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Effect of Jogging Duration on Concentration Levels among University Students

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Abstract

Background: Concentration is an important component of cognitive function. However, many college students experience reduced attention spans, often lasting only 10 to 15 minutes. Previous studies have shown that poor concentration levels remain common among university students. Physical exercise, such as jogging, may improve brain function and enhance concentration. This study aimed to evaluate the influence of jogging duration on concentration levels among university student.

Methods: This experimental study was conducted in 2024, involving medical students from a university in Jakarta, Indonesia. Participants were screened using the Physical Activity Readiness Questionnaire (PAR-Q) and selected through random sampling. Respondents were divided into three groups: a 10-minute jogging group, a 30-minute jogging group, and a control group without jogging intervention. The intervention was conducted for 8 weeks at each participant's location. Concentration levels were assessed before and after the intervention using the Concentration Grid Test, administered at the university. Data were analyzed using ANOVA to compare changes in concentration scores and the Kruskal-Wallis to compare post-intervention scores among groups.

Results: A total of 28 students participated, with females comprising the majority of participants (64.3%; n=18). The 10-minute jogging group demonstrated a significant improvement in concentration levels compared with the control group (p=0.004). Concentration Grid Test scores increased by 4.6 points in the 10-minute jogging group (p<0.001), and by 3.8 points in the 30-minute jogging group (p=0.003).

Conclusions: A 10-minute jogging session improves concentration levels among university students, suggesting that short-duration physical activity provide cognitive benefits and may support academic performance and well-being.

Keywords: Concentration level, concentration grid test, jogging duration, PAR-Q

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Introduction

Concentration is the ability to focus attention on particular task or subject without distraction from internal or external stimuli.[1] Good concentration enables individuals to maintain performance, process information efficiently, and perform cognitive activities, such as planning, decision-making, and problem-solving.[2,3] Impaired concentration may negatively affect academic achievements and daily functioning. Several factors have been associated with decreased concentration,

including stress, fatigue, poor sleep quality, unhealthy lifestyle and mental health problem.[4–9] These factors are commonly encountered among university students, making concentration problems prevalent in this population. Previous studies have shown that concentration levels among university students remain relatively low, despite some reporting predominantly good concentration performance.[10,11]

Regular physical exercise has been associated with improved cognitive function, including memory, attention, and concentration. Exercise may also improve self-confidence, reduce stress, and enhance academic performance.[12,.13] These effects are partly mediated through increased cerebral blood flow, improved neuroplasticity, and elevated levels of neurotrophic factors such as brain-derived neurotrophic factor (BDNF), insulin-like growth factor-1 (IGF-1), and vascular endothelial growth factor (VEGF).[14] Exercise also influences neurotransmitters synthesis, including dopamine, which plays an important role in attention and concentration process.[15]

Another intervention study has demonstrated that regular exercise improves concentration and other cognitive functions. An 8-weeks exercise intervention consisting of 40- minutes sessions performed three times weekly was shown to improve concentration levels among children with attention deficit hyperactivity disorder (ADHD).[16] However, evidence regarding the optimal duration of exercise for improving concentration remains inconsistent. A previous study reported a significant relationship between exercise duration and cognitive function,[17] whereas another found no significant differences in concentration improvement.[18] Moreover, intervention studies investigating jogging duration and concentration among university students are still limited. Therefore, this study aimed to evaluate the influence of jogging duration on concentration levels among university students in Jakarta, Indonesia.

Methods

This experimental study was conducted in 2024 using a randomized pretest-postest control group design. Participants were medical students from the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, classes of 2021–2023. Students who participated in structured exercise programs outside this study were excluded. Additional exclusion criteria included students with medical condition that could hinder exercise performance, smokers, students diagnosed with mental health disorders, and those receiving related medications. Dropout criteria included absence during concentration assessment sessions, failure to complete the prescribed exercise duration, or inability to provide monitoring data more than once. Ethical approval was obtained from the Ethics Committee of the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia (No. 01/08/KEP-FKIKUAJ/2024)

Participants completed informed consent forms and screening questionnaire before enrollment. Screening was performed using the Physical Activity Readiness Questionnaire (PAR-Q) questionnaire (Table 1) and an additional questionnaire assessing other exclusion criteria. The PAR-Q consisted of seven questions used to identify health conditions that could limit participation in moderate-to-vigorous physical activity.[19] Participants answering "yes" to any question were excluded from the study.

Concentration level was assessed using the Grid Concentration Test, a simple qualitative tool used to measure sustained attention and focus.[20] In this test, participants were instructed to identify numbers arranged randomly in a grid sequentially, from 00 to 99 within 1 minute.. Scores between 11 and 15 indicated impaired concentration, and score above 15 indicated above-average concentration. The Grid Concentration Test used in this study is presented in Figure 1.

