

Participation in Sports and Mental Health: Mediating Role of Cognitive Skills and Time Management

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The current study aims to explore the impact of participation in sports on the mental health of male and female university students in Pakistan through the mediating roles of cognitive skills and time management. A cross-sectional design was employed to conduct the research. The sample comprised $N = 327$ ($n = 174$ male; $n = 153$ female) students from various public and private universities in Pakistan. A self-developed questionnaire was utilised to assess the study variables. Data were analysed through Structural Equation Modelling using Smart PLS 4. Among male students, sports participation has a significant direct effect on cognitive skills, time management, and mental health. Cognitive skills and time management have a direct positive impact on mental health. Additionally, time management partially mediates the relationship between sports participation and mental health. Moreover, sports participation has a significant indirect effect on mental health through cognitive skills and time management. In female students, participation in sports has a direct effect on cognitive skills. Cognitive Skills have a significant impact on time management and mental health. Cognitive skills partially mediate the relationship between sports participation and mental health. Permutation MGA results revealed a substantial difference in the effects of time management and cognitive skills on mental health. Findings can help academic institutions encourage participation in both indoor and outdoor sports and introduce learning activities to improve cognitive skills. These components of personal growth will enable the students to manage complex tasks effectively.

Keywords: sports participation, mental health, cognitive skills, time management, multigroup analysis, PLS-SEM

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Introduction

Sports participation is characterized by a set of coherent activities involving physical or mental exertion performed by like-minded individuals. These activities involve a set of specific rules and an objective to win, either as individuals or as teams. Furthermore, sports activities focus on specific skills that can be refined through practice and training (O'Donnell et al., 2020). Apart from numerous physical and mental health benefits (Eather et al., 2023), participating in sports helps improve daily life skills, including cognitive functioning, time management, sportsmanship, achievement motivation, and a sense of competence (Rahman, 2024).

Cognitive skills are defined as higher-order brain activities involved in thinking, reasoning, problem-solving, judgment, and decision-making (American Psychological Association, n.d.). The development of cognitive skills depends on various genetic (Mustafin et al., 2020) and environmental factors (Tucker-Drob & Briley, 2014). This is a lifelong process that begins when an individual is born and continues to develop until adolescence and young adulthood, and is maintained afterwards (Craig & Bialystok, 2006). Cognitive skills are crucial for achieving major academic and career-related goals (Spinath et al., 2006). Physical activities are one of the leading factors in improving cognitive skills (AlMamari & Traynor, 2021; Donnelly et al., 2016). Time management can be understood as the ability of an individual to efficiently allocate a specific period to various daily activities, including studies, leisure activities, household tasks, social engagements, or a part-time job (Zoloth, 2024). Time management helps maintain discipline in life at any stage, whether it is a student's life or an adult's life, as it involves managing studies, extracurricular activities, hobbies, career, family, and other social responsibilities (Chansaengsee, 2017). Effective time management ultimately leads to better mental well-being (Garg, 2024).

Mental well-being is described as a state of being satisfied and contented with life, as well as being able to effectively cope with life's challenges (Campbell, 1976; Diener et al., 1999; Galderisi et al., 2015).

Sports participation helps individuals learn these skills through intrinsic motivation, skill development, as well as building social connections. Therefore, these skills also help improve mental wellbeing (Bengtsson et al., 2025; Ryan & Deci, 2017).

Participating in sports, which involves physical exertion, is associated with numerous positive health outcomes among university students. Passarello et al. (2022) conducted a neuropsychological assessment of two groups of university students, measuring their graphic fluency, cognitive skills and emotional well-being. One group of 30 students participated in sports and the other did not. Findings revealed that athletic students scored significantly higher on cognitive tasks than the sedentary ones. They also outperformed in tests of emotional well-being and executive brain functioning. Wang et al. (2020) surveyed 1,608 Chinese students and found that participation in extracurricular sports activities helps improve life satisfaction by reducing academic stress. Ishihara et al. (2020) found in a longitudinal study that the sports participation of 7th-grade students over the next two years helped improve academic performance through improved cardiovascular health. Quitting sports participation resulted in reduced academic performance and adverse health outcomes. Theory-based research further revealed that exercise and sports participation help improve cognitive skills, enhance the skill acquisition process, and improve overall health (Tomprowski & Pesce, 2019).

