0.009). Word production also declined significantly (fasting: 10.3 ± 3.7; non-fasting: 13.4 ± 2.8, p = 0.002). Effect sizes were large for overall cognition and short-term memory and medium for word production.

Conclusion: Ramadan fasting is associated with significant reductions in cognitive performance among young adults, particularly affecting short-term memory and word production. These findings highlight the potential cognitive challenges faced during fasting, which could impact academic and professional performance.

Key Words: Cognition, fasting, memory, mental status and dementia tests, mental recall

Introduction

The correlation between dietary habits and cognition has been a subject of scientific inquiry for a long time. In recent years, diets that emphasize intermittent fasting have increased in popularity. Intermittent fasting has been theorized to have many potential health benefits including weight loss and inflammation control.[1]

Fasting also impacts other bodily functions, including cognition.[2] Cognition is the complex function of the brain that involves the processing, storage, and application of information.[3] Abilities such as memory storage and retrieval, problem-solving, and perception are all part of cognition. Therefore, it is important to investigate what factors can possibly affect these functions of the brain.

During the month of Ramadan in Islam, Muslims observe a fast in which they refrain from consuming food and liquids for a period of 12 to 14 hours each day.[4] Muslims eat one meal before sunrise, and then refrain from all food and water until sunset. However they are expected to stay awake for long hours and essentially continue with their usual "pre-fasting" lifestyles. The adoption of this lifestyle leads to changes in their feeding habits.[2]

With nearly 1.9 billion Muslims worldwide, a significant proportion of this population consists of young adults, with the median age estimated to be around 23 years.[5] This demographic is characterized by a high level of cognitive engagement and academic or professional demands, therefore it is of utmost importance to research the effect of fasting on cognition.

While there have been many studies that explore the relationship between diet and brain function, there seems to be a literary gap in the effects of specifically, "Ramadan fasting" on the cognition of young adults. In regards to fasting during Ramadan, some studies have declared that it does not produce any significant changes in the cognition of an individual.[6] However, screening tests exist which investigate the possibility of mild cognitive dysfunction, such as the Montreal Cognitive Assessment.[7] The scrutinization of mild dysfunction in cognition rather than more extreme and obvious changes has not been pursued, and such findings can prove valuable in expectations to those individuals who fast.[8]

The findings of this study have the potential to contribute to the development of dietary strategies that support cognitive health and academic success in young adults.

Materials and Methods

In 2024, a quasi-experimental study was conducted at Rawalpindi Medical University, Pakistan, following approval from the ethical review board. It was based on a similar study conducted by Crhová and Kapounková in 2020 that assessed the effects of long-term fasting and intermittent fasting on cognition9. Our study involved 24 students aged 22-24 enrolled in the medical school. Non-probability convenience sampling was employed, and students with pre- existing cognitive disorders were excluded from the sample. Participants were asked about their sleeping and eating habits before fasting, and were informed about the study's parameters. They were then asked to consent to two separate interview sessions. Each participant was assigned a random number along with their gender (e.g., F3, M1).

The study was divided into two phases. The first phase, referred to as "pre-fasting," was conducted before the start of Ramadan. During this phase, participants were instructed to sleep for 8 hours, eat normally, and not fast for more than 4 hours. After meeting these criteria, participants were administered a cognitive assessment. Their scores were recorded under their individual identification code as pre-fasting scores.

The second phase, referred to as "fasting," took place after two weeks of Ramadan fasting. In this phase, participants were re-administered the same cognitive assessment. The criteria for this stage required participants to have been fasting for more than 7 hours and to have slept a minimum of 8 hours. Cognitive assessment scores were recorded under each individual's identification code as fasting scores.

The cognitive assessment utilized was the Montreal Cognitive Assessment (MoCA), which consists of 7 subtests evaluating various cognitive functions such as visuospatial orientation and abstraction. Subscores from all tests were summed to produce a total score. The maximum score on the MoCA is 30, with a score above 26 considered normal.

Additionally, a questionnaire was developed, including demographic questions and questions related to the fasting experience.