A total of 30 students were selected through random sampling and equally divided into three groups: Group I, Group II, and a control group. Group I performed 10-minute jogging sessions, while Group II performed 30 minute jogging sessions. Both intervention group exercised three times weekly for 8 weeks. The control group did not perform structured exercise during the study period.

Exercise intensity was maintained at moderate intensity using the Karvonen Formulato determine each participant's target heart rate.[21] The target heart rate range was set at 50–70% of maximum heart rate according to the recommendations of the American Heart Association. Intervention monitoring was conducted using fitness or running applications that recorded exercise duration and average heart rate during each session. Participants were also required to submit selfie photographs as additional verification of compliance. Monitoring data were submitted

84	27	51	78	59	52	13	85	61	55
28	60	92	04	97	90	31	57	29	33
32	96	65	39	80	77	49	86	18	70
76	87	71	95	98	81	01	46	88	00
48	82	89	47	35	17	10	42	62	34
44	67	93	11	07	43	72	94	69	56
53	79	05	22	54	74	58	14	91	02
06	68	99	75	26	15	41	66	20	40
50	09	64	08	38	30	36	45	83	24
03	73	21	23	16	37	25	19	12	63

Figure 1 Table used for Grid Concentration Test[20]

weekly to the researchers through the LINE application.

Concentration levels were measured before and after the intervention. Baseline concentration assessment was carried out during the week before the intervention, while final assessment was conducted during the week after the 8-week intervention period. All concentration assessments were performed in a classroom at the university campus.

Statistical analysis was done according to data distribution. Normally distributed data were analyzed using the Paired t-test, while non-normality distributed data were analyzed using the Wilcoxon matched-pairs signed rank test. One-way ANOVA followed by Bonfferoni's post hoc analysis was used to compare differences in concentration score changes among groups. The Kruskal-Wallis test was used to compare final concentration scores between groups. Statistical significance was set at $p<0.05$.

Results

Of the 77 students who met the inclusion and exclusion criteria, 30 participants were selected for the study. However, two participants dropped out during the intervention period, therefore, only 28 participants were included in the final analysis. Most participants were female (64.3%; n=18) (Table 2).

In Group I, median concentration score increased significantly (p=0.001) from 7 (range 1–14) at baseline to 11 (range 6–18) after the intervention. Similarly, Group II

Table 1 Physical Activity Readiness Screening Questions (PAR-Q)[19]

Questions	Yes	No
Has your doctor ever told that you have a heart condition or high blood pressure?		
Do you experience pain at rest, during daily activities, or while doing physical activity?		
Have you experienced loss of balance due to dizziness or lost consciousness within the past 12 months?		
Have you ever been diagnosed with another chronic medical condition other than heart disease or high blood pressure?		
Are you currently taking prescribed medications for a chronic medical condition?		
Do you currently have, or have you had within the past 12 months, any bone, joint, or soft tissue problems (including muscles, ligaments, or tendons) that could worsen with increased physical activity?		
Has your doctor ever advised you to do physical activity only under medical supervision?		

Table 2 Characteristics of Participants (n=28)

Characteristics	Group I (n=9)		Group II (n=9)		Control Group (n=10)		Total
	n	%	n	%	n	%	n (%)
Gender							
Male	3	33.3	4	44.4	3	30.0	10 (35.7)
Female	6	66.7	5	55.6	7	70.0	18 (64.3)

Table 3 Concentration Grid Test Scores

Group	Initial Concentration	Final Concentration	t-score / z-score	p-value
	Median (min–max)	Median (min–max)		
I[a]	7 (1–14)	11 (6–18)	4.6	0.001*
II[a]	10 (5–20)	12 (4–21)	3.8	0.003*
Control[b]	8 (3–22)	7.5 (6–19)	0.2	0.891
p-value		0.07[c]		

Note: *p-value < 0.05, [a] t-scores were obtained using paired t-test in Group I and II, [b]z-score was obtained using the Wilcoxon matched-pairs signed rank test in control gorup, [c]Kruskal-Wallis test

demonstrated a significant improvement (p=0.003) in median concentration score from 10 (range 5–20) to 12 (range 4–21). In contrast, the control group showed a slight decrease in the median concentration score from 8 (range 3–22) to 7.5 (range 6–19), although this difference was not statistically significant (p=0.891) (Table 3).

Comparison of post-intervention concentration scores among groups using the Kruskal–Wallis test showed no statistically significant overall difference (p=0.070). Interestingly, there was a significant score difference between Group I and the control group on the final concentration score (p=0.003), whereas no significant difference was found between group II and the control group (p=0.208), indicating that 10-minute jogging was more effective in improving concentration levels compared with no intervention (Table 3).