According to a study by Johnson and Loprinzi (2019), participation in physical activity, particularly in team sports, can enhance cognitive function and academic performance. Furthermore, sports participation has been shown to reduce symptoms of anxiety and depression, as well as improve self-esteem and social connectedness in university students (Eather et al., 2023; Panza et al., 2020). Several other studies have found a positive impact of sports participation on mental wellbeing, improved cognitive skills, and reduced stress and anxiety among college and university students (Graupensperger et al., 2021; Pourranjbar et al., 2019; Thomas et al., 2019). Significant gender differences have been found in sports participation and its impact on cognitive functioning and mental health of university students by Kruger (2023), Puett et al. (2014), and Sağiroğlu et al. (2023).

Despite being aware of the numerous physical and mental health benefits associated with sports participation, students often hesitate to participate due to concerns about an excessive workload, lack of time and other social responsibilities (Ávalos-Ramos et al., 2024; Hekim & Er, 2022; Vojvodic et al., 2020). On the other hand, various studies have demonstrated the significant positive impact of sports participation on daily life skills, with time management being the most important. Ghalib et al. (2024) conducted a multi-method study to explore the impact of

sports participation on the well-being and personal development of university students. Among 300 adults from sports clubs in Peshawar, Pakistan, it was found that sports participation helps improve social well-being and daily life skills, including time management and decision making. Khan et al. (2019) also confirm that sports participation has a significant positive impact on time management skills in university students. Cronin and Allen (2018) employed Banson and Saito's framework to explore the relationship between coaching climate, sports participation and life skills development in British youth.

They found that the coaching climate had a significant positive impact on time management and other life skills, including enhanced mood and satisfaction with life. These factors left a positive impact on mental well-being. Quinaud et al. (2023) conducted a qualitative study exploring improved time management skills, leadership, and mental well-being among medical students who were actively participating in basketball. The literature discussed above, on the one hand, reveals that university students participate less in sports due to perceived time constraints; on the other hand, it clearly explains the importance of sports participation in improving time management skills. This relationship has been extensively studied more in European countries than in Asian countries, especially in Pakistan and India.

Theoretical Background

The current study is grounded in mental well-being theory, self-determination theory and gender schema theory. Mental well-being theory, introduced by Rachmad (2024), states that mental well-being is characterized not only by the absence of mental disorder but also by the presence of positivity in life, which helps fight life's challenges and maintain satisfaction. This theory helps to understand the development and achievement of wellbeing by following three principles. First, an individual must recognize his/her emotions; secondly, maintain healthy social relationships; and thirdly, create an environment conducive to mental wellbeing. This theory also emphasizes the importance of physical activity in maintaining mental health. The current study also draws on self-determination theory as well as gender schema theory. Self-determination theory states that if an individual gets basic needs of autonomy,

competence and relatedness fulfilled, he/she will be able to have improved cognitive functioning and mental wellbeing (Ryan & Deci, 2000). Gender schema theory suggests men and women develop different social roles based on social expectations of their culture (Bem, 1981). The development of gender-based schemas leads them to perform differently in daily activities. This concept led the researchers of this study to explore how sports participation affects mental well-being of male and female university students through mediating roles of cognitive skills and time management.

Rationale

Participation in sports plays a vital role in maintaining both physical and mental health (Martín-Rodríguez et al., 2024). It not only reduces the likelihood of chronic health issues but also enhances well-being at every stage of life (Malm et al., 2019). A more competitive environment in education has limited the sports activities at the institutional level due to time restrictions (Sangwan et al., 2024), because of which stress, anxiety, and mental disorders have become common issues among youth, especially university students (McDowell et al., 2017; Siefken et al., 2019).

