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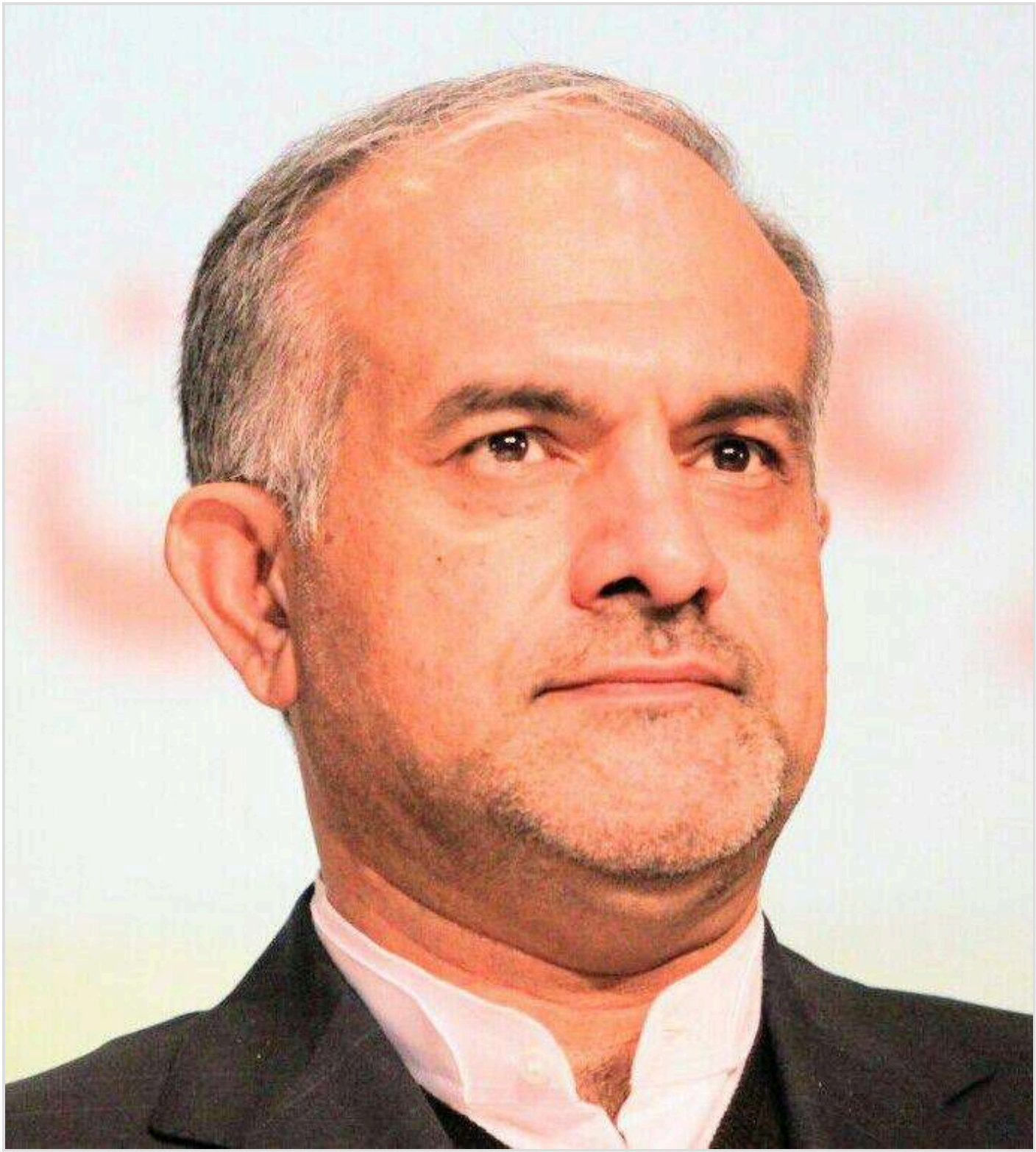

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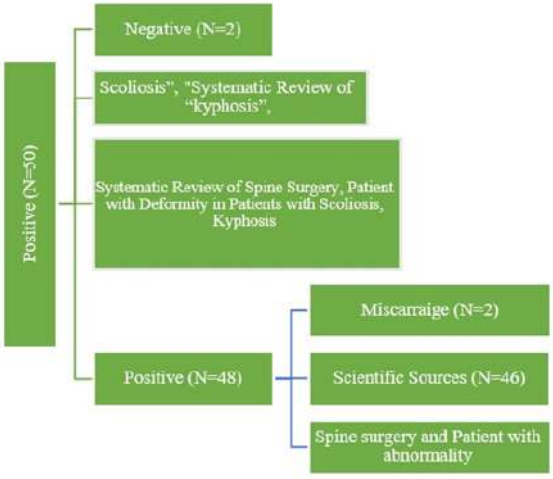

Spine Surgery in Patients with Scoliosis and Kyphosis: A Systematic Review

Adel Kiumarcy; Navid Golchin; Azadeh Rajabzadeh Kanafi

Volume 8, Issue 4 , April 2025, Pages 325-338

https://doi.org/10.26655/JMCHEMSCI.2025.4.1

Abstract Scoliosis or lateral curvature of the spine is a condition in which the spine undergoes curvature and rotation. In the present study, a systematic review of spine surgery in patients ... Read More

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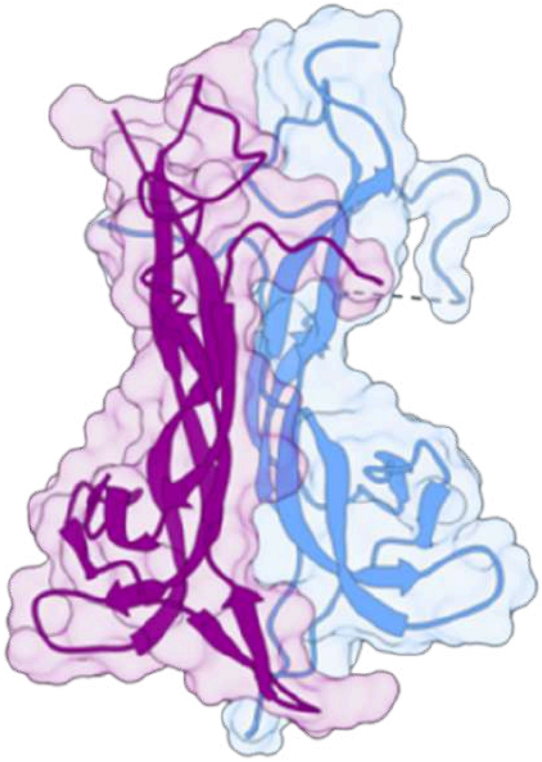

Memorizing Al-Quran Increases Serum BDNF Levels

Donna Adriani; Patwa Amani; Mustika Anggiane Putri; Yudhisman Imran; Irmiya Rachmiyani; Ahmad Fauzi; Emad Yousif

Volume 8, Issue 4 , April 2025, Pages 339-344

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Abstract Cognitive function refers to mental processes involving knowledge, information processing, and reasoning. Memorizing the Al-Quran can stimulate the production of brain-derived neurotrophic ... Read More

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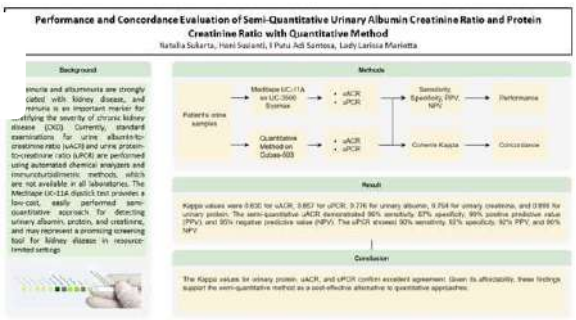

Performance and Concordance Evaluation of Semi-Quantitative Urinary Albumin Creatinine Ratio and Protein Creatinine Ratio with Quantitative Method

Natalia Sukarta; Hani Susianti; I Putu Adi Santosa; Lady Larissa Marietta

Volume 8, Issue 4 , April 2025, Pages 345-354

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Abstract Proteinuria and albuminuria are strongly associated with kidney disease, and albuminuria is an important marker for stratifying the severity of chronic kidney disease (CKD) as well ... Read More

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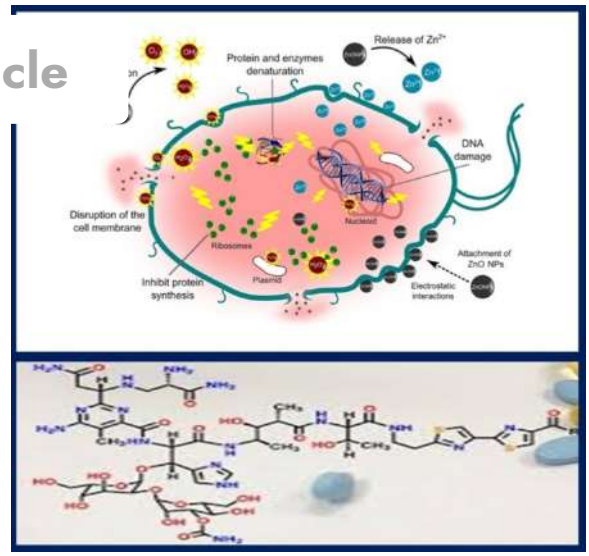