Discussion

This study has resulted that 10-minute jogging sessions is effectively improved concentration levels among university students compared with the control group. These findings support previous study reporting that physical exercise enhance cognitive functions such as memory, concentration and academic performance.[12] Moderate-intensity physical activity has also been associated with improved psychological well-being, through reductions in stress and anxiety as well as enhancement of mental resilience.[13] Physiologically, exercise improves cognitive function performance by increasing cerebral blood flow, mitochondrial cellular metabolism, and neuronal signaling pathway involved neuroplasticity.[14] These effects are mediated through increased levels of neuroplasticity-related biomarkers, such as BDNF, IGF-1, and VEGF, which collectively contribute to improved concentration level and attention.[14] Recent evidence has further supported the positive impact of short duration exercise on concentration and other cognitive functions. A pilot study among Korean college students has found that brief outdoor exercise, especially when combined with exposure to natural environments, significantly improves concentration, and self-efficacy, optimism, and hope.[22]

Interestingly, although group II also showed significant within-group improvement, no significant difference was observed between the 30-minute jogging group and the control group after intervention, suggesting that longer-duration jogging may not provide additional benefits compared with shorter-duration exercise. In contrast, a randomized controlled trial has documented that 30-minute moderate-intensity aerobic exercise enhanced

concentration-related cognitive performance among young adults.[23] The discrepancy between findings may be explained by differences in participant characteristics, intervention protocols, or external factor affecting concentration. Another study has also reported that although exercise improve concentration, the magnitude of change may be relatively small.[24] One possible explanation is the influence of academic workload and stress among university students. Differences in class levels and study demands may contribute to variations in concentration performance and response to exercise interventions.[22]

This study has several limitations. First, the study design could not fully control factors affecting concentration levels, such as environmental conditions, dietary intake, fatigue, stress, and sleep quality. Second, the intervention was conducted at each participant's location, resulting in variability in exercise environments and monitoring conditions. More controlled settings with standardized exercise facilities, dietary intake, and daily schedules may provide more accurate results. Future studies involving larger and more diverse populations are also recommended to improve generalizability and to evaluate the influence of different stress levels and academic demands on concentration outcomes.

In conclusion, 10-minute jogging sessions effectively improve concentration levels among university students. In contrast, 30-minute jogging sessions may not provide additional benefits and could potentially introduce fatigue that affects concentration performance. These findings suggest that short-duration moderate-intensity exercise may serve as a practical strategy to improve concentration and support students' academic performance and overall well-being.

Authors' Contributions

AW contributed to the study conception, data acquisition, funding acquisition, and final approval of the manuscript. AJ and JRT contributed to manuscript drafting and revision and provided final approval of the manuscript. NAP contributed to data analysis, manuscript drafting and revision, and final approval of the manuscript. IRH contributed to the study conception and design, data analysis and interpretation, manuscript drafting and revision, and final approval of the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

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Generative AI Disclosure Statement

The authors used artificial intelligence (AI) tools solely for English grammar correction and language refinement during manuscript preparation. The authors reviewed, verified, and take full responsibility for the final content of the manuscript.

References

1. Sörqvist P, Dahlström Ö, Karlsson T, Rönnberg J. Concentration: the neural underpinnings of how cognitive load shields against distraction. Front Hum Neurosci. 2016;10:221. doi: 10.3389/fnhum.2016.00221
2. Sörqvist P, Marsh JE. How concentration shields against distraction. Curr Dir Psychol Sci . 2015;24(4):267–72. doi: 10.1177/0963721415577356
3. Queensland Brain Institute, University of Queensland. How the brain enables us to rapidly focus attention. 2018 [cited 2024 Apr 14]. Available from: https://qbi.uq.edu.au/article/2018/12/how-brain-enables-us-rapidly-focus-attention
4. Córdova Olivera P, Gasser Gordillo P, Naranjo Mejía H, La Fuente Taborga I, Grajeda Chacón A, et al. Academic stress as a predictor of mental health in university students. Cogent Education. 2023;10(2):2232686. doi: 10.1080/2331186X.2023.2232686
5. Khan MA, Al-Jahdali H. The consequences of sleep deprivation on cognitive performance. Neurosciences [Ryadh]. 2023;28(2):91–9. doi: 10.17712/nsj.2023.2.20220108
6. Le HV. An investigation into factors affecting concentration of university students. Journal of English Language Teaching and Applied Linguistics. 2021;3(6):7–12. doi:10.32996/jeltal.2021.3.6.2
7. Schorb A, Niebauer J, Aichhorn W, Schiepek G, Scherr J, Claussen MC. Overtraining from a sports psychiatry perspective. Dtsch Z Sportmed. 2021;72(6):271–9. doi**:** 10.5960/dzsm.2021.496.
8. Slimani M, Znazen H, Bragazzi NL, Zguira MS, Tod D. The effect of mental fatigue on cognitive and aerobic performance in adolescent active endurance athletes: insights from a randomized counterbalanced, cross-over trial. J Clin

