Journal of Pioneering Medical Sciences
Received: August 08, 2026 | Accepted: October 17, 2026 | Published: November 15, 2026
Volume 15, Issue S02, Pages 205-210

DOI https://doi.org/10.47310/jpms202615S0223



Assessing Memory Function and the Role of a Healthy Lifestyle through Brain Training Games: A Cross-Sectional Study among University Healthcare Students

Fahad Somaa[1*], Turki Mansour Al-Argoubi[2], Salman Meteb Alsharif[3], Khalid Dahfer Al-Shehri[4], Fahad Al-Metere[5] and Azka Khan[6]

[1-5]Department of Occupational Therapy, Faculty of Medical Rehabilitation Sciences, King AbdulAziz University Jeddah, Saudi Arabia
[6]Faculty of Rehabilitation and Allied Health Sciences, Riphah International University, Islamabad, Pakistan

*Corresponding author: Fahad Somaa (e-mail: Fsomaa49@gmail.com).

©2026 the Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0

Abstract **Objectives:** Brain training games have gained popularity as cognitive enhancement tools. While their effectiveness has been studied in older adults, limited data exists on their impact in younger populations, particularly university students under academic pressure. **Objectives:** This study aimed to assess memory performance using brain training games among university healthcare students and explore associations with lifestyle factors and gender differences. **Methods:** A cross-sectional study was conducted with 101 students from King Abdulaziz University. Participants completed the Health-Promoting Lifestyle Profile II (HPLP II) and played two memory-focused brain games thrice. Scores and errors were recorded and analysed using SPSS 27 for descriptive statistics and multivariate analysis. **Results:** Most participants fell in the self-reported "Good" lifestyle category. The reported analyses did not show statistically significant differences in the two game scores across lifestyle categories (both $p>0.05$). Male participants scored higher on Game 2 than female participants ($p = 0.035$), while Game 1 did not show a detectable sex difference ($p = 0.637$). Conclusion: These are associations with task-specific game scores; the single-session design does not measure training-induced improvement or general memory function.

Key Words Brain Training Games, Memory Function, Lifestyle Factors, Cognitive Performance, Health Promoting Behaviours

INTRODUCTION

Cognitive functions evolve throughout the lifespan. Executive functions and working memory peak in the 20s or 30s [1], others (semantic knowledge) can continue to develop until age 60-70 [2]. It is interesting because cognitive functions in young adults right up to the age of 20 are not at their fullest ability yet. As a result, there has been interest in cognitive training interventions in both younger and older adults. Video game training is one such intervention with a proven effect on improving performance in practiced tasks as well as in secondary cognitive domains, or transfer effect [3].

Poor lifestyle choices have become a major public health concern, contributing to rising rates of heart disease and premature death. University students often fall into harmful patterns skipping workouts, eating junk food, smoking and binge drinking without realizing the long-term consequences. On the contrary, simple positive changes like physical activity and healthy eating can dramatically boost well-being and prevent illness. Researchers have studied how habits impact physical health, but there's growing interest in how they shape brain function, especially in students. Doing physical activity does not just build muscle-it sharpens focus, strengthens memory and lowers the risk of dementia. Healthy habits, such as nutritious eating and regular physical activity helps protect cognitive decline [4].

While lifestyle is often linked to physical health, an increasing number of studies suggest it also plays a key role in cognitive functioning among university students. For example, staying physically active has been found to boost brain health and lower the chances of cognitive decline [5]. Healthy eating and exercise can help defend against cognitive decline [4]. In the past ten years, the use of smartphones and mobile internet has grown quickly, leading to a rise in mobile apps. Many of these applications focus on health, especially improving brain function. Some studies have looked at how well these brain training apps work and results show that using them for 12 weeks or more can help improve cognitive skills [3,6].

While some studies suggest benefits, the long-term effects of cognitive training for people with Mild Cognitive Impairment (MCI) are still unclear, especially when it comes to preventing dementia [7]. Even so, using cognitive games before dementia develops has shown encouraging results in improving mental performance [8]. Brain training games are made to activate and strengthen different areas of thinking. They often involve activities like memory challenges, problem-solving tasks, puzzles and exercises that improve focus and attention [9,10]. Research has linked these games to better memory, faster thinking, sharper attention, improved multitasking and even better mood [11,12].