A systematic review on the chemistry of drugs and nanoparticles used in drugs used in cancer patients, relying on nursing and care tips

Shima Sadat Aghahosseini; Saghar Erfani

Volume 8, Issue 4 , April 2025, Pages 355-365

https://doi.org/10.26655/JMCHEMSCI.2025.4.4

Abstract Introduction: In the present study, the chemistry of drugs and nanoparticles used in drugs used in cancer patients

has been studied, focusing on nursing and care tips. Nanoparticles ... Read More

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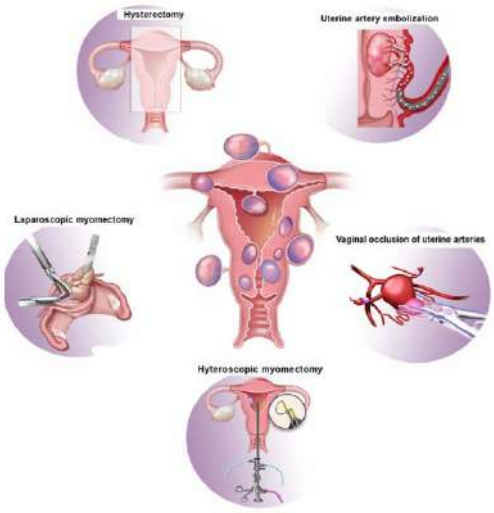

Comparative Study on Reproductive and Surgical Outcomes in Laparoscopic Myomectomy: Temporary Uterine Artery Cross-clamping for Large Submucosal Leiomyomas Compared to Alternative Methods

Zauresh Barmanasheva; Daniyar Dzhakupov; Talgat Kudaibergenov; Mariya Laktionova; Mairash Baimuratova; Vladimir Kotlobovsky; Aknur Turgumbayeva

Volume 8, Issue 4 , April 2025, Pages 366-378

https://doi.org/https://doi.org/10.26655/JMCHEMSCI.2025.4.5

Abstract A significant proportion of women face primary infertility or pregnancy loss, while secondary infertility is reported in approximately half of women with myomatous nodules (MN). The ... Read More

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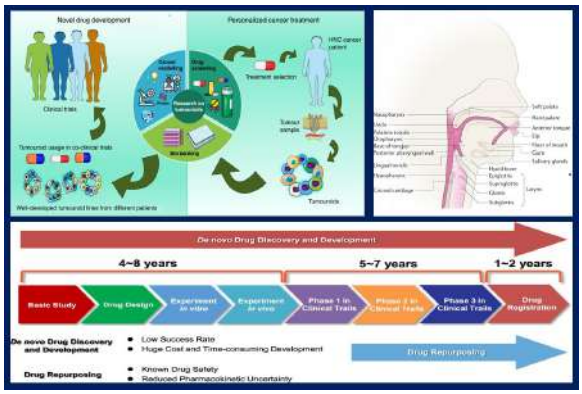

A Systematic Review of Drug Therapy in Head and Neck Cancer Patients Based on Nursing and Pharmaceutical Care

Shima Sadat Aghahosseini; Saghar Erfani

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Abstract This study systematically reviews drug therapy in patients with head and neck cancer based on nursing and drug care. The particles, which carry two different types of drugs, designed ... Read More

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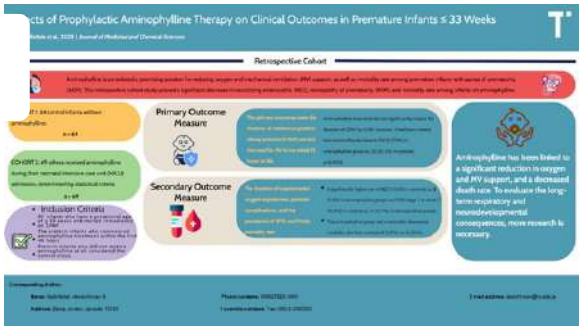

Effects of Prophylactic Aminophylline Therapy on Clinical Outcomes in Premature Infants ≤ 33 Weeks

Abedulrhman S. Abdelfattah; Hamzeh R Al-Momani; Amjad S Tarawneh; Aya M Makkawi; Zeina K Masoud

Volume 8, Issue 4 , April 2025, Pages 392-404

https://doi.org/10.26655/JMCHEMSCI.2025.4.7

Abstract Aminophylline is utilized to treat apnea of prematurity (AOP) during the critical first 72 hours of life. The aim of this study was to quantify the disparity in the length of continuous ... Read More

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Journal of Medicinal and Chemical Sciences 8 (2025) 339-344

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Original Article

Memorizing Al-Quran Increases Serum BDNF Levels

Donna Adriani[1*], Patwa Amani[1], Mustika Anggiane Putri[1], Yudhisman Imran[2], Irmiya Rachmiyani[3], Ahmad Fauzi[4], Emad Yousif[5]

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MOCA-INA

ABSTRACT

Cognitive function refers to mental processes involving knowledge, information processing, and reasoning. Memorizing the Al-Quran can stimulate the production of brain-derived neurotrophic factor (BDNF), a crucial protein that plays a significant role in promoting the survival of neurons and synapses involved in memory and learning. BDNF levels can be used to assess cognitive function. Mild Cognitive Impairment (MCI) is often evaluated using the MOCA-INA score. This study utilized an observational analytic design with a cross-sectional approach. Extensive studies have explored the effects of learning and memorizing the Al-Quran on cognitive abilities in adults. In this study, cognitive function was evaluated by measuring serum BDNF levels and the MOCA-INA score. The study involved 88 adult participants aged 18-30 years who met the inclusion and exclusion criteria. The BDNF levels in the 11-20 juz group (45540.25 ± 11661.84 pg/mL) and the 21–30 juz group (46005.6 ± 7304.86 pg/mL) were significantly higher than those in the <10 juz group (37414.88 ± 10229.63 pg/mL). The difference between Quran memorization and BDNF levels was statistically significant ($p = 0.002$). However, the MOCA-INA scores did not show a significant difference across the three groups ($p = 0.696$). The amount of Al-Quran memorized is significantly associated with serum BDNF levels. Memorizing the Al-Quran may provide cognitive benefits, particularly in enhancing brain neurotrophic factors, and could be a beneficial practice for improving cognitive function in Muslims.

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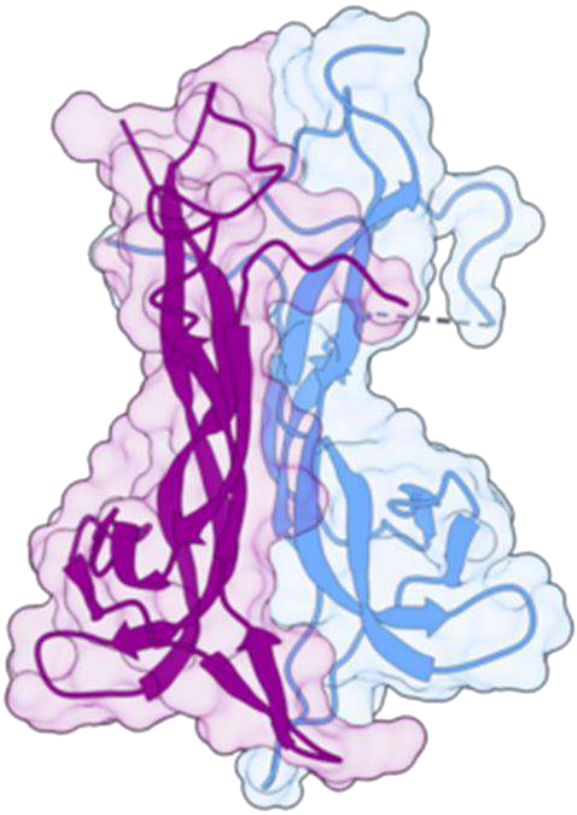
GRAPHICAL ABSTRACT



Introduction

Cognitive function refers to a set of mental processes involved in learning, memory, attention, perception, language, intelligence, and reasoning. Some of the cognitive functions that are often assessed include learning, memory, attention, and executive function [1]. Studies have shown that cognitive function tends to decline after the age of 20 [2]. One way to assess cognitive function is through the measurement of Brain Derived Neurotrophic Factor (BDNF) levels, a crucial protein that plays a significant role in promoting the survival of synapses and neurons involved in memory and learning processes [4]. BDNF is particularly expressed in the hippocampus and para-hippocampus areas, which are vital for cognitive tasks related to memory and learning [5].

