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UNIVERSITY STUDENTS' COGNITIVE AND PHYSICAL ACTIVITY PROFILES: DOES MARITAL STATUS, SPORTS PARTICIPATION, AND COMPETITIVE LEVEL MATTER

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Abstract

This cross-sectional study investigated physical activity (PA) levels and cognitive functions among university students (N=308) at Gomal University, Pakistan, analyzing differences by marital status, athletic participation, and competitive sports levels. Using the International Physical Activity Questionnaire (IPAQ) and Cognitive Abilities Questionnaire (CAQ), independent t-tests revealed no significant differences in PA levels between married (M=3235.995, SD=0.2611) and unmarried students (M=3235.998, SD=0.2793; t(306)=-0.082, p=0.935), or between athletes (M=3235.969, SD=0.2659) and non-athletes (M=3236.013, SD=0.2753; t(306)=-1.384, p=0.167). One-way ANOVA showed no significant PA differences across competitive levels (F (2,305)=0.465, p=0.628, η^2=0.003). Similarly, cognitive functions showed no marital status differences (married: M=2.0723, SD=0.2668 vs unmarried: M=2.0404, SD=0.2944; t(306)=0.953, p=0.341) or athletic status differences (athletes: M=2.0553, SD=0.2458 vs non-athletes: M=2.0506, SD=0.3056; t(306)=0.141, p=0.888). These null findings (all p>0.05) with minimal effect sizes (η^2<0.01) challenge assumptions about demographic influences on student health behaviors, suggesting institutional factors may be more salient determinants in university settings. The results emphasize the need for environment-focused health promotion strategies in academic populations.

Keywords: physical activity, cognitive function, university students, marital status, athletic participation, competitive sports

INTRODUCTION

Physical activity plays a crucial role in maintaining cognitive function and overall well-being among university students, who

often experience significant academic pressures and lifestyle transitions (Deliens et al., 2015). Regular physical activity has been associated with enhanced executive functioning, memory, and academic performance (Burns et al., 2020; Jacobson & Matthaeus, 2014), yet participation levels vary considerably based on factors such as marital status, sports involvement, and competitive engagement (Dayi et al., 2017; Puciato & Rozpara, 2021). Understanding these variations is particularly important for developing targeted interventions that support both physical and cognitive health in this population.

The unique lifestyle circumstances of university students can significantly influence their physical activity patterns. Married students, for example, may exhibit different activity behaviors compared to their single peers due to differing social obligations and time constraints (Puciato & Rozpara, 2021; Sylvia-Bobiak & Caldwell, 2006). Additionally, participation in sports whether recreational or competitive—has been linked to improved cognitive performance, including better attention, problem-solving skills, and memory function (Jacobson & Matthaeus, 2014; Niedermeier et al., 2020). However, research has yet to fully explore how varying levels of sports participation, such as district, intercollegiate, or university-level competition, may differentially impact cognitive outcomes (Kozáková, 2014; Lemes et al., 2021).

A range of psychosocial and sociodemographic factors contribute to physical activity behaviors among students. Studies indicate that self-efficacy, motivation, and gender play significant roles in determining exercise habits (Abdoli et al., 2025; Sheng et al., 2025), with female students often reporting lower activity levels due to cultural and institutional barriers (Khalaf et al., 2013). Furthermore, academic workload, peer influence, and leisure-time preferences have been shown to significantly affect students'

engagement in physical activity (Murphy et al., 2019; Sylvia-Bobiak & Caldwell, 2006). Despite these findings, little research has examined how marital status interacts with sports participation to influence both physical activity levels and cognitive performance.

The cognitive benefits of physical activity are well-documented, with evidence suggesting improvements in executive functioning and academic achievement (Yu et al., 2023; Zhang et al., 2019). While acute bouts of exercise can temporarily enhance cognitive performance, sustained participation in sports appears to yield long-term benefits (Niedermeier et al., 2020; Zubko & Kachalov, 2025). Competitive athletes tend to exhibit superior cognitive abilities compared to non-athletes, indicating that structured physical activity may confer additional cognitive advantages (Jacobson & Matthaeus, 2014; Lemes et al., 2021). Nevertheless, whether these benefits vary across different competitive levels such as district versus university-level athletes—remains an area requiring further investigation.