This study examines whether self-reported health-promoting lifestyle categories and sex are associated with scores obtained during two brief game-based tasks among university healthcare students. No intervention or pre/post cognitive assessment was conducted, so the study cannot determine whether games improve memory or whether lifestyle causes different performance.

METHODS

Participants

This cross-sectional study was conducted at King Abdulaziz University during the education year 2023-2024. Eligible participants were male and female university students from different department. About 101 participants completed the survey.

Survey Instrument

In the initial segment of the survey, participants were requested to disclose their gender, age, weight, height, BMI, program of study. Subsequently, in the second segment, respondents were presented with Lifestyle questionnaire. The Health-Promoting Lifestyle Profile II (HPLP II) was used to assess participants lifestyle behaviours. It uses 52 items to list health promoting behaviours in 6 domains: health responsibility, physical activity, nutrition, spiritual growth, social relations and stress management [13]. Responses are recorded using a 4-point Likert scale, with the options being: 1 = Never, 2 = Sometimes, 3 = Often and 4 = Routinely. Based on the respondents' answers to all items, the overall lifestyle score is determined by simply adding all items and the score ranges from 52 to 208, high being the score showing more frequent health promoting behaviours. For interpretive purposes, total scores were classified into four lifestyle categories: Poor: 52-90, Moderate: 91-129, Good: 130-168, Excellent: 169-208. HPLP II is well validated instrument that is highly reliable and internally consistent on different populations.

In the third section of the survey, participants engaged in two brain training games designed to assess aspects of memory function. Each participant was instructed to play both games three times. After each attempt, they were required to record two key metrics:

- Score achieved in each try
- Number of errors made during each try

Thus, for each game, participants provided data for three separate trials, resulting in a total of six scores and six corresponding error counts. These numeric entries were used to evaluate performance trends and consistency across repeated attempts, as well as to explore possible associations between cognitive performance and lifestyle factors.

Procedure

The study received ethical approval from the Ethical Committee of King Abdulaziz University. Participation in the survey was voluntary and respondents' answers were treated with strict confidentiality. An online questionnaire was created using Google Forms and distributed through various social media platforms. Before starting the survey, participants were presented with an informed consent form, which they had to read and agree to.

Data Analysis

Data was entered and analysed through SPSS version 27. First of all, normality of the data was checked so that the tests could be decided. Descriptive statistics was applied and multiple regression analysis was applied.

Analysis Clarification

Game scores and error counts were recorded over three attempts for each task. The within-person structure, score-combination algorithm, prespecified primary outcome, HPLP-II categorization thresholds and the use of any correction for multiple testing must be defined before interpreting subgroup comparisons. A single-session association does not provide evidence for cognitive-training efficacy.

RESULTS

A total of 101 university healthcare students participated in the study. Table 1 presents the frequency distribution of participant characteristics, including gender, program of study, BMI categories and lifestyle scores. Table 2 shows descriptive statistics for age, BMI, memory function scores (Game 1, Game 2 and composite) and total errors.

The Shapiro-Wilk test indicated that Game 1 and Game 2 scores were normally distributed ($p>0.05$), allowing parametric analyses to be used.

Multivariate analysis was conducted to examine the effects of gender and lifestyle categories on memory function outcomes. The results showed a statistically significant difference in Game 2 scores between males and females ($p = 0.035$), with a moderate effect size (partial $\eta^2=0.044$). No significant differences were observed for Game 1 scores by gender ($p = 0.637$) as summarised in Table 3 and Figure 1. Comparison across lifestyle categories revealed no statistically significant differences in memory function outcomes for either Game 1 ($p = 0.587$) or Game 2 ($p = 0.572$), indicating that lifestyle category was not associated with performance in the memory games.as summarized in Table 4 and Figure 2. Pearson correlation analyses demonstrated no significant associations between lifestyle scores and memory function, with weak correlations for Game 1 ($r = -0.073$, $p = 0.469$) and Game 2 ($r = 0.132$, $p = 0.189$).