Besides BDNF levels, cognitive function can also be assessed using tools such as the MOCA-INA score. The MOCA-INA score is commonly used to screen for Mild Cognitive Impairment (MCI) [6].

The Al-Quran, the holy book of Islam, is believed by Muslims to be the word of Allah SWT revealed to the Prophet Muhammad SAW [7,9]. Individuals who read, memorize, and study the Al-Quran are referred to as Hafidz [10]. Memorizing the Al-Quran is a challenging task, as it requires strong memory and high concentration [11]. Several studies have indicated that memorizing the Al-Quran may have cognitive benefits, particularly in improving cognitive function.

Materials and Methods

The aim of this study was to observe and analyze the effects of memorizing the Al-Quran on cognitive function in adults using a cross-sectional approach. The study was conducted at Perguruan Tinggi Ilmu Quran (PTIQ) to evaluate this relationship. The study involved 88 adult participants (men and women aged ≥ 18 years), who provided written informed consent after receiving a full explanation of the study's purpose and procedures.

Inclusion criteria included adults aged 18 years and above, while exclusion criteria were participants diagnosed with psychotic disorders, neurological disorders, those on antidepressant or antipsychotic medications, or those with malignancies.

Participants were divided into three groups based on the number of Al-Quran parts (juz) they had memorized: the first group (Group 1) included participants who had memorized fewer than 10 juz, the second group (Group 2) included those who had memorized 11-20 juz, and the third group (Group 3) included participants who had memorized 21-30 juz.

Cognitive function was assessed through two methods: the measurement of serum BDNF levels and the MOCA-INA (Montreal Cognitive Assessment for Indonesian participants) score. Serum BDNF levels were measured using the ELISA method, in collaboration with PRODIA Laboratory. The MOCA-INA test evaluates various aspects of cognitive functioning, including short-term memory, visuospatial memory, executive functions, attention, language, and spatial and temporal orientation. The MOCA-INA is a widely used cognitive screening tool, with scores between 25 and 30 generally considered within the normal range.

Ethics approval was obtained from the Faculty of Medicine, Universitas Trisakti (No. 179/KER/FK/X/2022). Data processing was conducted using SPSS v.25, with results presented as mean ± SD. To assess the differences between groups, an ANOVA test was applied. A statistical significance level of $p < 0.05$ was considered meaningful.

Results

Based on the data presented in the study, a total of 88 participants were included, consisting of 49 males (55.68%) and 39 females (44.32%), as indicated in Table 1. The general characteristics of the participants at baseline included their age, BDNF serum levels, and MOCA-INA scores.

The mean age of the participants was 25.18 years, with a standard deviation of 2.94 years, indicating that the participants were relatively young adults with minimal age variation. The mean BDNF serum level was recorded at 40356.55 pg/mL, with a standard deviation of 10747.37 pg/mL, reflecting a moderate variation in BDNF levels among participants. In addition, the MOCA-INA score, which assesses cognitive function, had a mean value of 25.14 with a standard deviation of 2.96, suggesting that the majority of participants had relatively stable cognitive performance (Table 1).

These baseline characteristics provide an overview of the population studied, indicating a balanced gender distribution and consistent ranges for the key variables. The data also serve as a foundation for further analysis, particularly in exploring the relationships between demographic and biological factors, such as BDNF levels and cognitive function, across different groups in the study.

Table 1: Distribution of the general characteristics of the participants at base line

Characteristics	Mean (pg/mL)	SD (pg/mL)
Age (yo)	25.18	2.94
BDNF (pg/mL)	40356.55	10747.37
MOCA-INA	25.14	2.96

The findings revealed that the serum levels of brain-derived neurotrophic factor (BDNF) were notably higher in individuals who had memorized a greater number of Al-Quran juz. Specifically, participants in the 11–20 juz group exhibited an average BDNF serum level of 45540.25 ± 11661.84 pg/mL, while those in the 21–30 juz group showed an even higher average of 46005.6 ± 7304.86 pg/mL. In contrast, participants who had memorized fewer than 10 juz had significantly lower average BDNF serum levels, measuring 37414.88 ± 10229.63 pg/mL. Statistical analysis indicated a significant correlation between the extent of Al-Quran memorization and BDNF serum levels, with a p-value of 0.002, suggesting that increased memorization activity may positively influence BDNF levels (Table 2).

However, the analysis of cognitive function using the MOCA-INA (Montreal Cognitive Assessment - Indonesian version) score showed no significant differences across the three groups, as evidenced by a p-value of 0.696. This indicates that while memorization activity appears to have a measurable impact on BDNF serum levels, it may not directly translate to observable differences in

cognitive function, as assessed by MOCA-INA, among the groups studied. These findings, summarized in (Table 2), highlight the potential neurobiological benefits associated with memorization activities while suggesting that further research is needed to fully understand the relationship between BDNF levels and cognitive outcomes.

Table 2: BDNF levels and MOCA-INA score

Characteristics	Memorization Al-Quran			*P*-value
	< 10 juz (n=29)	11-20 juz (n=30)	21-30 juz (n=29)	
BDNF (pg/mL)	37414.88 ± 10229.63	45540.25 ± 11661.84	46005.60 ± 7304.86	0.002
MOCA-INA	25 ± 3.08	25 ± 2.88	25.73 ± 2.66	0.696

Discussion

This study showed that the highest level of BDNF and MOCA-INA score was observed among the participants who memorized the Al-Quran in the category of juz 21 – 30. BDNF plays an important role in changing to brain structure. BDNF is correlated with increased cognitive function. BDNF activity improve cognitive function [3,11]. Assessment of cognitive function consists of attention and concentration, executive function, memory, language, visuoconstruction, conceptual thinking, calculation, and orientation skills [12,13].

Memorization involves processes called basic cognitive processes which include encoding, storing, and recalling memories, because these processes occur in many memory systems that function differently but are interconnected [13]. Memorization of the Al-Quran means the process of memorizing the Al-Qur'an as a whole, both memorization and accuracy of reading as well as pursuing, reciting and paying attention to keeping memorization from forgetting [14]. Memorizers of the Al-Quran in Arabic are called Hafidz Al-Quran. Hafidz Al-Quran is a person who memorizes well after going through the process of memorizing verse by verse of the Al-Qur'an on purpose. Hafiz Qur'an can recite verses of the Al-Qur'an without looking at these verses and must always keep their memorization so that they are not forgotten. Indeed, the Qur'an is easy to memorize as stated in one of its verses: "And verily We have made the Qur'an easy to understand and remember, then has anyone learned a lesson?" [15]. A study by Zoladz *et al.* repeated stimulation triggers long-term potentiation (LTP) [16].

A study by Irfannuddin et al. showed that Hafidz Al-Quran group has a significantly higher BDNF serum level than administrative workers group. Environmental stimulation related religious activity like memorizing Al-Quran may affect BDNF to support neuroplasticity [17]. Zoladz *et al.* found that BDNF regulates long-term potentiation (LTP) in the hippocampus, which is a form of synaptic plasticity that contributes to long-term memory formation. [16].

Based on Hussain MH's study (2021) the treatment group listening to the Al-Quran had increased memory and was statistically significant. This is because listening to the Al-Quran can increase mood and happy hormones [18]. Based on Irawati K's study (2018), reading the Al-Quran can prevent cognitive function decline in the elderly because reading and listening to the Al-Quran gives calm, piety, and controlling emotions for the reader [19]. Religious activities can improve cognitive function in terms of increasing the MoCa-Ina score [20,22].

Conclusion

The amount of juz memorized Al-Quran is significantly related to BDNF serum level. In practical terms, we may suggest that Muslims memorize the Al-Quran to improve cognitive function.

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Disclosure Statement

The authors declare that they have no conflicts of interest to disclose in this study.

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Original Article

Memorizing Al-Quran Increases Serum BDNF Levels

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ABSTRACT

Cognitive function refers to mental processes involving knowledge, information processing, and reasoning. Memorizing the Al-Quran can stimulate the production of brain-derived neurotrophic factor (BDNF), a crucial protein that plays a significant role in promoting the survival of neurons and synapses involved in memory and learning. BDNF levels can be used to assess cognitive function. Mild Cognitive Impairment (MCI) is often evaluated using the MOCA-INA score. This study utilized an observational analytic design with a cross-sectional approach. Extensive studies have explored the effects of learning and memorizing the Al-Quran on cognitive abilities in adults. In this study, cognitive function was evaluated by measuring serum BDNF levels and the MOCA-INA score. The study involved 88 adult participants aged 18-30 years who met the inclusion and exclusion criteria. The BDNF levels in the 11-20 juz group (45540.25 ± 11661.84 pg/mL) and the 21–30 juz group (46005.6 ± 7304.86 pg/mL) were significantly higher than those in the <10 juz group (37414.88 ± 10229.63 pg/mL). The difference between Quran memorization and BDNF levels was statistically significant (p = 0.002). However, the MOCA-INA scores did not show a significant difference across the three groups (p = 0.696). The amount of Al-Quran memorized is significantly associated with serum BDNF levels. Memorizing the Al-Quran may provide cognitive benefits, particularly in enhancing brain neurotrophic factors, and could be a beneficial practice for improving cognitive function in Muslims.