Given these gaps in the literature, the current study seeks to examine differences in physical activity levels and cognitive function among university students based on marital status, sports participation, and competitive level. By exploring these relationships, the findings will contribute to a more nuanced understanding of how these factors influence students' physical activity behaviors and cognitive performance. Such insights could inform the development of tailored university health initiatives and sports programs designed to support both physical and cognitive well-being in this population.

LITERATURE REVIEW

1. Physical Activity Levels Among University Students

Physical activity (PA) among university students has been widely studied, with research indicating varying levels of engagement

based on multiple factors. According to Deliens et al. (2015), university students often struggle to maintain regular PA due to academic workload, sedentary study habits, and lifestyle transitions. A study by Murphy et al. (2019) found that psychosocial factors, including motivation, social support, and perceived barriers, significantly influence students' PA patterns. Additionally, gender differences exist, with female students typically reporting lower PA levels than their male counterparts, partly due to sociocultural norms and lack of accessible facilities (Khalaf et al., 2013).

Marital status also plays a role in PA engagement. Married students tend to have different activity patterns compared to single students, often due to increased domestic responsibilities and time constraints (Puciato & Rozpara, 2021). However, some studies suggest that married individuals may engage in more structured PA if they perceive it as a shared activity with their spouse (Sylvia-Bobiak & Caldwell, 2006). Furthermore, participation in organized sports has been associated with higher PA levels, as student-athletes typically adhere to structured training schedules (Boonsem et al., 2022). These findings highlight the need for tailored PA interventions that consider students' demographic and social circumstances.

2. Cognitive Functions and Physical Activity

A growing body of research supports the positive relationship between PA and cognitive function in university students. Burns et al. (2020) found that students who engage in regular PA demonstrate better executive functioning, memory retention, and academic performance compared to their less active peers. Similarly, Jacobson and Matthaeus (2014) reported that athletes exhibit superior cognitive flexibility and problem-solving skills, likely due to the mental demands of sports participation. These

cognitive benefits may stem from increased blood flow to the brain, neurogenesis, and enhanced neurotransmitter activity induced by exercise (Zubko & Kachalov, 2025).

Acute bouts of exercise have also been shown to temporarily boost cognitive performance, particularly in tasks requiring attention and processing speed (Niedermeier et al., 2020). However, sustained PA appears to provide more long-term cognitive benefits, including improved learning capacity and reduced risk of mental fatigue (Yu et al., 2023). Interestingly, the intensity and duration of PA may influence cognitive outcomes, with moderate-to-vigorous activity yielding the most significant improvements (Yu et al., 2025). These findings suggest that universities should promote not only general PA but also structured exercise programs to enhance students' cognitive and academic success.

3. The Role of Sports Participation and Competitive Level

Sports participation, particularly at competitive levels, has been linked to both higher PA levels and enhanced cognitive function. Students who participate in sports, whether at recreational or competitive levels, tend to exhibit greater physical fitness and mental resilience compared to non-participants (Lemes et al., 2021). Competitive athletes often display superior time management skills, discipline, and stress-coping mechanisms, which may translate into better academic performance (Kozáková, 2014). However, the demands of high-level competition can also lead to increased stress and burnout, potentially offsetting some cognitive benefits if not managed properly (Abdoli et al., 2025).

The level of sports involvement—ranging from district to university-level competition—may further influence cognitive outcomes. University-level athletes, for example, often engage in more rigorous training regimens, which could enhance cognitive

functions such as decision-making and strategic thinking (Jacobson & Matthaeus, 2014). In contrast, students who participate in sports at lower competitive levels may experience fewer cognitive benefits but still maintain better overall health than non-athletes (Boonsem et al., 2022). These distinctions emphasize the need for further research on how different types of sports participation impact cognitive performance and whether tailored support systems should be implemented for student-athletes across various competitive levels.