Table 1: Frequency Distribution of Participant Characteristics (N = 101)

Variable	Category	Frequency (n)	Percentage
Gender of Participants	Male	76	75.2
	Female	25	24.8
Program of Study	Occupational Therapy	27	26.7
	Physical Therapy	15	14.9
	Dentistry	12	11.9
	Pharmacology	10	9.9
	Respiratory Therapy	11	10.9
	Medicine	22	21.8
	Radiology	1	1.0
	Speech and Language Therapy	2	2.0
	Laboratory Medicine	1	1.0
BMI Category	Underweight (<18.5)	8	7.9
	Healthy Range (18.5-24.9)	52	51.5
	Overweight (25-29.9)	23	22.8
	Obese (30-39.9)	15	14.9
	Severely Obese (≥40)	3	3.0
Lifestyle Score Category	Poor (52-90)	2	2.0
	Moderate (91-129)	38	37.6
	Good (130-168)	52	51.5
	Excellent (169-208)	9	8.9

Table 2: Descriptive Statistics of Participant Characteristics (N = 101)

Variable	Mean	Std. Deviation
Age	21.44	1.992
Weight	72.05	18.384
Height	169.00	8.25106
BMI (kg/m²)	25.10	5.62
Average score Game 2	11932.84	2304.74
Average Score Game 1	25238.59	2757.99
Composite Score for both games	18585.71	1792.52
Total Error (Game 1)	4.82	2.736
Total Error (Game 2)	3.52	1.188

Table 3: Effect of Playing Brain Games on Memory among Males and Females using Multivariate Analysis

Average Score Game 1	Gender	N	Mean	Std. Deviation	p value
	Male	76	25163.8154	2528.58817	0.637
	Female	25	25465.8880	3412.01466	
Average score Game 2	Male	76	12208.7720	2303.31721	0.035
	Female	25	11094.0000	2140.01168	

Table 4: Effect of Playing Brain Games on Memory between Different Lifestyle categories using Multivariate Analysis

Average Score Game 1	Lifestyle category	N	Mean	Std. Deviation	p value
	Poor	2	23750.0000	4926.17253	0.587
	Moderate	38	25678.0703	2567.56478	
	Good	52	25024.9458	2968.46402	
	Excellent	9	24948.1467	1876.24820	
Average score Game 2	Poor	2	10375.0000	2793.07179	0.572
	Moderate	38	11707.8947	1926.92607	
	Good	52	12052.8846	2628.82613	
	Excellent	9	12535.1856	1686.80418	

