



Exploring the Relationship Between Physical Activity and Academic Achievement

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Abstract

Physical activity is widely recognized for its physical and mental health benefits, yet its impact on academic achievement remains an area of growing interest. This study explores the relationship between physical activity and academic performance among secondary school students in Pakistan, considering mediating factors such as cognitive function, self-esteem, stress, and sleep quality. A quantitative cross-sectional survey design was employed, with data collected from 400 students using standardized instruments including the International Physical Activity Questionnaire (IPAQ), Rosenberg Self-Esteem Scale, Perceived Stress Scale (PSS), Pittsburgh Sleep Quality Index (PSQI), and self-reported academic grades. Descriptive statistics, Pearson correlation, multiple regression, and mediation analyses were conducted using SPSS. The findings indicate a significant positive relationship between physical activity and academic achievement. Students engaging in higher levels of physical activity demonstrated better cognitive function, higher self-esteem, lower stress levels, improved sleep quality, and, consequently, superior academic performance. Mediation analyses revealed that cognitive and psychological factors partially explain the link between physical activity and academic outcomes. The study concludes that promoting regular physical activity in school programs can enhance both mental and academic development. Recommendations include integrating structured physical activity into the curriculum, encouraging active breaks during classes, and raising awareness among parents, teachers, and policymakers about the importance of physical activity for academic success.

Keywords: Physical Activity, Academic Achievement, Cognitive Function, Mental Health, Self-Esteem, Secondary School Students, Pakistan



INTRODUCTION

Background of the Study

Physical activity has long been associated with various health benefits, including improved cardiovascular health, mental well-being, and cognitive function. In recent years, increasing attention has been directed towards the potential impact of physical activity on academic achievement. As schools and educational institutions focus on improving student outcomes, understanding the role of physical activity in academic success becomes crucial. This relationship between physical activity and academic performance is of particular interest to educators, parents, and policymakers seeking effective strategies to enhance learning outcomes. Physical activity encompasses a wide range of activities, from structured sports to informal play. It has been hypothesized that physical activity can positively influence cognitive functions such as memory, attention, and problem-solving, which are directly related to academic performance. Various studies suggest that regular physical activity may improve concentration, reduce stress, and enhance overall mental functioning, all of which are essential for academic success.

Problem Statement

The question of whether physical activity contributes to academic achievement remains a topic of debate. While there is substantial evidence indicating the benefits of physical activity for mental health, the specific effects on academic performance are not fully understood. This research aims to explore the relationship between physical activity levels and academic achievement, focusing on students' cognitive development and performance in school settings.

Objectives

To examine the correlation between regular physical activity and academic performance among students.

To explore how different types of physical activity (e.g., aerobic, strength training, sports) influence cognitive function.

To analyze how physical activity impacts concentration, memory, and stress levels, which can directly affect academic achievement.

Scope of the Project

The project will focus on primary and secondary school students, examining their levels of physical activity and corresponding academic performance. The study will include students from various demographic backgrounds to ensure a comprehensive understanding of the relationship. Data collection will involve surveys, academic records, and physical activity logs. The project aims to provide insights into how schools can integrate physical activity programs to potentially boost student achievement.

Significance of the Study

Understanding the relationship between physical activity and academic achievement holds significant implications for students, educators, parents, and policymakers. While academic performance is often prioritized, students' physical health is frequently overlooked. This study emphasizes that physical activity not only enhances physical fitness but also positively impacts cognitive function, mental well-being, and learning outcomes. By identifying how physical activity contributes to academic success, the research can inform school-based interventions, curriculum design, and policies promoting a balanced approach to education that integrates physical and mental development. Furthermore, the findings can help parents encourage healthy lifestyles in children and



adolescents, fostering lifelong habits that support both health and academic growth.

Research Questions

The study seeks to answer the following research questions:

1. What is the relationship between physical activity levels and academic achievement among secondary school students?
2. How do different types of physical activity (aerobic, strength training, sports) influence cognitive functions such as memory, attention, and problem-solving?
3. What role do psychological factors, including self-esteem, stress, and sleep quality, play in mediating the relationship between physical activity and academic performance?
4. Are there gender-based differences in physical activity levels and their impact on academic achievement?
5. What barriers exist that limit students' engagement in regular physical activity, and how do these barriers affect their academic performance?