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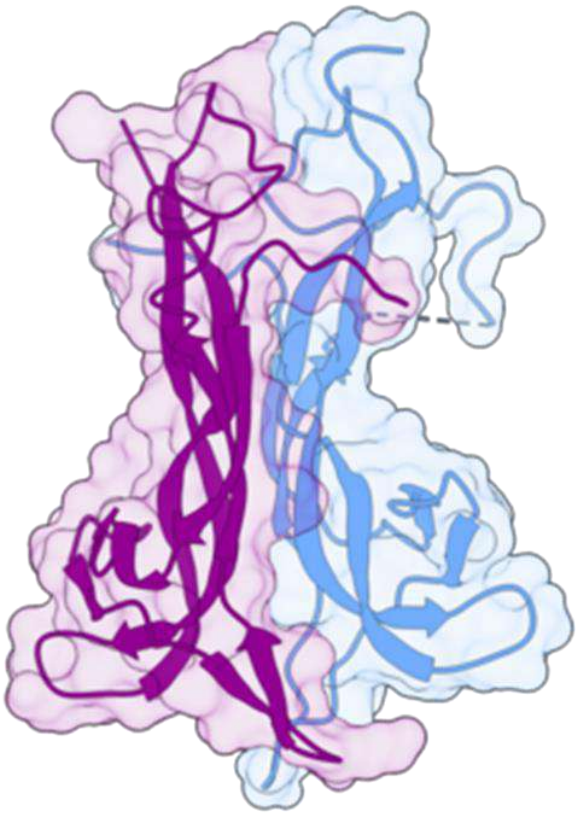
GRAPHICAL ABSTRACT



Introduction

Cognitive function refers to a set of mental processes involved in learning, memory, attention, perception, language, intelligence, and reasoning. Some of the cognitive functions that are often assessed include learning, memory, attention, and executive function [1]. Studies have shown that cognitive function tends to decline after the age of 20 [2]. One way to assess cognitive function is through the measurement of Brain Derived Neurotrophic Factor (BDNF) levels, a crucial protein that plays a significant role in promoting the survival of synapses and neurons involved in memory and learning processes [4]. BDNF is particularly expressed in the hippocampus and para-hippocampus areas, which are vital for cognitive tasks related to memory and learning [5].

Besides BDNF levels, cognitive function can also be assessed using tools such as the MOCA-INA score. The MOCA-INA score is commonly used to screen for Mild Cognitive Impairment (MCI) [6].

The Al-Quran, the holy book of Islam, is believed by Muslims to be the word of Allah SWT revealed to the Prophet Muhammad SAW [7,9]. Individuals who read, memorize, and study the Al-Quran are referred to as Hafidz [10]. Memorizing the Al-Quran is a challenging task, as it requires strong memory and high concentration [11]. Several studies have indicated that memorizing the Al-Quran may have cognitive benefits, particularly in improving cognitive function.

Materials and Methods

The aim of this study was to observe and analyze the effects of memorizing the Al-Quran on cognitive function in adults using a cross-sectional approach. The study was conducted at Perguruan Tinggi Ilmu Quran (PTIQ) to evaluate this relationship. The study involved 88 adult participants (men and women aged ≥ 18 years), who provided written informed consent after receiving a full explanation of the study's purpose and procedures.

Inclusion criteria included adults aged 18 years and above, while exclusion criteria were participants diagnosed with psychotic disorders, neurological disorders, those on antidepressant or antipsychotic medications, or those with malignancies.

Participants were divided into three groups based on the number of Al-Quran parts (juz) they had memorized: the first group (Group 1) included participants who had memorized fewer than 10 juz, the second group (Group 2) included those who had memorized 11-20 juz, and the third group (Group 3) included participants who had memorized 21-30 juz.

Cognitive function was assessed through two methods: the measurement of serum BDNF levels and the MOCA-INA (Montreal Cognitive Assessment for Indonesian participants) score. Serum BDNF levels were measured using the ELISA method, in collaboration with PRODIA Laboratory. The MOCA-INA test evaluates various aspects of cognitive functioning, including short-term memory, visuospatial memory, executive functions, attention, language, and spatial and temporal orientation. The MOCA-INA is a widely used cognitive screening tool, with scores between 25 and 30 generally considered within the normal range.

Ethics approval was obtained from the Faculty of Medicine, Universitas Trisakti (No. 179/KER/FK/X/2022). Data processing was conducted using SPSS v.25, with results presented as mean ± SD. To assess the differences between groups, an ANOVA test was applied. A statistical significance level of $p < 0.05$ was considered meaningful.

Results

Based on the data presented in the study, a total of 88 participants were included, consisting of 49 males (55.68%) and 39 females (44.32%), as indicated in Table 1. The general characteristics of the participants at baseline included their age, BDNF serum levels, and MOCA-INA scores.

The mean age of the participants was 25.18 years, with a standard deviation of 2.94 years, indicating that the participants were relatively young adults with minimal age variation. The mean BDNF serum level was recorded at 40356.55 pg/mL, with a standard deviation of 10747.37 pg/mL, reflecting a moderate variation in BDNF levels among participants. In addition, the MOCA-INA score, which assesses cognitive function, had a mean value of 25.14 with a standard deviation of 2.96, suggesting that the majority of participants had relatively stable cognitive performance (Table 1).

These baseline characteristics provide an overview of the population studied, indicating a balanced gender distribution and consistent ranges for the key variables. The data also serve as a foundation for further analysis, particularly in exploring the relationships between demographic and biological factors, such as BDNF levels and cognitive function, across different groups in the study.

Table 1: Distribution of the general characteristics of the participants at base line

Characteristics	Mean (pg/mL)	SD (pg/mL)
Age (yo)	25.18	2.94
BDNF (pg/mL)	40356.55	10747.37
MOCA-INA	25.14	2.96

The findings revealed that the serum levels of brain-derived neurotrophic factor (BDNF) were notably higher in individuals who had memorized a greater number of Al-Quran juz. Specifically, participants in the 11–20 juz group exhibited an average BDNF serum level of 45540.25 ± 11661.84 pg/mL, while those in the 21–30 juz group showed an even higher average of 46005.6 ± 7304.86 pg/mL. In contrast, participants who had memorized fewer than 10 juz had significantly lower average BDNF serum levels, measuring 37414.88 ± 10229.63 pg/mL. Statistical analysis indicated a significant correlation between the extent of Al-Quran memorization and BDNF serum levels, with a p-value of 0.002, suggesting that increased memorization activity may positively influence BDNF levels (Table 2).

However, the analysis of cognitive function using the MOCA-INA (Montreal Cognitive Assessment - Indonesian version) score showed no significant differences across the three groups, as evidenced by a p-value of 0.696. This indicates that while memorization activity appears to have a measurable impact on BDNF serum levels, it may not directly translate to observable differences in

cognitive function, as assessed by MOCA-INA, among the groups studied. These findings, summarized in (Table 2), highlight the potential neurobiological benefits associated with memorization activities while suggesting that further research is needed to fully understand the relationship between BDNF levels and cognitive outcomes.

Table 2: BDNF levels and MOCA-INA score

Characteristics	Memorization Al-Quran			*P*-value
	< 10 juz (n=29)	11-20 juz (n=30)	21-30 juz (n=29)	
BDNF (pg/mL)	37414.88 ± 10229.63	45540.25 ± 11661.84	46005.60 ± 7304.86	0.002
MOCA-INA	25 ± 3.08	25 ± 2.88	25.73 ± 2.66	0.696

Discussion

This study showed that the highest level of BDNF and MOCA-INA score was observed among the participants who memorized the Al-Quran in the category of juz 21 – 30. BDNF plays an important role in changing to brain structure. BDNF is correlated with increased cognitive function. BDNF activity improve cognitive function [3,11]. Assessment of cognitive function consists of attention and concentration, executive function, memory, language, visuoconstruction, conceptual thinking, calculation, and orientation skills [12,13].