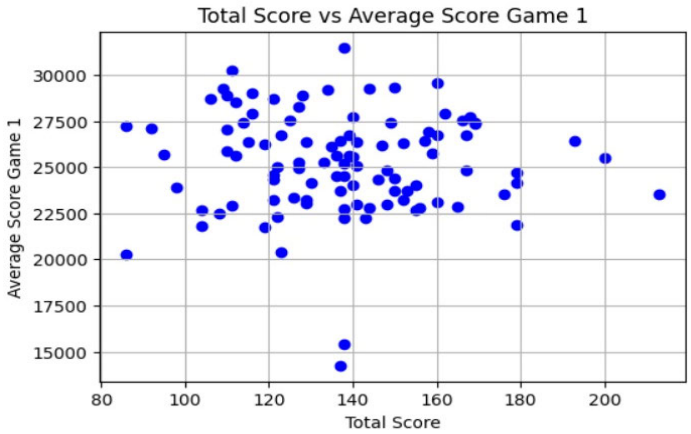


Figure 1: Scatter Plot between Lifestyle Total Scoring Vs Average Game Score 1

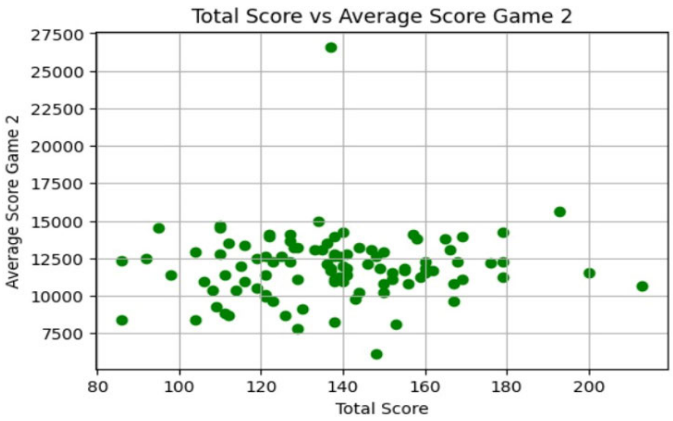


Figure 2: Scatter Plot between Lifestyle Total Scoring Vs Average Game Score 2

DISCUSSION

This study found that most university healthcare students had a "Good" lifestyle and showed average scores in both memory games. However, there was no statistically significant link between lifestyle categories and memory performance. Although the "Excellent" lifestyle group showed slightly better scores in Game 2, the difference wasn't meaningful statistically. Interestingly, when looking at gender differences, males scored significantly higher than females in Game 2, suggesting a moderate effect size. In contrast, there was no significant gender difference in Game 1 scores.

The present study examined the relationship between memory performance and lifestyle using brain training games among university healthcare students. Although students in the "Moderate" and "Excellent" lifestyle categories had higher average scores, the correlation was not statistically significant (Game 1: $r = -0.073$, $p = 0.469$; Game 2: $r = 0.132$, $p = 0.189$). Similarly, no significant differences were found across lifestyle groups (Game 1: $F[3,97] = 0.646$, $p = 0.587$; Game 2: $F[3,97] = 0.670$, $p = 0.572$). Contrary to this, Toril *et al.* [14] noted marked advances in the memory capabilities of older adults after extended training with video games. This difference might stem from the limited exposure to gaming in this study as opposed to the systematic, prolonged training in Toril *et al.*'s study. While the study focused on older adults, both studies support the cognitive value of digital games. The outcomes suggest that age, intervention length and lifestyle specificity may influence cognitive training effects [14].

Conversely, Guimaraes *et al.* [15] studied the impact of active video game-based physical activities and aerobic exercises on cognitive function in older adults, reporting a statistically significant enhancement in overall cognitive performance, especially in executive functioning skills, for the active gaming group ($p<0.05$). Compared to the current study, these findings are contrary to what was found when brain games were used and showed no considerable difference in lifestyle-based group memories. The discrepancy might stem from the different age groups, length of the intervention and the level of physical activity done. In this study, younger adults were subjected to short-duration cognitive games, while the other study employed digitally engaging physical activities over a longer period, likely leading to considerable cognitive improvements [15].

In the present study, individuals were classified based on the quality of their lifestyle and memory was measured using computer-based brain games. In comparison, Tazeem *et al.*'s [16] research compared medical students during adolescence who consistently practiced physical activity with those who played computer games, comparing selective cognitive abilities like memory and attention. Their results showed that physical activity students had considerably higher cognitive scores compared to the gaming group ($p<0.05$), indicating a causal relationship between physical lifestyle habits and cognition. In contrast to the present study utilizing a composite lifestyle score and obtaining no significant correlations, Tazeem *et al.* [16] investigated unique groups of behaviors, which may have yielded sharper contrasts in cognition. The variation in outcome can be ascribed to age of population, nature of cognitive activity and specificity of behavior assessment. Regardless, both pieces of research indicate that lifestyle behavior is strongly correlated with cognitive functioning in student samples [16].

Gates *et al.* [6] in their Cochrane systematic review stated that CCT for 12+ weeks produced small but significant improvements in cognition in healthy older adults (standardized mean difference = 0.15, 95% CI: 0.05 to 0.25; $p<0.01$). Whereas, our investigation employed short-term, game-oriented memory tasks, Gates *et al.* targeted longer-term interventions. Notwithstanding age and length variations, both sets of research attested to cognitive training effectiveness. Our investigation is the only one, however, that connects lifestyle habits with cognitive performance and this was not a main thrust in Gates' review. Our current study results indicated even a short-term session of game exposure, coupled with a healthy life, can gain appreciable improvements in memory. Gates *et al.*'s findings support the notion that consistent cognitive stimulation improves long-term brain health. Both highlight Gates the modifiable component of cognitive function through behavioural interventions [6].