Although a substantial body of literature exists on sports participation and mental health, the existing research is primarily focused on the direct effects of sports participation on psychological health or life satisfaction (Appelqvist-Schmidlechner et al., 2018; Eather et al., 2023; Hiremath, 2019; Lubans et al., 2016; St Quinton, 2022; Wiedenman et al., 2024). Similarly, literature is available on the relationship between sports participation and students' academic performance or cognitive skills across various educational levels (Bjelica & Jovanović, 2016; Buha et al., 2024; Giordano et al., 2021; Liu & Taresh, 2024). However, these studies have not addressed the issue of mental health with the mediating role of cognitive skills, as well as time management. The present study addresses a gap in previous research by incorporating time management as a mediator between sports activities and mental health. The present research further contributes to the existing literature by linking regular sports participation with cognitive skills, time management, and mental health. This study aims to investigate the impact of participating in sports on university students' mental health, examining the mediating roles of cognitive skills and time management. Differences in behavioural patterns and the nature of responsibilities between males and females have created a significant disparity in the gender-based participation ratio in sports (Deaner et al., 2016; Rosenfeld, 2017; Strandbu et al., 2019). Collectively,

female university students in Pakistan participate in sports less frequently than males (Ge et al., 2022; Laar et al., 2019; Safdar et al., 2025). This has led researchers of the current study to explore the gender differences in the study's variables.

Objectives

1. To analyze the role of sports participation on cognitive skills of university students.
2. To analyze the role of sports participation on time management.
3. To analyze the mediating role of cognitive skills and time management between sports participation and mental health of university students.

Hypotheses

Based on the previous discussion, we have formulated the following hypotheses:

H1a: Sports participation has a significant positive impact on the cognitive skills of male university students.

H1b: Sports participation has a significant positive impact on the cognitive skills of female university students.

H2a: Sports participation has a significant positive impact on the mental health of male university students.

H2b: Sports participation has a significant positive impact on the mental health of female university students.

H3a: Cognitive skills have a significant impact on the mental health of male university students.

H3b: Cognitive skills have a significant impact on the mental health of female university students.

H4a: Cognitive skills mediate the relationship between sports participation and the mental health of male university students.

H4b: Cognitive skills mediate the relationship between sports participation and the mental health of female university students.

H5a: Sports participation has a significant positive impact on the time management skills of male university students.

H5b: Sports participation has a significant positive impact on the time management skills of female university students.

H6a: Time management skills have a significant impact on the mental health of male university students.

H6b: Time management skills have a significant impact on the mental health of female university students.

H7a: Time management skills mediate the relationship between sports participation and the mental health of male university students.

H7b: Time management skills mediate the relationship between sports participation and the mental health of female university students.

H8a Cognitive skills and time management act as serial mediators between sports participation and the mental well-being of male university students.

H8b Cognitive skills and time management act as serial mediators between sports participation and the mental well-being of female university students.

Method

Research Design

A correlation (cross-sectional) research design was employed to explore the impact of sports participation on the cognitive skills, time management, and mental health of university students in Pakistan. The study was conducted from October 2023 to May 2024, taking into account the exam schedule, holidays, and ongoing national sports competitions. The target population consisted of undergraduate and graduate students competing in cricket, football, volleyball, netball, boxing, badminton, and table tennis at the national levels. This timeline was also dependent on the schedule and travel convenience of students who volunteered to collect data from their respective cities and were living in other cities for study purposes.

Sample

The sample of the current study comprises $N=327$ graduate and undergraduate students from public and private universities in the province of Punjab, Pakistan. Of these, $n = 174$ were male and $n = 153$ were female students. The sample size was calculated using the inverse square root method (Kock & Hadaya, 2018). According to this method, the minimum required sample size depends on the ratio of standard error and the minimum expected path coefficient (Hair et al., 2022, P. 26).

According to the described method, assuming the significance level of 5%, a minimum expected path coefficient 0.2, the minimum sample size required was 155 (154.51, rounded up). To enhance the external validity of the study, a larger sample size was targeted. Therefore, approximately 500 participants were approached for inclusion in the study. An 11-item questionnaire was developed to measure the frequency of sports participation, cognitive skills, time management, and mental well-being following approval from the departmental ethics committee and formal start of the research. Students from the parent department volunteered to collect the data. A total of 500 questionnaires were distributed among the university students actively participating in sports through snowball sampling. The study was conducted on the students who were involved in sports activities and who were representing their educational institutions in sports competitions. The initial participants were approached through institutional sports clubs, coaches and student sports networks. The

sample was then expanded by snowball sampling with these participants as referrals for other eligible student athletes. All the respondents voluntarily participated in the data collection and informed consent was obtained orally prior to data collection.