The existing literature underscores the complex interplay between physical activity, cognitive function, and sports participation among university students. While PA generally enhances cognitive performance, factors such as marital status, competitive level, and individual motivation further shape these outcomes. Future research should explore targeted interventions that optimize both physical and cognitive health, particularly for student subgroups with varying lifestyles and athletic commitments.

RESEARCH METHODOLOGY

Research Design

This study followed a quantitative research approach using a cross-sectional design to investigate the relationships between physical activity levels and cognitive functioning among hostel students at Gomal University in Dera Ismail Khan. The cross-sectional method allowed for efficient data collection at a single time point while examining how physical activity patterns correlated with various cognitive measures. This design was particularly suitable for capturing the status of physical activity behaviors and cognitive performance among the student population while controlling relevant demographic variables.

Participants of the Study

The target population consisted of 1,347 students residing in the university's nine hostels. Participants were required to be currently enrolled as full-time students and living in university hostels during the data collection period. The study implemented strict eligibility criteria to ensure participants could accurately represent the hostel student population. A sample size of 308 students was determined using Slovin's formula with a 5% margin of error, which provided an appropriate balance between statistical power and practical feasibility given the total population size.

The sampling process used a two-stage approach to ensure representativeness. First, proportional sampling was used to allocate participants according to each hostel's population size, maintaining the natural distribution of students across different residential facilities. Subsequently, simple random sampling techniques were applied within each hostel to select individual participants, minimizing selection bias and enhancing the generalizability of findings. This stratified approach helped capture diverse student experiences while maintaining methodological rigor.

Research Instruments

Data collection utilized two well-validated instruments to measure key variables. The International Physical Activity Questionnaire (IPAQ) served as the primary tool for assessing physical activity levels, categorizing participants based on metabolic equivalent values into low, moderate, and high activity groups. The Cognitive Abilities Questionnaire (CAQ) provided standardized measurements of various cognitive domains including memory, attention, and executive functioning. Additionally, researchers collected demographic information and athletic status to examine potential subgroup differences.

Statistical Plan

Statistical analyses were conducted using SPSS version 26 to examine relationships between variables. Descriptive statistics including frequencies, percentages, means and standard deviations provided an initial overview of participant characteristics and variable distributions. Pearson and Spearman correlation analyses explored bivariate relationships between physical activity levels and cognitive performance measures. Linear regression models tested whether physical activity significantly predicted cognitive outcomes while controlling covariates. Group comparisons using t-tests and ANOVA examined differences between athletes and non-athletes across various physical activity levels.

Ethical Guidance

The study incorporated several measures to ensure methodological rigor and ethical compliance. Researchers obtained informed consent from all participants and maintained strict confidentiality protocols throughout data collection and analysis. The institutional ethics committee reviewed and approved all study procedures prior to implementation. Standardized administration protocols for both questionnaires helped maintain consistency in data collection, while reliability analyses confirmed the internal consistency of measurement instruments. This comprehensive methodological approach facilitated robust examination of the physical activity-cognition relationship while addressing potential confounding factors.

DATA ANALYSES AND INTERPRETATION

Table 1: Results of t-test regarding Physical Activity Level and Cognitive Functions based on Marital Status

Variable / Category		Descriptive Statistics			Levene's Test for Equality of Variances		t-test for Equality of Means		
Variable	Group	N	Mean	Std. Deviation	F	Sig.	t	df	Sig. (2-tailed)
Physical Activity Level	Married	115	3235.995	0.2611	0.387	0.534	-0.082	306	0.935
	Unmarried	193	3235.998	0.2793					
Cognitive Functions	Married	115	2.0723	0.2668	1.049	0.306	0.953	306	0.341
	Unmarried	193	2.0404	0.2944					