The present study tested memory performance with brain training games and investigated gender and lifestyle effects in healthcare students. Compared to Nath *et al.* [17], the same population was assessed for empathy levels, with the emphasis placed on stable emotional functioning supported by organized training. Both pieces of research have a similar background-healthcare undergraduates-and highlight the need for non-conventional interventions to develop student potential. Contrary to Nath *et al.* [17] who obtained positive results from empathy training, our findings did not show any significant correlation between lifestyle and memory performance (Game 1: $p = 0.587$; Game 2: $p = 0.572$). Gender differences were also largely nonsignificant, apart from Game 2, in which males performed better ($p = 0.035$). This contrast implies that empathy might be more responsive to formally structured training, whereas memory performance might need longer-term cognitive or behavioral interventions. In general, although both emotional and cognitive ability are important within healthcare education, this comparison demonstrates the greater modifiability of emotional intelligence in response to brief interventions relative to cognitive performance, which can be affected by lengthy and multifactorial factors [17].

The present study tested memory performance with two brain-training games among health care students, considering gender and lifestyle impact. No gender difference was evident in Game 1 ($p = 0.637$), but males scored higher than females in Game 2 ($p = 0.035$). Lifestyle was not significantly related to scores on memory (Game 1: $p = 0.587$; Game 2: $p = 0.572$), although the "Moderate" category had higher descriptive scores. Relative to Peretz *et al.* [18], who reported large memory gains with personalized cognitive training in older adults, our results differ in statistical significance. The most notable distinction is in intervention design; Peretz's utilized a personalized, extended training, whereas ours applied short, non-personalized tasks. Regardless, both experiments emphasize the function of computer-based cognitive tools. Our findings indicate that brief game exposure is not likely to produce quantifiable memory improvements in young healthy adults, in contrast to organized programs in older adults. Future studies should investigate longer or tailored interventions to improve cognitive functioning effectively [18].

Jehangir [19] found notable enhancements in working memory after organized brain training exercises, particularly in younger adults. The disparity in results could be due to differences in methodology-Jehangir employed a randomized controlled trial with multiple sessions, while our study was cross-sectional with minimal training exposure. Both studies establish the importance of brain games in cognitive research, but our results indicate that short-term exposure is perhaps not enough for considerable improvement in memory. Jehangir's findings support the importance of ongoing, focused interventions in improving cognitive function. Although age was of primary concern in Jehangir's research, gender differences between our findings show individual variation in game-based memory performance. Altogether, the results underscore intervention design, frequency and participant characteristics as paramount [19].

Compared with Yang *et al.* [20], who reported video game-based interventions improving older adults' cognitive performance, our findings reflect a variance in efficacy. This difference could be due to age-related responsiveness or the longer intervention durations in Yang's meta-analysis compared to our one-session cross-sectional study. The implication of Yang's results is the potential for gamified tools to enhance cognition with long-term exposure, while ours implies that short-term usage might not result in detectable memory improvement among young adults. Both studies verify the efficacy of brain games for cognitive improvement but stress the value of intervention duration and population heterogeneity. Our study points out that gender could affect certain game responses, while Yang et al. demonstrated generalized improvement across many cognitive areas. These results combined endorse additional longitudinal and age-varied research into brain game effectiveness [20].

CONCLUSION

In this cross-sectional sample of 101 university healthcare students, the reported lifestyle categories were not detectably associated with the two game scores. A sex difference was observed only for Game 2 ($p = 0.035$) and should be interpreted cautiously because the game's psychometric properties, repeated-trial handling and multiplicity adjustment are not established. The results relate to performance on two specific tasks and cannot be generalized to memory enhancement or overall cognitive ability.