The subjects of the study were students from the university, who were in their degree program and who agreed to take part in the study. Only students who indicated some sports activity participation at least once a week or rarely were included in the final analysis so that the effects of sports activity participation could be evaluated meaningfully by the respondents. Questionnaires that had significant missing items, non-completion or answers that were contradictory were discarded. Additionally, students who reported no involvement in any physical activity were excluded from the sample since the study explored the relationship between sports engagement, cognitive skills and mental health. After data cleaning procedures, 327 questionnaires, which were valid and met the inclusion criteria, were retained for data analysis from the 389 questionnaires sent.

Demographic Information

Table 1 shows the demographic information of participants. From the sample of 327 participants, 46.79% (n = 153) were female students while 53.21% (n = 174) were male students. Out of the total sample, approximately 78% participants were selected from undergraduate programs of universities while remaining 22% were selected from graduate programs.

Table 1

Demographic Information of Participants

Variables	<i>f</i>	%
Gender		
Female	153	46.79
Male	174	53.21
Education Level		
Undergraduate	255	77.98
Graduate	72	22.02
Sports Participation		
Everyday	12	3.67
4-5 times a week	42	12.84
2-3 times a week	78	23.85
Once a week or Rarely	195	59.63

Note: *f*= Frequency, % = Percentage

Questionnaire Development

The questionnaire was self-developed according to the foundation of Social Cognitive Theory (Bandura, 1986), which explains that experiential learning and active involvement in activities are significant strategies for developing cognitive skills such as attention, problem solving, and decision making skills. The cognitive skills items were created based on a literature search on the relationship between participation in sports and cognitive development. The construct was operationalized by having participants report greater focus, motivation to execute critical tasks, improved problem-solving skills, and better decisions in their everyday lives due to engaging in sports. The first items were assessed for content validity by experts in sports sciences and social sciences. Then, the psychometric characteristics of the instrument were determined by reliability analysis, validity analysis, factor loadings, composite reliability and convergent validity analysis. Moreover, items of mental health were adapted from (Bijkerk et al., 2023).

Sports Participation

Sports participation is measured as the frequency of participating in sports per week (O'Donnell et al., 2020). Participants were asked about the frequency of sports participation in a closed-ended question (1 = rarely or once a week and 4 = Everyday). Increased participation frequency means higher involvement in physical activities; therefore, it is expected to help develop cognitive skills like concentration, motivation, and problem solving and decision-making skills. Active involvement in sport also fosters discipline, time management and psychological well-being which positively impact students' academic and personal growth (Martín-Rodríguez et al., 2024; Malm et al., 2019).

Cognitive Skills

This construct is measured using four statements that inquire about participants' perception of improved focus, increased motivation to perform any critical task other than playing, problem-solving, and everyday decision-making (Ericsson & Oliver, 2019). Respondents rated the statements on a 5-point Likert scale ranging from 0 to 4.

Time Management

Time management is assessed using two statements that inquire about how efficiently participants manage their time for studies and sports, rated on a 5-point Likert scale (Sağıroğlu et al., 2023).

Mental Health

The mental health construct was designed on the basis of the subjective well-being literature and the conceptualisation of mental health of the

World Health Organization. This construct was operationalized by three indicators of psychological outcomes from sports participation, in the form of lower level of stress, higher positive mood and better overall well-being. Previous studies have consistently included these dimensions as key factors in positive mental health and psychological function of students and physical active people (Bijkerk et al., 2023). This is measured by asking participants to rate their stress level, boost in positive mood, and general well-being on a 4-point Likert scale.

Analysis

Data were analyzed through Partial Least Squares-Structural Equation Modelling using Smart PLS 4. The serial mediation model was created, comprising four reflective constructs: one exogenous (sports participation), two mediating (cognitive skills and time management), and one endogenous construct (mental health). The Path Model was tested in 2 Phases. Phase 1 involved evaluating the measurement model by assessing and validating its psychometric properties, including Cronbach's alpha, composite reliability, content validity, and discriminant validity. Common method bias is also addressed in this phase. Phase 2 involved assessing path coefficients and multi-group analyses.

Results

Measurement model evaluation was performed by calculating the PLS Algorithm. Reliability was evaluated using Cronbach's alpha and composite reliability, based on the minimum set criteria of 0.7 (Hair et al., 2022). Convergent validity was assessed using AVE, with values above 0.50 considered acceptable (Hair et al., 2022). Discriminant validity is considered to be established if the HTMT ratio is below 0.85 (or 0.90 for conceptually similar constructs) (Henseler et al., 2015). The results of the psychometric properties have been presented in Table 2.