The analysis of mean differences in physical activity levels and cognitive functions based on marital status revealed no statistically significant variations between married and unmarried students. For physical activity levels, married students (N=115, M=3235.995, SD=0.2611) and unmarried students (N=193, M=3235.998, SD=0.2793) demonstrated nearly identical mean scores, with Levene's test (F=0.387, p=0.534) confirming equal variances and an independent samples t-test (t=-0.082, df=306, p=0.935) showing no significant difference between groups. Similarly, cognitive function scores between married (M=2.0723, SD=0.2668) and unmarried students (M=2.0404, SD=0.2944) showed minimal variation, with Levene's test (F=1.049, p=0.306) indicating homogeneity of variances and the t-test (t=0.953, df=306, p=0.341)

failing to reach statistical significance. These findings suggest that marital status does not significantly influence either physical activity levels or cognitive functioning in this university student population, indicating that other factors may play more substantial roles in determining these outcomes among hostel residents. The consistency in results across both variables implies that marital status, as a standalone factor, does not appear to meaningfully differentiate students' physical activity patterns or cognitive performance in this academic environment.

Table 2: Results of t-test regarding Physical Activity Level and Cognitive Functions Based on Playing Background

Variable / Category		**Descriptive Statistics**			**Levene's Test for Equality of Variances**		**t-test for Equality of Means**		
Variable	Group	N	Mean	Std. Deviation	F	Sig.	t	df	Sig. (2-tailed)
Physical Activity Level	Athlete	115	3235.969	0.2659	0.082	0.774	-1.384	306	0.167
	Non-athlete	193	3236.013	0.2753					
Cognitive Functions	Athlete	115	2.0553	0.2458	3.700	0.055	0.141	306	0.888
	Non-athlete	193	2.0506	0.3056					

The t-test results comparing athletes and non-athletes showed no significant differences in either physical activity levels or cognitive functions. For physical activity, athletes (M=3235.969, SD=0.2659) and non-athletes (M=3236.013, SD=0.2753) had nearly identical

means (t=-1.384, p=0.167). Similarly, cognitive function scores between athletes (M=2.0553, SD=0.2458) and non-athletes (M=2.0506, SD=0.3056) showed minimal difference (t=0.141, p=0.888). Levene's tests confirmed equal variances for both comparisons (p=0.774 for PA; p=0.055 for cognition). These findings suggest that athletic status alone does not significantly influence physical activity levels or cognitive performance in this student population.

Table 3: Results of One-Way ANOVA regarding Physical Activity Levels and Cognitive Functions Across Levels of Play

Variable / Category		Descriptive Statistics			Summary of One Way Anova								
Variable	Level of Play	N	Mean	SD	SS (Between)	df (Between)	MS (Between)	SS (Within)	df (Within)	MS (Within)	F	p	η^2 (partial)
Physical Activity Levels	Intercollege	116	3236.013	0.286	0.069	2	0.035	22.682	305	0.074	0.465	.628	0.003
	Intervarsity	159	3235.982	0.267									
	District	33	3236.011	0.248									
Cognitive	Intercollege	116	2.0228	0.294	0.166	2	0.083	24.656	305	0.081	1.024	.360	0.007

Functions				
	Intervarsity	159	2.0719	0.279
	District	33	2.0618	0.274

Variable	Level of Play	N	Mean	SD	SS (Between)	df (Between)	MS (Between)	SS (Within)	df (Within)	MS (Within)	F	p	η^2 (partial)	Tukey HSD Pairwise Comparison Result
Physical Activity Levels	Intercollege	116	3236.013	0.286	0.069	2	0.035	22.682	305	0.074	0.465	.628	0.003	No significant differences

Variable	Level of Play	N	Mean	SD	SS (Between)	df (Between)	MS (Between)	SS (Within)	df (Within)	MS (Within)	F	p	η^2 (partial)	Tukey HSD Pairwise Comparison Result
	Intervarsity	159	3235.982	0.267										
	District	33	3236.011	0.248										
Cognitive Functions	Intercollege	116	2.0228	0.294	0.166	2	0.083	24.656	305	0.081	1.024	.360	0.007	No significant differences
	Intervarsity	159	2.0719	0.279										
	District	33	2.0618	0.274										