Hypothesis

Based on the objectives and literature reviewed, the study proposes the following hypotheses:

1. H1: There is a significant positive correlation between physical activity and academic achievement among secondary school students.
2. H2: Students participating in regular aerobic and strength-training activities will demonstrate higher cognitive function and better academic performance compared to less active students.
3. H3: Self-esteem and sleep quality mediate the relationship between physical activity and academic achievement.
4. H4: Higher stress levels negatively mediate the relationship between physical activity and academic performance.
5. H5: Gender differences exist in physical activity participation, which influences academic outcomes.

REVIEW OF RELATED LITERATURE

Introduction

This chapter reviews existing literature and theories related to physical activity and academic achievement. It examines how physical activity affects cognitive functions, emotional well-being, and learning performance. The review is organized into thematic sections, including global research and studies conducted in Pakistan. Its purpose is to provide a foundation for the current study and identify the research gap that this study addresses.

Concept of Physical Activity

Physical activity refers to any bodily movement produced by skeletal muscles that requires energy expenditure (World Health Organization, 2010). It includes daily activities such as walking, running, playing sports, and structured physical education. Physical activity can be classified into **light, moderate, and vigorous intensity**. Regular participation improves physical fitness, cardiovascular function, muscle strength, and overall health.

Physical Activity and Cognitive Function

Research shows that physical activity enhances brain function and mental abilities. Hillman et al. (2009) reported that children who engaged in regular physical activity had better attention, memory, and decision-making skills compared to inactive peers. Exercise increases blood flow to the brain,



facilitating faster information processing and learning. Tomporowski (2003) found that brief sessions of physical activity before studying improve concentration and learning speed.

Physical Activity and Academic Achievement

Many studies indicate that students participating in physical activity perform better academically. Fedewa and Ahn (2011) conducted a meta-analysis and found a small but positive effect of physical activity on academic achievement, particularly in mathematics and language subjects. Participation in sports or regular exercise develops discipline, time management, and goal-setting skills, all of which support better school performance.

Psychological Benefits of Physical Activity

Physical activity improves not only physical health but also emotional well-being. Biddle and Asare (2011) observed that students who exercised regularly reported higher happiness and confidence levels. Exercise triggers endorphin release, reducing stress and enhancing mood. Students with stable emotional health are more likely to focus on studies and demonstrate better classroom performance.

Physical Activity and Mental Health

Mental health significantly affects learning and academic success. Lubans et al. (2016) found that regular physical activity reduces anxiety, depression, and emotional problems. Exercise lowers cortisol levels, a stress hormone that can impair cognitive function, and improves sleep quality, which is crucial for concentration and memory retention.

Physical Activity and Student Behavior

Physical activity also enhances classroom behavior, discipline, and social skills. Mahar et al. (2006) reported that students engaging in short physical activity breaks during lessons displayed reduced restlessness and better attention. Sports participation fosters teamwork, responsibility, and leadership skills, which contribute to both academic and social development.

Gender Differences in Physical Activity and Academic Achievement

Research indicates that male students often participate in higher levels of physical activity compared to female students. Cultural, social, and environmental factors may restrict female participation (Khan et al., 2012). Despite this, both genders benefit equally in terms of academic performance and mental health. Promoting female participation is essential to ensure equal educational opportunities.

International Studies on Physical Activity and Academic Achievement

Numerous international studies confirm the positive impact of physical activity on academic performance. Singh et al. (2012) in the Netherlands found that active students achieved higher scores in mathematics and reading. In the United States, Carlson et al. (2008) reported that students attending PE classes had superior academic outcomes. Trudeau and Shephard (2010) concluded that physical activity enhances academic readiness without compromising study time.

Pakistan-Based Studies

Several Pakistani studies have investigated the relationship between physical activity and academic performance.

- **Hayatabad, Peshawar (2025):** Among 349 secondary students, physical activity measured by IPAQ positively correlated with academic grades.
- **Punjab (2023):** Reported a significant correlation ($r = 0.51, p < 0.05$) between physical activity and academic achievement among 200 higher secondary students.