Table 2

Psychometric Properties of the Study Constructs (N=327)

Variables	K	Loading Range	α	Composite Reliability	AVE	HTMT<0.9
Cognitive Skills	4	0.531-0.740	0.536	0.737	0.416	Yes
Time Management	2	0.760-0.875	0.518	0.802	0.671	Yes
Mental Health	3	0.541-0.823	0.469	0.725	0.475	Yes

Note: K=total number of items, α = Cronbach's alpha.

Results reported in Table 2 indicate that the Cronbach's alpha of the constructs is below the specified criterion of 0.7. According to Hair et al. (2022), if the composite reliability of all variables exceeds the given criterion (0.7), further analysis can proceed. The AVE of time management (0.671) exceeded the 0.50 criterion, whereas the AVE values of cognitive skills (0.416) and mental health (0.475) fell below it, indicating that convergent validity was only partially established for these constructs. For all the other constructs, considering the composite reliability of 0.7 and outer loading range from 0.53 to 0.74, the construct can be considered as reliable and valid (Hair et al., 2022). The HTMT ratio for all the constructs is below 0.9, verifying that the discriminant validity is established (Henseler et al., 2015).

Multicollinearity (VIF)

Multicollinearity is an important assumption of structural equation modelling. It suggests that the independent variables of the study should not be correlated with each other (Hair et al., 2022). The assessment of VIF was conducted to ensure that common method bias did not affect the study's results. The value of VIF between independent variables should be less than 3 to make sure that multicollinearity does not exist (Hair et al., 2022). The findings indicate that the VIF ratio is below 3 for all independent variables corresponding to their respective dependent variables (Podsakoff et al., 2003). Hence, multicollinearity as well as common method bias does not exist in this study. Further evaluation can proceed.

Structural Model Evaluation

The structural model was evaluated in three steps. Firstly, the in-sample and out-of-sample predictive power of the study model was evaluated. Secondly, path coefficients were calculated, thirdly, permutation multigroup analysis was performed to compare the findings of male and female university students. Steps 2 and 3 were performed as part of the hypothesis testing process.

Explanatory Power of the Model

Given the criteria for the explanatory power of the estimated path model, Hair et al. (2022) suggested reporting R^2 and Q^2 . R^2 was calculated using bootstrap to measure the in-sample predictive power, whereas Q^2 was calculated using PLS predict to explore the out-of-sample predictive power of the model.

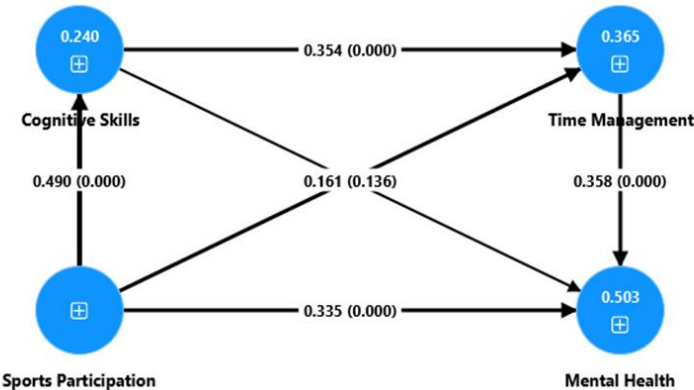
It has been found that the model exhibits moderate to strong explanatory power both in-sample (Cognitive skills $R^2 = 0.171$; time management $R^2 = 0.261$; mental health $R^2 = 0.422$) and out-of-sample

(Cognitive skills $Q^2 = 0.156$; time management $Q^2 = 0.188$; mental health $Q^2 = 0.269$).