REFERENCES

[1] Blakemore, S.J. and S. Choudhury. "Development of the adolescent brain: Implications for executive function and social cognition." *Journal of Child Psychology and Psychiatry*, vol. 47, nos. 3-4, 2006, pp. 296-312.

[2] Park, D.C. *et al.* "Models of visuospatial and verbal memory across the adult life span." *Psychology and Aging*, vol. 17, no. 2, 2002, p. 299.

[3] Nouchi, R. *et al.* "Brain training game boosts executive functions, working memory and processing speed in the young adults: A randomized controlled trial." *PLOS ONE*, vol. 8, no. 2, 2013, article e55518.

[4] Caamaño-Navarrete, F. *et al.* "Healthy lifestyle related to executive functions in Chilean university students: A pilot study." *Healthcare*, 2024.

[5] Salas-Gomez, D. *et al.* "Physical activity is associated with better executive function in university students." *Frontiers in Human Neuroscience*, vol. 14, 2020, article 11.

[6] Gates, N.J. *et al.* "Computerised cognitive training for 12 or more weeks for maintaining cognitive function in cognitively healthy people in late life." *Cochrane Database of Systematic Reviews*, no. 2, 2020.

[7] Gates, N.J. *et al.* "Computerised cognitive training for preventing dementia in people with mild cognitive impairment." *Cochrane Database of Systematic Reviews*, no. 3, 2019.

[8] Bonnechère, B. *et al.* "Brain training using cognitive apps can improve cognitive performance and processing speed in older adults." *Scientific Reports*, vol. 11, no. 1, 2021, article 12313.

[9] Nouchi, R. *et al.* "Brain training game improves executive functions and processing speed in the elderly: A randomized controlled trial." *PLOS ONE*, vol. 7, no. 1, 2012, article e29676.

[10] Simons, D.J. *et al.* "Do 'brain-training' programs work?" *Psychological Science in the Public Interest*, vol. 17, no. 3, 2016, pp. 103-186.

[11] Wang, G. *et al.* "Game-based brain training for improving cognitive function in community-dwelling older adults: A systematic review and meta-regression." *Archives of Gerontology and Geriatrics*, vol. 92, 2021, article 104260.

[12] Zickefoose, S. *et al.* "Let the games begin: A preliminary study using Attention Process Training-3 and Lumosity brain games to remediate attention deficits following traumatic brain injury." *Brain Injury*, vol. 27, no. 6, 2013, pp. 707-716.

[13] Walker, S. *et al.* "The health-promoting lifestyle profile II." 1995.

[14] Toril, P. *et al.* "Video game training enhances cognition of older adults: A meta-analytic study." *Psychology and Aging*, vol. 29, 2014. DOI:10.1037/a0037507.

[15] Guimarães, A. *et al.* "Active videogame-based physical activity vs. aerobic exercise and cognitive performance in older adults: A randomized controlled trial." *Journal of Physical Education and Sport*, 2018. DOI:10.7752/jpes.2018.01026.

[16] Tazeem, M.S. *et al.* "A cross-sectional comparative study of select cognitive functions in adolescent medical students engaged in physical activities and video gaming." *Digital Journal of Clinical Medicine*, vol. 6, no. 2, 2024, p. 12.

[17] Nath, R. *et al.* "Cultivating compassion: A cross-sectional evaluation of empathy among medical undergraduate students." *Digital Journal of Clinical Medicine*, vol. 7, no. 1, 2024, pp. 1.

[18] Peretz, C. *et al.* "Computer-based, personalized cognitive training versus classical computer games: A randomized double-blind prospective trial of cognitive stimulation." *Neuroepidemiology*, vol. 36, no. 2, 2011, pp. 91-99.

[19] Jehangir, S. "Impact of brain training activities on working memory and age-related differences: A randomized controlled trial." *Pakistan Journal of Rehabilitation*, vol. 9, no. 2, 2020, pp. 42-47.

[20] Yang, C. *et al.* "The effect of video game-based interventions on performance and cognitive function in older adults: Bayesian network meta-analysis." *JMIR Serious Games*, vol. 9, no. 4, 2021, article e27058