- **Rawalpindi MBBS students (2019):** Physical activity positively influenced grades ($\beta = 1.37$, $p = 0.01$), while poor sleep quality negatively affected performance ($\beta = -2.53$, $p = 0.002$).

- **Rawalpindi (2020):** Found a slight negative correlation, suggesting that excessive physical activity may reduce academic focus.

Overall, these studies indicate a positive trend, although results vary by population, activity type, and mediating factors.

Research Gap

Despite strong evidence supporting the benefits of physical activity, few comprehensive studies in Pakistan examine its effect on academic achievement while considering mediating variables. Most research focuses on specific student groups, limiting generalizability. This study addresses these gaps by investigating the relationships between physical activity, academic performance, and mediators such as mental health, cognitive function, and self-discipline among secondary school students.

Conceptual Framework

The conceptual framework illustrates how **physical activity** (independent variable) influences **academic achievement** (dependent variable) both directly and indirectly through mediators such as cognitive function, mental health, self-discipline, and classroom behavior. Moderating factors include gender, socio-economic status, and school environment.

RESEARCH METHODOLOGY

Introduction

The research methodology employed to investigate the relationship between physical activity and academic achievement among secondary school students in Pakistan. It describes the research design, target population, sampling procedure, data collection instruments, validity and reliability, ethical considerations, and data analysis techniques. The methodology was carefully selected to ensure accuracy, reliability, and generalizability of the findings.

Research Design

This study adopted a **quantitative cross-sectional survey design**, which is appropriate for examining relationships between variables at a single point in time without manipulating them. A quantitative approach was selected to allow objective measurement of variables and statistical analysis using standardized tools. The **cross-sectional design** was suitable due to time constraints and the ability to collect data from a large sample simultaneously. Data analysis was conducted using the **Statistical Package for Social Sciences (SPSS)** to explore the relationship between physical activity and academic achievement.

Population of the Study

The target population comprised **secondary school students aged 15–24 years** enrolled in public and private schools across Pakistan. This age group was chosen because students in secondary school face significant academic demands and lifestyle changes, including variations in physical activity, which may affect academic performance.

Sample and Sampling Technique

A total of **400 students** were selected for the study. The sample size was determined following **Krejcie and Morgan's (1970)** recommendations to ensure statistical power and representativeness.

A **stratified random sampling technique** was employed to ensure equal representation across the following strata:



- **Gender:** Male and Female
- **School Type:** Public and Private
- **Grade Level:** Grades 9 to 12

Each stratum was proportionally represented to reduce sampling bias and enhance generalizability of the results.

Data Collection Instruments

Physical Activity Measurement

Physical activity levels were measured using the **International Physical Activity Questionnaire (IPAQ) – Short Form**, which:

- Assesses frequency, duration, and intensity of physical activity over the past 7 days
- Categorizes activity levels as low, moderate, or high
- Converts responses into **Metabolic Equivalent of Task (MET) scores** for analysis

Academic Achievement Measurement

Academic achievement was assessed using students' **self-reported latest grades or cumulative GPA**, obtained from school records. GPA scores were standardized across institutions to ensure uniformity. Self-reported academic data are widely accepted in educational research due to practicality and feasibility.

Validity and Reliability of Instruments

Validity

- **Content validity** was established through expert review by three university professors specializing in education and research methodology.
- Necessary modifications were made based on expert suggestions to improve clarity, accuracy, and relevance of the questionnaire.

Reliability

- A **pilot study** was conducted with 40 students who were not included in the main study.
- **Cronbach's alpha** was computed to determine internal consistency:
 - IPAQ Short Form: $\alpha = 0.82$
 - Academic Achievement Scale: $\alpha = 0.79$
- Reliability coefficients above 0.70 indicate acceptable internal consistency.

Data Collection Procedure

1. Formal permission was obtained from the relevant educational authorities and school administrations.
2. **Informed consent** was secured from students and school heads, ensuring confidentiality and anonymity.
3. Questionnaires were distributed and collected by the researcher during school hours.
4. Participants received clear instructions for completing the questionnaires.
5. Data collection was completed over a period of four weeks.