Hypothesis Testing

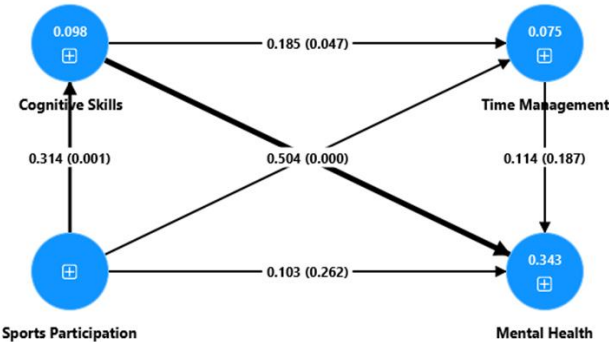
Path coefficients are calculated using a bootstrap with 5,000 sub-samples, bias-corrected and accelerated. Gender differences are calculated with Permutation Multigroup Analysis (MGA). MGA was conducted to examine differences in the direct and indirect effects of sports participation between male and female university students through cognitive skills and time management (Hair et al., 2023). Figures 1 and 2 refer to the standardized coefficients of hypothesized paths for male and female students, respectively. Path coefficients for male participants are presented in Figure 1, while those for female participants are presented in Figure 2. Detailed findings have been reported in Table 3.

Figure 1



Direct Path Co-Efficient in Male University Students (n=174)

Figure2



Direct Path Co-Efficient in Female University Students (n=153)

Table 3*Direct and Indirect Path Co-Efficient (N=327)*

Path	Males (n=174)					Females (n=153)				
	β	S. E	p	Hypotheses	Decision	β	S. E	p	Hypotheses	Decision
Direct Effects										
Sports Participation → Cognitive Skills	0.490***	0.085	0.000	H1a	Accepted	0.314***	0.095	0.001	H1b	Accepted
Sports Participation → Time Management	0.346***	0.078	0.000	H5a	Accepted	0.153	0.090	0.088	H5b	Rejected
Sports Participation → Mental Health	0.335***	0.088	0.000	H2a	Accepted	0.103	0.092	0.262	H2b	Rejected
Time Management → Mental Health	0.358***	0.093	0.000	H6a	Accepted	0.114	0.086	0.187	H6b	Rejected
Cognitive Skills → Time Management	0.354***	0.065	0.000	--	--	0.185*	0.093	0.047	--	
Cognitive Skills → Mental Health	0.161	0.108	0.136	H3a	Rejected	0.504***	0.083	0.000	H3b	Accepted
Indirect Effects										
Sports Participation → Cognitive Skills → Mental Health	0.079	0.062	0.205	H4a	Rejected	0.158**	0.058	0.006	H4b	Accepted
Sports Participation → Time Management → Mental Health	0.124***	0.039	0.001	H7a	Accepted	0.017	0.017	0.309	H7b	Rejected
Sports Participation → Cognitive Skills → Time Management → Mental Health	0.062**	0.020	0.002	H8a	Accepted	0.007	0.007	0.367	H8b	Rejected

Note: . * $p < .05$, ** $p < .01$, *** $p < .001$.

The findings in Table 3 indicate that sports participation has a significant impact on cognitive skills ($\beta = 0.490$, $p < 0.01$), time management ($\beta = 0.346$, $p < 0.01$), and mental health ($\beta = 0.335$, $p < 0.01$) among male students. Time management also has a positive impact on mental health ($\beta = 0.358$, $p < 0.01$). These findings align with the previous research conducted by Buha et al. (2024), Eather et al. (2023), Liu and Taresh (2024), Quinaud et al. (2023), St Quinton (2022), and Zhao et al. (2025). Moreover, cognitive skills have a positive impact on time management ($\beta = 0.354$, $p < 0.01$). Indirect effects reveal that time management partially mediates the relationship between sports participation and mental health. Sports participation aids mental health, but this effect is more substantial when individuals learn time management to organise daily life activities (Specific indirect effect; $\beta = 0.124$, $p < 0.01$). This finding contributes to the existing literature, shedding light on the importance of sports participation in a more systematic manner. Sports participation enhances cognitive skills, which in turn facilitate better time management, resulting in a positive impact on the mental health of male university students who participate in sports (Specific indirect effect; $\beta = 0.062$, $p < 0.01$).

In female university students, participation in sports has a positive impact on cognitive skills ($\beta = 0.314$, $p < 0.01$). Moreover, cognitive skills have a positive impact on time management ($\beta = 0.185$, $p < 0.05$) and mental health ($\beta = 0.504$, $p < 0.01$). Cognitive skills completely mediate the relationship between sports participation and mental health, with a specific indirect effect ($\beta = 0.158$, $p < 0.01$) and a relatively weak effect size. These findings are validated by the existing literature (Ávalos-Ramos et al., 2024; Hekim & Er, 2022; Passarello et al., 2022; Sağiroğlu et al., 2023). However, it has been found that among female university students, participation in sports does not impact time management and mental health. Time management also does not impact their mental health.