Med. 2018;7(12):510. doi: 10.3390/jcm7120510.
9. Granero-Jiménez J, López-Rodríguez MM, Dobarrio-Sanz I, Cortés-Rodríguez AE. Influence of physical exercise on psychological well-being of young adults: a quantitative study. Int J Environ Res Public Health. 2022;19(7):4282. doi: 10.3390/ijerph19074282.
10. Lestari H, Setiasih W, Lovelly Vadincha A, Bakhtiar S, Muzzamil F. Sarapan memengaruhi tingkat konsentrasi belajar mahasiswa Universitas Bhayangkara. Parade Riset Mahasiswa.2023;1(1):575–86.
11. Paceli V, Setianingrum EL, Telussa AS, Nurina RL. Hubungan kualitas tidur dengan konsentrasi pada mahasiswa Fakultas Kedokteran Universitas Nusacendana. Cendana Medical Journal. 2022;2(24):301–8. doi: 10.35508/cmj.v10i2.9143
12. Nethravathi R, Sreenivas M. Role of sports participation on attention and concentration among children. Int J Indian Psychol. 2020;8(1):330–5. doi:10.25215/0801.041
13. Malm C, Jakobsson J, Isaksson A. Physical activity and sports—real health benefits: a review with insight into the public health of Sweden. Sports (Basel). 2019;7(5):127. doi: 10.3390/sports7050127
14. Pickersgill JW, Turco C V, Ramdeo K, Rehsi RS, Foglia SD, Nelson AJ. The combined influences of exercise, diet and sleep on neuroplasticity. Front Psychol. 2022;13:831819. doi:10.3389/fpsyg.2022.831819
15. Marques A, Marconcin P, Werneck AO, Ferrari G, Gouveia ÉR, Kliegel M, et al. Bidirectional association between physical activity and dopamine across adulthood—a systematic review. Brain Sci. 2021;11(7):829. doi:10.3390/brainsci11070829
16. Sun W, Yu M, Zhou X. Effects of physical exercise on attention deficit and other major symptoms in children with ADHD: A meta-analysis. Psychiatry Res. 2022;311:114509. doi:10.1016/j.psychres.2022.114509
17. Li M, Fang Q, Li J, Zheng X, Tao J, Yan X, et al. The effect of chinese traditional exercise-baduanjin on physical and psychological well-being of college students: a randomized controlled trial. PLoS One. 2015;10(7):e0130544. doi:10.1371/journal.pone.0130544
18. van den Berg V, Saliasi E, de Groot RHM, Chinapaw MJM, Singh AS. Improving cognitive performance of 9-12 years old children: just dance? A randomized controlled trial. Front Psychol. 2019;10:174. doi:10.3389/fpsyg.2019.00174
19. Warburton DER, Bredin SSD, Jamnik VK, Gledhill N. Validation of the PAR-Q+ and ePARmed-X+. Health & Fitness Journal of Canada. 2011;4(2):38–46. doi:10.14288/hfjc.v4i2.151
20. Harris DV, Harris BL. The athlete's guide to sports psychological: mental skills for physical people. Champaign, Illinois USA: Human Kinetics;1984.
21. Yabe H, Kono K, Onoyama A, Kiyota A, Moriyama Y, Okada K, et al. Predicting a target exercise heart rate that reflects the anaerobic threshold in nonbeta-blocked hemodialysis patients: the Karvonen and heart rate reserve formulas. Ther Apher Dial. 2021;25(6):884–9. doi: 10.1111/1744-9987.13628
22. Lee K, Bae H, Jang S. Effect of exercise combined with natural stimulation on korean college students' concentration and positive psychological capital: a pilot study. Healthcare (Switzerland). 2022;10(4):673. doi: 10.3390/healthcare10040673
23. Loprinzi PD, Kane CJ. Exercise and cognitive function: a randomized controlled trial examining acute exercise and free-living physical activity and sedentary effects. Mayo Clin Proc. 2015;90(4):450–60. doi: 10.1016/j.mayocp.2014.12.023
24. Linde K, Alfermann D. Single versus combined cognitive and physical activity effects on fluid cognitive abilities of healthy older adults: a 4-month randomized controlled trial with follow-up. J Aging Phys Act. 2014;22(3):302–13. doi:10.1123/japa.2012-0149.