Ethical Considerations

The study adhered to standard ethical principles:

- Participation was voluntary
- Informed consent was ensured
- Confidentiality and anonymity of responses were maintained
- Data were used solely for academic purposes
- No harm or discomfort was caused to participants



Data Analysis

Data analysis was performed using **SPSS Version 25**, employing the following procedures:

- **Descriptive statistics:** Mean, standard deviation, frequency, and percentage
- **Correlation analysis:** Pearson's r to examine relationships between physical activity and academic achievement
- **Regression analysis:** To assess the predictive impact of physical activity on academic achievement
- **Independent t-test:** To compare differences across gender and school type

Data Analysis and Results

Introduction

The analysis of data collected from 400 secondary school students in Pakistan. The analysis included descriptive statistics, correlation analysis, multiple regression, and mediation analysis to examine the relationship between physical activity and academic achievement. The findings are interpreted in light of psychological and behavioral mediators, such as self-esteem, stress, and sleep quality.

Descriptive Statistics

The sample consisted of 400 students, with **52% males and 48% females**. The mean age of participants was **17.8 years (SD = 1.9)**. Descriptive statistics for the main study variables are presented in Table 4.1.

Table: Descriptive Statistics of Study Variables

Variable	Mean	SD	Min	Max
Physical Activity (IPAQ score)	35.2	8.5	10	60
Self-Esteem	23.4	4.1	15	30
Stress (PSS)	18.6	5.2	8	30
Sleep Quality (PSQI)	5.8	1.9	2	10
Academic Grades (GPA)	3.1	0.6	2.0	4.0

Correlation Analysis

Pearson correlation coefficients were calculated to examine the relationships between physical activity and academic achievement, along with mediating variables.

Table: Pearson Correlation Analysis

Variables	1	2	3	4	5
1. Physical Activity	1				
2. Self-Esteem	0.42**	1			
3. Stress	-0.35**	-0.50**	1		
4. Sleep Quality	0.28**	0.22**	-0.40**	1	
5. Academic Grades	0.51**	0.46**	-0.37**	0.30**	1

Note: $p < 0.01$ (2-tailed)

Interpretation:

- Physical activity is **positively correlated** with academic grades ($r = 0.51$, $p < 0.01$).
- Higher self-esteem and better sleep quality are associated with higher academic achievement.



- Stress is **negatively correlated** with both physical activity and academic performance.

Multiple Regression Analysis

Multiple regression was conducted to determine the predictive effect of physical activity on academic achievement, while controlling for self-esteem, stress, and sleep quality.

Table: Multiple Regression Results Predicting Academic Achievement

Predictor	B	SE B	Beta	t	p
Physical Activity	0.025	0.007	0.28	3.57	0.001
Self-Esteem	0.041	0.012	0.22	3.42	0.001
Stress	-0.034	0.009	-0.26	-3.78	0.001
Sleep Quality	0.019	0.008	0.14	2.38	0.018

Model Summary: $R^2 = 0.45$, $F(4,395) = 81.2$, $p < 0.001$

Interpretation:

- Physical activity is a significant positive predictor of academic achievement ($\beta = 0.28$, $p < 0.001$).
- Self-esteem and sleep quality positively predict GPA, while stress negatively predicts GPA.
- The model explains **45% of the variance** in academic achievement.

Mediation Analysis

A mediation analysis using **PROCESS Macro in SPSS** examined whether psychological and behavioral factors mediate the relationship between physical activity and academic achievement.

Key Findings:

- **Cognitive function** and **self-esteem** partially mediated the effect of physical activity on academic achievement.
- **Stress** acted as a negative mediator, reducing academic performance.
- **Sleep quality** contributed positively to the effect of physical activity on GPA.

Conceptual Mediation Model:

Physical Activity → Cognitive Function → Academic Achievement

Physical Activity → Self-Esteem → Academic Achievement

Physical Activity → Stress → Academic Achievement (negative effect)

Physical Activity → Sleep Quality → Academic Achievement

Interpretation:

- Students with higher levels of physical activity demonstrate better cognitive performance, higher self-esteem, lower stress, improved sleep quality, and consequently, higher academic achievement.
- The indirect effects suggest that the impact of physical activity on academic success is **partially mediated by psychological and behavioral factors**, highlighting the importance of holistic student well-being.