Permutation Multigroup Analysis (MGA)

The current research aims to explore further the gender differences in the impact of sports participation on the cognitive skills, time management, and mental health of university students. Permutation MGA (Cheah et al., 2020; Hair et al., 2023) was performed for that purpose.

Table 4*Gender Differences in Direct and Indirect Path Co-Efficient (N=327)*

Path	Difference (Males- Females)	p
Direct Effects		
Sports Participation → Cognitive Skills	0.176	0.225
Sports Participation → Time Management	0.193	0.116
Sports Participation → Mental Health	0.231	0.065
Time Management → Mental Health	0.243*	0.047
Cognitive Skills → Time Management	0.169	0.087
Cognitive Skills → Mental Health	-0.343*	0.020
Indirect Effects		
Sports Participation → Cognitive Skills → Mental Health	-0.079	0.373
Sports Participation → Time Management → Mental Health	0.106*	0.020
Sports Participation → Cognitive Skills → Time Management → Mental Health	0.055**	0.009

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4 indicates that time management (Difference = 0.243, $p < 0.05$) and cognitive skills (Difference = -0.343, $p < 0.05$) have a different impact on the mental health of male and female university students. Time management has a significant impact on the mental health of male students, whereas it has a non-significant effect on the mental health of female students. Moreover, cognitive skills did not have a significant impact on the mental health of male university students. In contrast, it has a strong positive impact on the mental health of female university students.

There is also a significant difference in the indirect impact of sports participation on mental health via time management (Difference = 0.106, $p < 0.05$) in male and female university students. In other words, time management partially mediates the relationship between sports participation and mental health in male university students, whereas it does not mediate this path in female students. Furthermore, Sports Participation has a significant indirect effect on Mental Health through cognitive skills and time management in male university students but is non-significant in female students (Difference = 0.055, $p < 0.01$).

Discussion

Previous studies have emphasised the positive role of sports participation in improving cognitive, time management, and mental health skills among university students. Playing sports enhances focus, discipline, and stress management, which in turn support positive mental health. The findings indicate that participation in sports significantly enhances cognitive skills such as problem-solving, concentration, and memory (Boufrida, 2025; Deniz & Korkmaz, 2024). These advanced cognitive skills, in turn, serve as a mediating process through which athletic participation impacts mental health. Therefore, sports could be a viable approach to support students' mental and cognitive development in each educational institution.

The majority of Pakistan's population belongs to the middle class. This group faces numerous challenges. Male children during adolescence and young adulthood often take on the responsibility of performing outdoor household tasks, such as grocery shopping and dropping off younger siblings at their academic institutions. At the same time, fathers are busy with their jobs from morning till evening. In many families, female students are not allowed to travel alone to their academic institutions due to security reasons. In these situations, male siblings are supposed to drop their female counterparts off at their academic institutions. These activities enhance male responsibilities, requiring mental effort, cognitive skills, and time management. Participating in sports helps individuals improve their cognitive skills and time management. Meeting all responsibilities also brings a sense of achievement, which contributes positively to their mental health.

In female university students, participation in sports has a positive impact on cognitive skills. Moreover, cognitive skills have a positive impact on time management and mental health. These findings are validated by the existing literature (Ávalos-Ramos et al., 2024; Hekim & Er, 2022; Passarello et al., 2022; Sağiroğlu et al., 2023). However, among female university students, participation in sports does not affect time management or mental health. Time management also does not impact their mental health. These findings may be attributed to the different social responsibilities of female university students studying in Pakistan. Additionally, female university students participate in sports less frequently than males, despite the well-known health benefits of physical activity (Ge et al., 2022; Laar et al., 2019; Safdar et al., 2025). The results of this study led the researchers to conclude that there is a need to address the importance of sports and physical activity among female adolescents and adults to have a better quality of life in later life.