Memorization involves processes called basic cognitive processes which include encoding, storing, and recalling memories, because these processes occur in many memory systems that function differently but are interconnected [13]. Memorization of the Al-Quran means the process of memorizing the Al-Qur'an as a whole, both memorization and accuracy of reading as well as pursuing, reciting and paying attention to keeping memorization from forgetting [14]. Memorizers of the Al-Quran in Arabic are called Hafidz Al-Quran. Hafidz Al-Quran is a person who memorizes well after going through the process of memorizing verse by verse of the Al-Qur'an on purpose. Hafiz Qur'an can recite verses of the Al-Qur'an without looking at these verses and must always keep their memorization so that they are not forgotten. Indeed, the Qur'an is easy to memorize as stated in one of its verses: "And verily We have made the Qur'an easy to understand and remember, then has anyone learned a lesson?" [15]. A study by Zoladz *et al.* repeated stimulation triggers long-term potentiation (LTP) [16].

A study by Irfannuddin et al. showed that Hafidz Al-Quran group has a significantly higher BDNF serum level than administrative workers group. Environmental stimulation related religious activity like memorizing Al-Quran may affect BDNF to support neuroplasticity [17]. Zoladz *et al.* found that BDNF regulates long-term potentiation (LTP) in the hippocampus, which is a form of synaptic plasticity that contributes to long-term memory formation. [16].

Based on Hussain MH's study (2021) the treatment group listening to the Al-Quran had increased memory and was statistically significant. This is because listening to the Al-Quran can increase mood and happy hormones [18]. Based on Irawati K's study (2018), reading the Al-Quran can prevent cognitive function decline in the elderly because reading and listening to the Al-Quran gives calm, piety, and controlling emotions for the reader [19]. Religious activities can improve cognitive function in terms of increasing the MoCa-Ina score [20,22].

Conclusion

The amount of juz memorized Al-Quran is significantly related to BDNF serum level. In practical terms, we may suggest that Muslims memorize the Al-Quran to improve cognitive function.

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Disclosure Statement

The authors declare that they have no conflicts of interest to disclose in this study.

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Memorizing Al - Quran Improves Cognitive Function

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ABSTRACT

Introduction: Cognitive function is a mental process consisting of knowledge, information processing, and reasoning. Memorizing the Al-Quran can stimulate the brain neurotrophic factor. Cognitive function can be assessed from the serum levels of Brain Derived Neurotrophic Factor (BDNF). BDNF is a crucial protein that plays a significant role in promoting the survival of both synapses and neurons that are involved in the essential cognitive processes of memory and learning. One of the methods used to evaluate Mild Cognitive impairment (MCI) is by MOCA-INA score. **Materials and Methods:** This study was an observational analytic study with a cross-sectional design. Extensive research has been conducted on the impact of learning and memorizing Al-Quran on the cognitive abilities of adults. Cognitive function was assessed through the measurement of serum BDNF levels and MOCA-INA score**.** The study involved 88 adult participants aged 18 – 30 years who fulfilled the inclusion and exclusion criteria. **Results:** The BDNF levels were higher in 11 – 20 juz groups (45540.25 ± 11661.84 pg/mL) and 21 – 30 juz groups (46005.6 ± 7304.86 pg/mL) than in <10 juz groups (37414.88 ± 10229.63 pg/mL), and there was a significant difference between memorizing Al-Quran and BDNF levels (p=0.002). The MOCA-INA score did not show a significant difference among the three groups (p=0.696). **Conclusion:** The amount of juz memorized Al-Quran is significantly related to BDNF serum level. Learning and memorizing the Al-Quran can be a beneficial practice for Muslims to improve their cognitive abilities.

Keywords: BDNF, Cognitive, memorizing Al-Quran, MOCA-INA

INTRODUCTION

The terminology of cognition is a psychological processes of learning, memory and attention, perception, and language, intelligence, and reasoning. Some of the cognitive functions are of learning, memory, attention, and executive function [1]. Based on the study there was found that there was a decrease in cognitive function at the age of over 20 years [2].

One of the assessments of cognitive function can be proven through Brain Derived Neurotrophic Factor (BDNF) levels. BDNF is a crucial protein that plays a significant role in promoting the survival of both synapses and neurons that are involved in the essential cognitive processes of memory and learning [3]. BDNF plays an important role in the memory process. BDNF is expressed in the hippocampus and para hippocampus areas [4]. Cognitive function measurements may also be assessed using the MOCA-INA score. One of the method used to screen Mild Cognitive impairment (MCI) is by MOCA-INA score [5].

The Al-Quran is the holy book of Islam, believed by Muslims to be the word of Allah SWT and revealed to the Prophet Muhammad SAW. [6] [7] [8]. Someone who reads, memorizes and studies the Al-Quran is called Hafidz [9]. Memorizing the Al-Quran is not an easy thing to do, because memorizing the Al-Quran requires strong memory and high concentration [10]. Several studies have found that memorizing the AL-Quran can improve cognitive function.

MATERIALS AND METHODS

The aim of this study is to observe and analyze data using a cross-sectional approach. This study was conducted at Perguruan Tinggi Ilmu Quran (PTIQ) to find the effect of memorizing the Al-Quran on cognitive function in adulthood. The study participants involved 88 adult men and women aged $\geq$ 18 years who signed an informed consent form after receiving an explanation of the study. Exclusion criteria were: participants suffer from psychotic disorders, neurological disorders, taking antidepressant drugs, antipsychotics, or malignancy. Participants

were divided into three groups according the amount of memorization of Al-Quran part (juz). The first group has a total memorization of less than 10 juz, the second group has a total memorization of 11 – 20 juz, and the third group has a total memorization of 21 – 30 juz.

Cognitive function was assessed through the measurement of serum BDNF levels and MOCA-INA score. The BDNF serum levels were measured professionally using the ELISA method in collaboration with PRODIA Laboratory.

The MOCA-INA (Montreal Cognitive Assessment for Indonesian participants) is a test to evaluate different aspects of cognitive functioning. These areas include short-term memory, visuospatial memory, executive functions, attention, language, and spatial and temporal orientation. The MOCA-INA is a popular cognitive screening test, scores between 25 and 30 are typically considered normal.

Ethics clearance (No. 179/KER/FK/X/2022) was obtained from the Faculty of Medicine, Universitas Trisakti for this study. Using the SPSS v.25 program, data processing was conducted. The data were showed as mean ± SD. An ANOVA test was applied to assess the difference of mean between group. The statistical differences is considered significant if $p<0.05$.

RESULTS

The total number of participants in this study were 88 participants consisting of 49 (55.68 %) male and 39 (44.32 %) female (Table 1). The BDNF serum levels were higher in 11 – 20 juz groups (45540.25 ± 11661.84 pg/mL) and 21 – 30 juz groups (46005.6 ± 7304.86 pg/mL) than in <10 juz groups (37414.88 ± 10229.63 pg/mL), and there was a significant difference between memorizing Al-Quran and BDNF serum levels (p=0.002). The MOCA-INA score did not show a significant difference among the three groups (p=0.696) (Table 2).

DISCUSSION

This study showed that the highest level of BDNF and MOCA-INA score was observed among the participants who memorized the Al-Quran in the category of juz 21 – 30. BDNF plays an important role in changing to brain structure. BDNF is correlated with increased cognitive function. BDNF activity improve cognitive function [11].

Memorization involves processes called basic cognitive processes which include encoding, storing, and recalling memories, because these processes occur in many memory systems that function differently but are interconnected [12]. Memorization of the Al-Quran means the process of memorizing the Al-Qur'an as a whole, both memorization and accuracy of reading as well as pursuing, reciting and paying attention to keeping memorization from forgetting [13]. Memorizers of the Al-Quran in Arabic are called Hafidz Al-Quran. Hafidz Al-Quran is a person who memorizes well after going through the process of memorizing verse by verse of the Al-Qur'an on purpose. Hafiz Qur'an can recite verses of the Al-Qur'an without looking at these verses and must always keep their memorization so that they are not forgotten. Indeed, the Qur'an is easy to memorize as stated in one of its verses: "And verily We have made the Qur'an easy to understand and remember, then has anyone learned a lesson?" [14]. A study by Zoladz et al. repeated stimulation triggers long-term potentiation (LTP) [15].

A study by Irfannuddin et al Hafidz Al-Quran group has a significantly higher BDNF serum level than administrative workers group. Environmental stimulation related religious activity like memorizing Al-Quran may affect BDNF to support neuroplasticity [16]. A study by Zoladz et al., found that BDNF regulates long-term potentiation (LTP) in the hippocampus, which is a form of synaptic plasticity that contributes to long-term memory formation. [15].

Based on Hussain MH's study (2021) the treatment group listening to the Al-Quran had increased memory and was statistically significant. This is because listening to the Al-Quran can increase mood and happy hormones [17]. Based on Irawati K's study (2018), reading the

Al-Quran can prevent cognitive function decline in the elderly because reading and listening to the Al-Quran gives calm, piety, and controlling emotions for the reader [18]. Religious activities can improve cognitive function in terms of increasing the MoCa-Ina score [19].

CONCLUSION

The amount of juz memorized Al-Quran is significantly related to BDNF serum level. In practical terms, we may suggest that Muslims memorize the Al-Quran to improve cognitive function.