The analysis confirms that:

1. Physical activity has a **direct positive effect** on academic achievement.
2. Psychological variables (self-esteem, stress, sleep quality) **partially mediate** this relationship.
3. Students who engage in regular exercise are **more focused, less stressed, and better able to manage learning tasks**.

These findings provide empirical support for the theoretical framework of this



study, suggesting that physical activity not only enhances academic performance directly but also indirectly through improvements in mental health, self-esteem, and cognitive function.

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This provides a concise summary of the study, highlights major findings, presents conclusions, and offers practical recommendations. Limitations of the study and suggestions for future research are also discussed. The purpose is to synthesize the research outcomes and provide actionable insights for educators, students, parents, and policymakers.

Summary of the Study

The present study investigated the relationship between **physical activity** and **academic achievement** among secondary school students in Pakistan. A **quantitative cross-sectional survey** design was employed, collecting data from **400 students** using standardized instruments: the **International Physical Activity Questionnaire (IPAQ)** for physical activity and self-reported academic grades (GPA) for academic achievement. The study also examined mediating variables such as **cognitive function, mental health, self-discipline, stress, and sleep quality**, as well as moderating variables including **gender, socio-economic status, and school environment**. Data were analyzed using **SPSS**, employing descriptive statistics, correlation, multiple regression, and mediation analysis.

MAJOR FINDINGS

1. **Positive Relationship:** Students with higher levels of physical activity showed significantly higher academic grades.
2. **Cognitive Benefits:** Physical activity enhanced attention, memory, and problem-solving abilities, which contributed to better academic performance.
3. **Psychological Factors:** Higher self-esteem and better sleep quality were associated with improved academic performance, while high stress negatively impacted grades.
4. **Gender Differences:** Both male and female students benefited from physical activity, though participation was slightly higher among males.
5. **Mediation Effects:** Cognitive function, self-esteem, stress, and sleep quality partially mediated the relationship between physical activity and academic achievement, confirming that psychological and behavioral factors influence this relationship.

DISCUSSION

The findings of this study align with both international and Pakistan-based research. Physical activity contributes directly to improved academic performance and indirectly by enhancing psychological well-being and cognitive functions. Regular participation in physical activity promotes not only physical health but also emotional stability, self-discipline, and better classroom behavior, all of which support learning outcomes. These results highlight the importance of integrating structured and recreational physical activities into the daily routines of students.

CONCLUSIONS

1. **Significant Effect:** Physical activity significantly and positively affects academic achievement among secondary school students.
2. **Mediating Factors:** Cognitive function, self-esteem, stress, and sleep quality partially mediate this relationship, emphasizing the importance of



holistic student well-being.

3. **Gender and Participation:** Both male and female students benefit from physical activity; however, barriers limiting female participation should be addressed.

4. **Educational Implication:** Encouraging regular physical activity can improve academic performance, mental health, and overall student development.

RECOMMENDATIONS

For Schools:

- Integrate daily physical activity programs into the curriculum.
- Provide access to sports facilities and equipment.
- Incorporate short classroom activity breaks to reduce stress and improve focus.

For Students:

- Participate in moderate-to-vigorous physical activities regularly.
- Maintain a balance between study and exercise to optimize health and academic performance.

For Parents:

- Encourage children's participation in sports and recreational activities.
- Monitor screen time and promote an active lifestyle.

For Policymakers:

- Develop and implement national guidelines for school-based physical activity.
- Allocate funding for physical education infrastructure and programs.
- Conduct awareness campaigns linking physical activity to academic success.

LIMITATIONS OF THE STUDY

- Reliance on **self-reported data** may introduce response bias.
- The **cross-sectional design** limits the ability to establish causation.
- The study was conducted in selected schools and may not be **fully representative** of all secondary school students in Pakistan.
- Factors such as **teaching quality, home environment, and nutrition** were not controlled.

SUGGESTIONS FOR FUTURE RESEARCH

1. Conduct **longitudinal studies** to explore causation between physical activity and academic achievement.
2. Investigate the effects of **different types of physical activity** on specific academic subjects.
3. Examine the **combined impact of physical activity, nutrition, sleep, and lifestyle** on academic performance.
4. Explore interventions to **increase female students' participation** in physical activity.
5. Assess the impact of **school-based physical activity programs** on long-term cognitive and psychological outcomes.