Results

The main objective of this study is to investigate the change in cognition in individuals in a non-fasting state and during fasting conditions. A total of 24 participants were included in the study, aged 22-24, with the gender distribution being 50% female and 50% male. When assessed with the Montreal Cognitive Assessment, cognitive scores were significantly lower during fasting (M = 28.4, SD = 2.2) compared to the non-fasting state (M = 28.4, SD = 0.9), as shown in Table-I.

Table-I Cognitive performance before and during Ramadan fasting.

Cognitive Measure	Before Fast (Mean ± SD)	During Fast (Mean ± SD)	P-value (Wilcoxon Signed Rank Test)
Overall MoCA Score	28.4 ± 0.9	24.3 ± 2.2	0.011
Short-Term Memory	14.9 ± 0.4	11.4 ± 2.9	0.011
Word Production	13.4 ± 2.8	10.3 ± 3.7	0.011

The Wilcoxon signed-rank test was employed as a non-parametric test for the small sample size of the study, which revealed a statistically significant reduction in cognitive performance during fasting conditions (p=0.009). A paired-sample t-test when applied to the data also indicated a statistically significant reduction, with a p-value of 0.011. Calculation of effect size indicated a large effect (Cohen's D = 1.74) and the power of this result was 0.934, indicating strong confidence in the findings (Table-II).

Table-II Effect sizes and power for cognitive measures

Cognitive Measure	Effect Size (Cohen's D)	Power
Overall MoCA Score	1.74	0.998
Short-Term Memory	1.17	0.469
Word Production	0.95	0.296

The MoCA also allows for interpretation of subdomains of cognition, and it was found that the most significant score declines were found in the skills of short-term memory and word production. Short-term memory scores during fasting (M = 11.4, SD = 2.9) were significantly lower compared to non-fasting scores (M= 14.9, SD = 0.4), with the Wilcoxon signed-rank test (p=0.011) and the paired-sample t-test supported this finding. The effective size for short-term memory was large (Cohen's D = 1.17), though the power was somewhat lower (0.610).

Word production also showed a statistically significant reduction during fasting condition, with participants scoring lower during fasting (M=10.3, SD = 3.7) than in non-fasting conditions (M = 13.4, SD = 2.8), with a Wilcoxon p-value of 0.011 and a t-test p-value of 0.002. The effect size for word production was medium (Cohen's D = 0.945), with a relatively low power (0.297).

Discussion

In this study, the cognitive skills of participants were tested and compared in fasting and non-fasting states. Significant reductions were found in the individuals after 2 weeks of fasting in Ramadan. More particularly, the subdomains of Word Production and Short Term Memory declined the greatest. These results align with previous findings that fasting can impact cognitive abilities.[10, 11]

These results show that the practice of fasting during Ramadan may influence cognitive performance. Previous research has demonstrated the brain's reliance on glucose for optimal performance, and the hypoglycemia that occurs during a fast may explain the observed impairments in short-term memory.[12] Word production may be attributed to slower mental processing and difficulties in language-related domains.[13] Some studies find that fasting can be beneficial in cases of neurodegenerative disease involving an increase of cellular signaling molecules such as IGF-1 and mTOR14, 15.

The large effect sizes in these study, especially for overall score and short term memory, suggest that the effects of fasting on cognition are not trivial and have significant implications, especially for those who partake in activities that require higher levels of cognitive performance. The findings of this study highlight the need for further research to explore the mechanisms underlying such changes and the investigation of strategies for their attenuation.

There are several limitations of this study to consider. The small sample size may limit the generalizability of the findings, and the study had a specific population of medical students. Future studies must be done, with larger and more

diverse samples to confirm these results and to better understand the impact of fasting conditions of the cognitive function of the brain.

Conclusion

In conclusion, this study demonstrates that Ramadan fasting is associated with significant reductions in cognitive performance. These findings highlight the importance of recognizing and addressing the cognitive challenges faced by individuals who fast, especially in academic and professional settings.

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