ACKNOWLEDGMENTS

The study's funding was graciously provided by the Faculty of Medicine at Universitas Trisakti, and the authors are immensely grateful for their support.

CONFLICTS OF INTEREST

Competing interests: No relevant disclosures. The authors declare that we have no conflicts of interest to disclose.

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FIGURE LEGEND

Table 1. Distribution of the general characteristics of the participants at base line

Characteristics	Mean	SD
Age (yo)	25.18	2.94
BDNF (pg/mL)	40356.55	10747.37
MOCA-INA	25.14	2.96

Table 2. BDNF levels and MOCA-INA score

Characteristics	Memorization Al-Quran			p value
	< 10 juz	11 – 20 juz	21 – 30 juz	
BDNF (pg/mL)	37414.88 ± 10229.63	45540.25 ± 11661.84	46005.6 ± 7304.86	0.002
MOCA-INA	25 ± 3.08	25 ± 2.88	25.73 ± 2.66	0.696

2. Bukti konfirmasi review

Manuscript Needs Revision (#JMCS-2501-2746 (R1))
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Manuscript ID: JMCS-2501-2746

Manuscript Title: **Memorizing Al - Quran Increases Serum BDNF Levels**

Authors: Donna Adriani, Patwa Amani, Mustika Anggiane Putri, Yudhisman Imran, Irmiya Rachmiyani, Ahmad Fauzi, Emad Yousif

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Reviewers Recommendation:
Reviewer 1:
Reviewer Comment For Author:

Abstract Structure :
The abstract mentions "Extensive research has been conducted on the impact of learning and memorizing Al-Quran on the cognitive abilities of adults," which is vague. Specify the findings of this study rather than general statements.
The phrase "The amount of juz memorized Al-Quran is significantly related to BDNF serum level" should specify the statistical significance (e.g., p = 0.002).
Ensure all claims in the abstract are supported by data in the main text.
2. Background/Introduction Issues
Sentence Repetition : The introduction repeats itself in parts. For example, the role of BDNF is mentioned multiple times.
Grammar and Syntax :
"Cognitive function can be assessed from the serum levels of Brain Derived Neurotrophic Factor (BDNF)" could be rephrased as "Cognitive function can be evaluated using serum BDNF levels."
"Based on the study there was found that there was a decrease in cognitive function at the age of over 20 years" is awkwardly phrased. Simplify it to: "Studies have shown a decline in cognitive function after age 20."
Citations Missing : Several claims lack citations. For instance:
"One of the assessments of cognitive function can be proven through Brain Derived Neurotrophic Factor (BDNF) levels" requires a reference.
"BDNF plays an important role in the memory process" should cite specific studies.
Logical Flow : The transition between sentences can be improved. For example, after discussing BDNF, directly introduce the role of memorizing the Al-Quran.
3. Materials and Methods Issues
Clarity of Procedures :
The description of participant selection is unclear. Specify how participants were recruited and screened.
The method for dividing participants into groups based on memorization levels is vague. Was it self-reported or verified?
Units and Consistency :
Ensure consistent use of units throughout. For example, "pg/mL" is used inconsistently with "pg /mL."
Define acronyms like "MOCA-INA" on first use.
Replicates :

Mention the number of replicates explicitly when describing experiments. For example, "Three replicates of 88 participants were tested per group."
Bias Assessment :
The exclusion criteria are listed, but inclusion criteria are not fully detailed. Specify any additional criteria beyond age and consent.
Ethical Approval :
While ethical approval is mentioned, include the date and full details of the ethics committee.
ADD THIS REFERERNCESGholipour, N., Amiripour, A. (2023). 'Relationship Between Personal Myth and Early Maladaptive Schemas with General Health in Third Year Male and Female High School Students in Islamshahr', Eurasian Journal of Science and Technology, 3(2), pp. 77-92. doi: 10.22034/ejst.2023.154920

Charsouei, S., Mohammad Rahimi, M. (2025). 'Determining Complications of Neurological System in Patients After Kidney Transplantation in Northwest Iran', Eurasian Journal of Science and Technology, 5(1), pp. 81-87. doi: 10.48309/ejst.2025.470565.1174

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Reviewer 2:
Reviewer Comment For Author:

Table Formatting :
Table 1 lacks proper alignment. Ensure columns are clearly labeled and aligned.
Use consistent decimal places for all values (e.g., mean and SD).
Figure Descriptions :
Figures are not included in the provided text. Ensure figures are high-quality and properly labeled.
Figure captions should provide more detail. For example, "Fig. 1. Distribution of BDNF Levels Across Groups" could include information on statistical tests used.
Data Presentation :
The statement "The BDNF levels were higher in 11–20 juz groups (45540.25 ± 11661.84 pg/mL) and 21–30 juz groups (46005.6 ± 7304.86 pg/mL)" should specify if these differences are statistically significant.
Provide confidence intervals for key results.

5. Discussion Issues
Repetition :
Some points in the discussion repeat those in the results section. Avoid redundancy by focusing on interpreting findings rather than restating them.
Comparative Analysis :
While the study compares different groups, deeper analysis is needed. For example, why do certain groups show higher BDNF levels than others?
Discuss potential mechanisms beyond neuroplasticity. Are there other pathways involved?
References :
Ensure all cited studies are relevant and up-to-date. For example, the reference to Zoladz et al. (2010) discusses physical activity but its relevance to memorization should be clarified.
Future Directions :
Expand on the concluding remarks about future research. Suggest specific areas, such as longitudinal studies or intervention trials.
6. Conclusions Issues
Brevity : The conclusion is concise but could elaborate on the broader implications of the findings. How might these results influence educational programs or religious practices?
Suggestions for Future Work : Mention specific gaps in knowledge that require further investigation.

3. Bukti konfirmasi submit revisi dan artikel yang sudah direvisi

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Authors: Donna Adriani, Patwa Amani, Mustika Anggiane Putri, Yudhisman Imran, Irmiya Rachmiyani, Ahmad Fauzi, Emad Yousif

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Artikel yang sudah direvisi

Memorizing Al - Quran Increases Serum BDNF Levels

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ABSTRACT

Introduction: Cognitive function refers to mental processes involving knowledge, information processing, and reasoning. Memorizing the Al-Quran can stimulate the production of brain-derived neurotrophic factor (BDNF), a crucial protein that plays a significant role in promoting the survival of neurons and synapses involved in memory and learning. BDNF levels can be used to assess cognitive function. Mild Cognitive Impairment (MCI) is often evaluated using the MOCA-INA score. This study utilized an observational analytic design with a cross-sectional approach. Extensive studies have explored the effects of learning and memorizing the Al-Quran on cognitive abilities in adults. In this study, cognitive function was evaluated by measuring serum BDNF levels and the MOCA-INA score. The study involved 88 adult participants aged 18-30 years who met the inclusion and exclusion criteria. The BDNF levels in the 11-20 juz group (45540.25 ± 11661.84 pg/mL) and the 21–30 juz group (46005.6 ± 7304.86 pg/mL) were significantly higher than those in the <10 juz group (37414.88 ± 10229.63 pg/mL). The difference between Quran memorization and BDNF levels was statistically significant ($p = 0.002$). However, the MOCA-INA scores did not show a significant difference across the three groups ($p = 0.696$). The amount of Al-Quran memorized is significantly associated with serum BDNF levels. Memorizing the Al-Quran may provide cognitive benefits, particularly in enhancing brain neurotrophic factors, and could be a beneficial practice for improving cognitive function in Muslims.

Keywords: BDNF, Cognitive, memorizing Al-Quran, MOCA-INA

INTRODUCTION

Cognitive function refers to a set of mental processes involved in learning, memory, attention, perception, language, intelligence, and reasoning. Some of the cognitive functions that are often assessed include learning, memory, attention, and executive function [1]. Studies have shown that cognitive function tends to decline after the age of 20 [2]. One way to assess cognitive function is through the measurement of Brain Derived Neurotrophic Factor (BDNF) levels, a crucial protein that plays a significant role in promoting the survival of synapses and neurons involved in memory and learning processes [4]. BDNF is particularly expressed in the hippocampus and para-hippocampus areas, which are vital for cognitive tasks related to memory and learning [5]. Besides BDNF levels, cognitive function can also be assessed using tools such as the MOCA-INA score. The MOCA-INA score is commonly used to screen for Mild Cognitive Impairment (MCI) [6]. The Al-Quran, the holy book of Islam, is believed by Muslims to be the word of Allah SWT revealed to the Prophet Muhammad SAW [7,9]. Individuals who read, memorize, and study the Al-Quran are referred to as Hafidz [10]. Memorizing the Al Quran is a challenging task, as it requires strong memory and high concentration [11]. Several studies have indicated that memorizing the Al Quran may have cognitive benefits, particularly in improving cognitive function.