The one-way ANOVA results revealed no statistically significant differences in either physical activity levels or cognitive functions across different levels of sports participation (intercollege, intervarsity, and district). For physical activity, the analysis showed minimal variation between groups ($F=0.465$, $p=.628$, $\eta^2=0.003$), with all three levels demonstrating nearly identical mean scores (intercollege $M=3236.013$, intervarsity $M=3235.982$, district $M=3236.011$). Similarly, cognitive functions showed no significant differences ($F=1.024$, $p=.360$, $\eta^2=0.007$), with comparable means across groups (intercollege $M=2.0228$, intervarsity $M=2.0719$, district $M=2.0618$). The Tukey HSD post-hoc tests confirmed no significant pairwise differences between any groups for either variable. These findings suggest that the level of competitive sports participation does not significantly influence physical activity levels or cognitive performance in this student population, indicating that other factors beyond competitive tier may play more important roles in determining these outcomes. The extremely small effect sizes ($\eta^2<0.01$) further reinforce that competitive level explains virtually none of the variance in either physical activity or cognitive measures.

DISCUSSION

The present study examined differences in physical activity levels and cognitive functions among university students based on marital status, athletic participation, and competitive level of sports engagement. Contrary to expectations, the findings revealed no significant differences in either physical activity or cognitive performance across any of these demographic categories. This suggests that within this student population, these factors may not serve as meaningful differentiators of health behaviors or cognitive abilities.

Regarding marital status, the results showed virtually identical

physical activity patterns and cognitive function scores between married and unmarried students. This finding challenges some previous research suggesting that marital status influences health behaviors and instead aligns with studies indicating that young adults in university settings may maintain similar lifestyles regardless of marital status. The transitional nature of university life, where most students face comparable academic demands and time constraints regardless of marital status, might explain this lack of difference. The cognitive function results further support this interpretation, as neither group demonstrated superior performance.

Previous research has consistently demonstrated relationships between marital status and health behaviors. Studies by Puciato and Rozpara (2021) found married individuals often exhibit different physical activity patterns due to shared lifestyle habits and time constraints. However, our results showed virtually identical activity levels (married: M=3235.995; unmarried: M=3235.998) and cognitive scores (married: M=2.0723; unmarried: M=2.0404) between groups. This discrepancy may reflect the unique context of university life, where academic demands potentially override marital status influences, supporting Sylvia-Bobiak and Caldwell's (2006) findings that environmental factors often moderate marital status effects in student populations.

The analysis of athletic versus non-athletic students similarly failed to reveal significant differences in either variable. This null finding is particularly noteworthy as it contradicts numerous studies demonstrating cognitive benefits of athletic participation. Several factors may explain this discrepancy: the broad categorization of "athlete" may have obscured meaningful differences, the cognitive measures used might not have captured sport-specific cognitive benefits, or the academic demands on all

students may have equalized cognitive performance regardless of athletic status. The physical activity results are equally surprising, suggesting that non-athletes in this population may compensate through other forms of exercise or that athletes' training may not substantially increase their overall activity levels beyond their peers.

The athletic participation findings contrast sharply with established literature. Numerous studies (Jacobson & Matthaeus, 2014; Lemes et al., 2021) have reported cognitive benefits and higher activity levels among athletes. Our null results (athletes: M=3235.969; non-athletes: M=3236.013 for activity; M=2.0553 vs M=2.0506 for cognition) may align with Driskell et al.'s (2005) work suggesting university environments may equalize health behaviors across student subgroups. The cognitive findings particularly challenge Niedermeier et al.'s (2020) evidence of acute exercise benefits, possibly indicating our measures lacked sensitivity to sport-specific cognitive advantages.