The findings emphasise that authorities at all levels, including homes, schools, and universities, must understand the distinct needs of males and

females. Physical activity is important for everyone. For men, distinct factors contributing to mental health include time management; for women, it is improved cognitive skills. These skills could be incorporated into daily learning activities in schools, helping them become a strong habit by the time students reach university level and ultimately contributing to a better quality of life. The findings of the current study have laid the grounds for practical implications for academics and the general population. School and higher education authorities should allocate specific days or hours each week for physical exertion-based sports, particularly for female students, to help them realise the importance of these activities. Apart from sports, the study method should include brain-based activities to sharpen students' cognitive skills. Teachers should practice effective time management to improve their teaching effectiveness for students.

Given the long-term physical and mental health benefits, as well as the improved cognitive and time-management skills associated with sports participation, organisations must arrange sports activities for employees to enhance their mental well-being. This will improve their daily life functioning. Promoting the importance of engaging in sports during adolescence may lead to beneficial outcomes later in life, aligning with the UN 2016 agenda to improve health and well-being across all ages.

Conclusion

Given the health challenges associated with a sedentary lifestyle among adolescents and young adults, the current study examined the positive health outcomes of sports participation among university students. The study aimed to investigate the impact of sports participation on the mental health of male and female university students in Pakistan, considering the mediating roles of cognitive skills and time management. Students of public and private universities in Punjab province, Pakistan, who regularly participated in sports and competed at the national level, were selected for the study. Building on previous literature and Mental Wellbeing Theory, it was found that sports participation has a positive impact on cognitive skills, time management and mental health of male and female university students. Moreover, the mediating role of cognitive skills and time management was also intended to be explored. These factors have been studied separately in prior research but not as a single path model in the context of Pakistan. The current research aims to maintain its originality by examining the relationship among sports participation, cognitive skills, time management, and mental health within a serial mediation model among male and female university students in Pakistan. Findings reveal the significant positive impact of sports participation on cognitive skills, time management and mental health in male students. Cognitive skills improve time management, which in turn improves mental health. These findings were non-

significant for female students. Only cognitive skills were positively affected by sports participation. Moreover, there was a difference in the impact of cognitive skills and time management on the mental health of male and female university students. The impact of time management on mental health is more robust in males than in females. In contrast, cognitive skills have a greater impact on the mental health of female university students than on that of male students. Time management partially mediates the relationship between sports participation and the mental health of male students but does not mediate the relationship in female students. These findings have led to several implications worth considering, which are discussed below.

Limitation and Suggestions

Despite the remarkable and distinctive findings of the present research, the study has some limitations that can be addressed in future research on similar variables. The sample of the study was limited to a single province. Including participants from different geographical locations would have led to more diverse findings. Detailed information on the socio-demographic background of the study participants, such as socioeconomic status, rural or urban lifestyle, and household responsibilities, was not collected due to the need to keep the questionnaire concise and the limited time available for completing the research. Measuring these variables and controlling for their effect would have led to more unique insights. The questionnaire used in this study was self-constructed and was only face-validated prior to the study. Although the psychometric properties met the standards for the current study, it would be more beneficial to either use a standardized instrument or to follow all the formalities of scale construction for the self-constructed questionnaire. It will provide a more valid basis for generalising the study's results and for formulating implications.

Implications

The findings have important policy and practical implications for universities and educational institutions. Therefore, universities should implement structured sports and physical activity programmes into their student development programmes, as participation in sports enhances the students' cognitive skills, which in turn improves their mental health outcomes. Effective educational policy makers should view sports as a recreational activity as well as a means for improving students' cognitive functions such as concentration, problem-solving skills, decision making, and self-regulation. University facilities should be made available for regular sports practice, sports events should be organized, and awareness sessions should be held on the beneficial effects of sport on psychological and cognitive development. In addition, academic support programs should include time-management and self-discipline training, since students who participate in sports tend to practice better

time-management, which improves cognitive skills and therefore reduces mental health problems. To address the barriers that female students encounter in sport, such as cultural barriers, limited facilities, safety concerns, and limited opportunities, universities should create gender-sensitive sports initiatives, especially given the insignificant relationship observed among female students. It is also important to foster an inclusive sporting culture and offer differentiated sport activities that are suitable to female students' interests and preferences in educational institutions. The integration of sports, cognitive-ability building, and time-management education can contribute to a healthier, more productive, and mentally stronger student body, enhancing academic achievement and well-being.

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