MATERIALS AND METHODS

The aim of this study was to observe and analyze the effects of memorizing the Al-Quran on cognitive function in adults using a cross sectional approach. The study was conducted at Perguruan Tinggi Ilmu Quran (PTIQ) to evaluate this relationship. The study involved 88 adult participants (men and women aged ≥ 18 years), who provided written informed consent after

receiving a full explanation of the study's purpose and procedures. Inclusion criteria included adults aged 18 years and above, while exclusion criteria were participants diagnosed with psychotic disorders, neurological disorders, those on antidepressant or antipsychotic medications, or those with malignancies. Participants were divided into three groups based on the number of Al-Quran parts (juz) they had memorized: the first group (Group 1) included participants who had memorized fewer than 10 juz, the second group (Group 2) included those who had memorized 11-20 juz, and the third group (Group 3) included participants who had memorized 21-30 juz.

Cognitive function was assessed through two methods: the measurement of serum BDNF levels and the MOCA-INA (Montreal Cognitive Assessment for Indonesian participants) score. Serum BDNF levels were measured using the ELISA method, in collaboration with PRODIA Laboratory. The MOCA-INA test evaluates various aspects of cognitive functioning, including short term memory, visuospatial memory, executive functions, attention, language, and spatial and temporal orientation. The MOCA-INA is a widely used cognitive screening tool, with scores between 25 and 30 generally considered within the normal range.

Ethics approval was obtained from the Faculty of Medicine, Universitas Trisakti (No. 179/KER/FK/X/2022). Data processing was conducted using SPSS v.25, with results presented as mean ± SD. To assess the differences between groups, an ANOVA test was applied. A statistical significance level of $p < 0.05$ was considered meaningful.

RESULTS

Based on the data presented in the study, a total of 88 participants were included, consisting of 49 males (55.68%) and 39 females (44.32%), as indicated in Table 1. The general

characteristics of the participants at baseline included their age, BDNF serum levels, and MOCA-INA scores.

The mean age of the participants was 25.18 years, with a standard deviation of 2.94 years, indicating that the participants were relatively young adults with minimal age variation. The mean BDNF serum level was recorded at 40356.55 pg/mL, with a standard deviation of 10747.37 pg/mL, reflecting a moderate variation in BDNF levels among participants. In addition, the MOCA-INA score, which assesses cognitive function, had a mean value of 25.14 with a standard deviation of 2.96, suggesting that the majority of participants had relatively stable cognitive performance (Table 1).

These baseline characteristics provide an overview of the population studied, indicating a balanced gender distribution and consistent ranges for the key variables. The data also serve as a foundation for further analysis, particularly in exploring the relationships between demographic and biological factors, such as BDNF levels and cognitive function, across different groups in the study.

The findings revealed that the serum levels of brain-derived neurotrophic factor (BDNF) were notably higher in individuals who had memorized a greater number of Al-Quran juz. Specifically, participants in the 11–20 juz group exhibited an average BDNF serum level of 45540.25 ± 11661.84 pg/mL, while those in the 21–30 juz group showed an even higher average of 46005.6 ± 7304.86 pg/mL. In contrast, participants who had memorized fewer than 10 juz had significantly lower average BDNF serum levels, measuring 37414.88 ± 10229.63 pg/mL.

Statistical analysis indicated a significant correlation between the extent of Al-Quran memorization and BDNF serum levels, with a p value of 0.002, suggesting that increased memorization activity may positively influence BDNF levels (Table 2).

However, the analysis of cognitive function using the MOCA-INA (Montreal Cognitive Assessment - Indonesian version) score showed no significant differences across the three groups, as evidenced by a p-value of 0.696. This indicates that while memorization activity appears to have a measurable impact on BDNF serum levels, it may not directly translate to observable differences in cognitive function, as assessed by MOCA-INA, among the groups studied. These findings, summarized in (Table 2), highlight the potential memorization activities while suggesting that further research is needed to fully understand the relationship between BDNF levels and cognitive outcomes.

DISCUSSION

This study showed that the highest level of BDNF and MOCA-INA score was observed among the participants who memorized the Al-Quran in the category of juz 21 – 30. BDNF plays an important role in changing to brain structure. BDNF is correlated with increased cognitive function.

BDNF activity improve cognitive function [3,11]. Assessment of cognitive function consists of attention and concentration, executive function, memory, language, visuoconstruction, conceptual thinking, calculation, and orientation skills [12,13].

Memorization involves processes called basic cognitive processes which include encoding, storing, and recalling memories, because these processes occur in many memory systems that function differently but are interconnected [13]. Memorization of the Al-Quran means the process of memorizing the Al-Qur'an as a whole, both memorization and accuracy of reading

as well as pursuing, reciting and paying attention to keeping memorization from forgetting [14].

Memorizers of the Al-Quran in Arabic are called Hafidz Al-Quran. Hafidz Al-Quran is a person who memorizes well after going through the process of memorizing verse by verse of the Al-Qur'an on purpose. Hafiz Qur'an can recite verses of the AlQur'an without looking at these verses and must always keep their memorization so that they are not forgotten. Indeed, the Qur'an is easy to memorize as stated in one of its verses: "And verily We have made the Qur'an easy to understand and remember, then has anyone learned a lesson?" [15]. A study by Zoladz et al. repeated stimulation triggers long-term potentiation (LTP) [16].

A study by Irfannuddin et al. showed that Hafidz Al-Quran group has a significantly higher BDNF serum level than administrative workers group. Environmental stimulation related religious activity like memorizing Al-Quran may affect BDNF to support neuroplasticity [17]. Zoladz et al. found that BDNF regulates long-term potentiation (LTP) in the hippocampus, which is a form of synaptic plasticity that contributes to long-term memory formation. [16].

Based on Hussain MH's study (2021) the treatment group listening to the Al-Quran had increased memory and was statistically significant. This is because listening to the Al Quran can increase mood and happy hormones [18]. Based on Irawati K's study (2018), reading the Al-Quran can prevent cognitive function decline in the elderly because reading and listening to the Al-Quran gives calm, piety, and controlling emotions for the reader [19]. Religious activities can improve cognitive function in terms of increasing the MoCa-Ina score [20,22].

CONCLUSION

The amount of juz memorized Al-Quran is significantly related to BDNF serum level. In practical terms, we may suggest that Muslims memorize the Al-Quran to improve cognitive function.

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The findings of this study were graciously provided by the Faculty of Medicine at Universitas Trisakti, and the authors are immensely grateful for their support.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest to disclose in this study.

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FIGURE LEGEND

Table 1. Distribution of the general characteristics of the participants at base line

Characteristics	Mean	SD
Age (yo)	25.18	2.94
BDNF (pg/mL)	40356.55	10747.37
MOCA-INA	25.14	2.96

Table 2. BDNF levels and MOCA-INA score

Characteristics	Memorization Al-Quran			p value
	< 10 juz	11 – 20 juz	21 – 30 juz	
BDNF (pg/mL)	37414.88 ± 10229.63	45540.25 ± 11661.84	46005.6 ± 7304.86	0.002
MOCA-INA	25 ± 3.08	25 ± 2.88	25.73 ± 2.66	0.696

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Manuscript Title: **Memorizing Al - Quran Increases Serum BDNF Levels**

Authors: Donna Adriani, Patwa Amani, Mustika Anggiane Putri, Yudhisman Imran, Irmiya Rachmiyani, Ahmad Fauzi, Emad Yousif

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Review Article

Memorizing Al-Quran Increases Serum BDNF Levels

Donna Adriani[1*], Patwa Amani[1], Mustika Anggiane Putri[1], Yudhisman Imran[2], Irmiya Rachmiyani[3], Ahmad Fauzi[4], Emad Yousif[5]

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ABSTRACT

Cognitive function refers to mental processes involving knowledge, information processing, and reasoning. Memorizing the Al-Quran can stimulate the production of brain-derived neurotrophic factor (BDNF), a crucial protein that plays a significant role in promoting the survival of neurons and synapses involved in memory and learning. BDNF levels can be used to assess cognitive function. Mild Cognitive Impairment (MCI) is often evaluated using the MOCA-INA score. This study utilized an observational analytic design with a cross-sectional approach. Extensive studies have explored the effects of learning and memorizing the Al-Quran on cognitive abilities in adults. In this study, cognitive function was evaluated by measuring serum BDNF levels and the MOCA-INA score. The study involved 88 adult participants aged 18-30 years who met the inclusion and exclusion criteria. The BDNF levels in the 11-20 juz group (45540.25 ± 11661.84 pg/mL) and the 21–30 juz group (46005.6 ± 7304.86 pg/mL) were significantly higher than those in the <10 juz group (37414.88 ± 10229.63 pg/mL). The difference between Quran memorization and BDNF levels was statistically significant (p = 0.002). However, the MOCA-INA scores did not show a significant difference across the three groups (p = 0.696). The amount of Al-Quran memorized is significantly associated with serum BDNF levels. Memorizing the Al-Quran may provide cognitive benefits, particularly in enhancing brain neurotrophic factors, and could be a beneficial practice for improving cognitive function in Muslims.