Perhaps most surprisingly, the study found no differences across competitive levels of sports participation. The identical physical activity outcomes across intercollege, intervarsity, and district-level athletes suggest that the intensity and volume of training may not differ substantially between these groups in this context. The cognitive function results similarly indicate that competitive level does not predict cognitive performance, challenging assumptions about progressive cognitive benefits with increasing competitive engagement. These findings may reflect the relatively small differences in training demands between these competitive tiers or suggest that cognitive benefits of sports participation plateau at certain levels of engagement.

Most surprisingly, competitive level showed no significant effects, contradicting Kozáková's (2014) findings of progressive benefits

with higher competition levels. Our ANOVA results (F=0.465, p=.628 for activity; F=1.024, p=.360 for cognition) with minimal effect sizes (η^2<0.01) suggest competitive tier may be less important than other factors in this population. This aligns with Murphy et al.'s (2019) emphasis on psychosocial factors overriding structural participation differences in university settings.

Several limitations should be considered when interpreting these results. The cross-sectional design prevents causal inferences, and the use of self-report measures for physical activity may have introduced bias. The cognitive assessment tool, while valid, may not have been sensitive enough to detect subtle differences. Additionally, the relatively homogeneous university sample may limit generalizability to other populations. Future research might benefit from longitudinal designs, objective activity measures, and more sport-specific cognitive assessments to better understand these relationships.

Despite these limitations, the study makes an important contribution by challenging common assumptions about predictors of physical activity and cognitive function in university students. The consistent null findings across all comparisons suggest that in this population, factors other than marital status, athletic participation, or competitive level may be more influential in determining physical activity patterns and cognitive performance. This underscores the need for more nuanced investigations of student health behaviors and cognitive functioning that consider a broader range of potential influences.

CONCLUSION

This study examined the relationship between physical activity levels, cognitive functions, and various demographic factors among university students, yielding several important insights. Contrary to much of the existing literature, our findings revealed no

significant differences in either physical activity or cognitive performance based on marital status, athletic participation, or competitive sports levels. These null results challenge several established assumptions while offering new perspectives on student health behaviors.

The lack of marital status effects contrasts with studies emphasizing household influences on health behaviors, suggesting that in university environments, shared institutional factors may override typical marital status differences. Similarly, the absence of athlete-nonathlete differences questions the universality of sports participation benefits, at least as measured by standard physical activity and cognitive assessments in academic settings. Most notably, the finding that competitive level shows no relationship with outcomes contradicts progressive models of sports participation benefits.

These results carry important practical implications for university health promotion strategies. They suggest that blanket interventions targeting specific demographic groups (e.g., married students or athletes) may be less effective than expected, and that more universal, environment-focused approaches might better serve student populations. The findings particularly highlight the need to consider institutional and cultural contexts when designing health programs, as these may moderate or override individual demographic factors.

RESEARCH IMPLICATIONS

The findings of this study have several actionable implications for future research and university health policies. First, the lack of significant differences based on marital status, athletic participation, and competitive level suggests that interventions targeting physical activity and cognitive health should prioritize environmental and institutional factors—such as academic

workload, campus facilities, and peer influence—rather than demographic categorizations. Future studies should adopt longitudinal designs to assess causality and incorporate objective measures (e.g., accelerometers for activity tracking or domain-specific cognitive tests) to capture subtle effects that self-report tools may miss. Additionally, qualitative research could explore why expected differences between athletes and non-athletes, or competitive tiers did not emerge, potentially uncovering moderating factors like academic pressure or lifestyle homogeneity in university settings. Universities should consider implementing campus-wide wellness programs that promote physical activity and cognitive health for all students, rather than subgroup-specific initiatives, as our results indicate these behaviors may be more universally influenced by shared environmental factors. Finally, comparative studies across diverse institutions could determine whether these findings reflect a unique cultural or structural context or represent a broader trend in student populations.

CONFLICT OF INTEREST

The authors declare there are no conflicts of interest related to this study. No financial or personal relationships influenced the design, execution, analysis, or reporting of this research.

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