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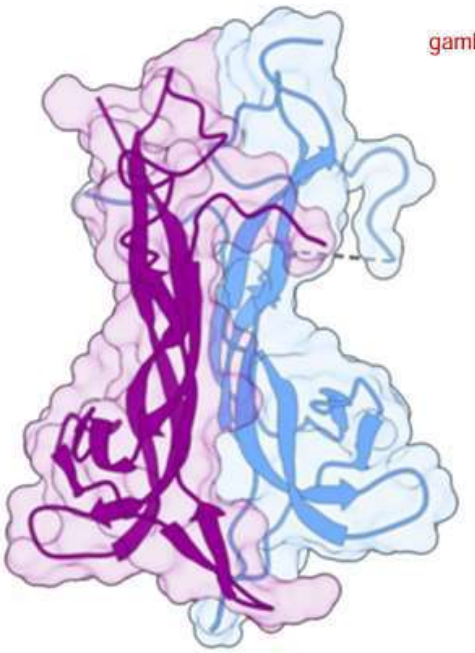
GRAPHICALABSTRACT



Introduction

Cognitive function refers to a set of mental processes involved in learning, memory, attention, perception, language, intelligence, and reasoning. Some of the cognitive functions that are often assessed include learning, memory, attention, and executive function [1]. Studies have shown that cognitive function tends to decline after the age of 20 [2]. One way to assess cognitive function is through the measurement of Brain Derived Neurotrophic Factor (BDNF) levels, a crucial protein that plays a significant role in promoting the survival of synapses and neurons involved in memory and learning processes [4]. BDNF is particularly expressed in the hippocampus and para-hippocampus areas, which are vital for cognitive tasks related to memory and learning [5].

Besides BDNF levels, cognitive function can also be assessed using tools such as the MOCA-INA score. The MOCA-INA score is commonly used to screen for Mild Cognitive Impairment (MCI) [6].

The Al-Quran, the holy book of Islam, is believed by Muslims to be the word of Allah SWT revealed to the Prophet Muhammad SAW [7,9]. Individuals who read, memorize, and study the Al-Quran are referred to as Hafidz [10]. Memorizing the Al-Quran is a challenging task, as it requires strong memory and high concentration [11]. Several studies have indicated that memorizing the Al-Quran may have cognitive benefits, particularly in improving cognitive function.

Materials and Methods

The aim of this study was to observe and analyze the effects of memorizing the Al-Quran on cognitive function in adults using a cross-sectional approach. The study was conducted at Perguruan Tinggi Ilmu Quran (PTIQ) to evaluate this relationship. The study involved 88 adult participants (men and women aged ≥ 18 years), who provided written informed consent after receiving a full explanation of the study's purpose and procedures.

Inclusion criteria included adults aged 18 years and above, while exclusion criteria were participants diagnosed with psychotic disorders, neurological disorders, those on antidepressant or antipsychotic medications, or those with malignancies.

Participants were divided into three groups based on the number of Al-Quran parts (juz) they had memorized: the first group (Group 1) included participants who had memorized fewer than 10 juz, the second group (Group 2) included those who had memorized 11-20 juz, and the third group (Group 3) included participants who had memorized 21-30 juz.

Cognitive function was assessed through two methods: the measurement of serum BDNF levels and the MOCA-INA (Montreal Cognitive Assessment for Indonesian participants) score. Serum BDNF levels were measured using the ELISA method, in collaboration with PRODIA Laboratory. The MOCA-INA test evaluates various aspects of cognitive functioning, including short-term memory, visuospatial memory, executive functions, attention, language, and spatial and temporal orientation. The MOCA-INA is a widely used cognitive screening tool, with scores between 25 and 30 generally considered within the normal range.

Ethics approval was obtained from the Faculty of Medicine, Universitas Trisakti (No. 179/KER/FK/X/2022). Data processing was conducted using SPSS v.25, with results presented as mean ± SD. To assess the differences between groups, an ANOVA test was applied. A statistical significance level of $p < 0.05$ was considered meaningful.

Results

Based on the data presented in the study, a total of 88 participants were included, consisting of 49 males (55.68%) and 39 females (44.32%), as indicated in Table 1. The general characteristics of the participants at baseline included their age, BDNF serum levels, and MOCA-INA scores.

The mean age of the participants was 25.18 years, with a standard deviation of 2.94 years, indicating that the participants were relatively young adults with minimal age variation. The mean BDNF serum level was recorded at 40356.55 pg/mL, with a standard deviation of 10747.37 pg/mL, reflecting a moderate variation in BDNF levels among participants. In addition, the MOCA-INA score, which assesses cognitive function, had a mean value of 25.14 with a standard deviation of 2.96, suggesting that the majority of participants had relatively stable cognitive performance (Table 1).

These baseline characteristics provide an overview of the population studied, indicating a balanced gender distribution and consistent ranges for the key variables. The data also serve as a foundation for further analysis, particularly in exploring the relationships between demographic and biological factors, such as BDNF levels and cognitive function, across different groups in the study.

Table 1: Distribution of the general characteristics of the participants at base line

Characteristics	Mean (pg/mL)	SD (pg/mL)
Age (yo)	25.18	2.94
BDNF (pg/mL)	40356.55	10747.37
MOCA-INA	25.14	2.96

The findings revealed that the serum levels of brain-derived neurotrophic factor (BDNF) were notably higher in individuals who had memorized a greater number of Al-Quran juz. Specifically, participants in the 11–20 juz group exhibited an average BDNF serum level of 45540.25 ± 11661.84 pg/mL, while those in the 21–30 juz group showed an even higher average of 46005.6 ± 7304.86 pg/mL. In contrast, participants who had memorized fewer than 10 juz had significantly lower average BDNF serum levels, measuring 37414.88 ± 10229.63 pg/mL. Statistical analysis indicated a significant correlation between the extent of Al-Quran memorization and BDNF serum levels, with a p-value of 0.002, suggesting that increased memorization activity may positively influence BDNF levels (Table 2).

However, the analysis of cognitive function using the MOCA-INA (Montreal Cognitive Assessment - Indonesian version) score showed no significant differences across the three groups, as evidenced by a p-value of 0.696. This indicates that while memorization activity appears to have a measurable impact on BDNF serum levels, it may not directly translate to observable differences in

cognitive function, as assessed by MOCA-INA, among the groups studied. These findings, summarized in (Table 2), highlight the potential neurobiological benefits associated with memorization activities while suggesting that further research is needed to fully understand the relationship between BDNF levels and cognitive outcomes.

Table 2: BDNF levels and MOCA-INA score

Characteristics	Memorization Al-Quran			*P*-value
	< 10 juz (n=29)	11-20 juz (n=30)	21-30 juz (n=29)	
BDNF (pg/mL)	37414.88 ± 10229.63	45540.25 ± 11661.84	46005.60 ± 7304.86	0.002
MOCA-INA	25 ± 3.08	25 ± 2.88	25.73 ± 2.66	0.696

Discussion

This study showed that the highest level of BDNF and MOCA-INA score was observed among the participants who memorized the Al-Quran in the category of juz 21 – 30. BDNF plays an important role in changing to brain structure. BDNF is correlated with increased cognitive function. BDNF activity improve cognitive function [3,11]. Assessment of cognitive function consists of attention and concentration, executive function, memory, language, visuoconstruction, conceptual thinking, calculation, and orientation skills [12,13].

Memorization involves processes called basic cognitive processes which include encoding, storing, and recalling memories, because these processes occur in many memory systems that function differently but are interconnected [13]. Memorization of the Al-Quran means the process of memorizing the Al-Qur'an as a whole, both memorization and accuracy of reading as well as pursuing, reciting and paying attention to keeping memorization from forgetting [14]. Memorizers of the Al-Quran in Arabic are called Hafidz Al-Quran. Hafidz Al-Quran is a person who memorizes well after going through the process of memorizing verse by verse of the Al-Qur'an on purpose. Hafiz Qur'an can recite verses of the Al-Qur'an without looking at these verses and must always keep their memorization so that they are not forgotten. Indeed, the Qur'an is easy to memorize as stated in one of its verses: "And verily We have made the Qur'an easy to understand and remember, then has anyone learned a lesson?" [15]. A study by Zoladz *et al.* repeated stimulation triggers long-term potentiation (LTP) [16].

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Conclusion

The amount of juz memorized Al-Quran is significantly related to BDNF serum level. In practical terms, we may suggest that Muslims memorize the Al-Quran to improve cognitive function.

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Disclosure Statement

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Authors: Donna Adriani, Patwa Amani, Mustika Anggiane Putri, Yudhisman Imran, Irmiya Rachmiyani, Ahmad Fauzi, Emad Yousif

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