



Mini Review

A Mini Review on Association between Physical Activity and Academic Performance among University Students

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Abstract: Academic Performance (AP) in higher education is a significant factor. It is very important to evaluate the factors that influence AP. In this review, we aimed to summarize the results from published articles in recent years about the correlation between Physical Activity (PA) and AP among university students. This review was done in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A literature search was conducted using the PubMed, Google Scholar, and PEDro databases. After applying inclusion and exclusion criteria and final screening, 11 studies were selected to include in the review. Physical Activity was measured by self-administered questionnaires in most studies, and AP was graded mostly using Grade Point Average (GPA). Few studies that were identified in this review revealed that PA had a positive influence on AP. Findings from studies have shown that PA has a positive correlation with AP. There is also evidence that PA is reduced among university students due to various factors. Hence, more longitudinal and interventional studies are needed to assess this relationship and to encourage involvement in PA among university students.

Keywords: Physical activity; Academic performance; Grade point average; University students

Introduction

Academic Performance (AP) in higher education is most commonly measured by exams. Memory, cognition, mental health, physical health, attention, and psychological well-being are some of the important factors that are essential for achieving good scores in exams and showing excellent AP in higher education (1). Previous studies found that Physical Activity (PA) positively correlated with health, attention, and cognition (1,2,3). Further, evidence from the literature shows a positive association between PA and AP (1,4). However, PA has been shown to reduce among university undergraduates due to individual, social and environmental factors during the university period (5).

When students enter the university, it could be a stressful life, as significant changes happen in their social and educational backgrounds. The university environment is a factor that triggers social and educational changes. University life has a wide range of social experiences in PA (6). A previous finding reported less participation in PA among the students who had a higher engagement in physical activities, and sports before attending the university. In these students, the main reason for not practicing in sports and PA during the university period was the time limitation. This is due to increased demands for academic achievements. The main motivation for engaging in PA during higher education was to maintain body shape, weight loss, avoid illness and improve health status (7). Also, previous studies found that

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most university students were less active (5, 8). Sedentary lifestyles and PA involvement were influenced by individual factors (e.g., perceived enjoyment, values, beliefs, self-discipline, time and convenience, state of mind), their social network (e.g., absence of parental control, modeling, social encouragement and peer pressure), physical environment (availability and accessibility of television, distance, climate and prices) and macro environment (e.g., media, advertising and society) (5).

The Influence of Physical Activity on Academic Performance

PA is described as: “any body movement produced by skeletal muscles that result in energy expenditure above resting level” (9). This includes any movement including walking, doing household chores, etc. It is evident that PA has positively influenced health (10). Also, shreds of evidence suggested that PA has beneficial effects on non-communicable diseases, obesity, mental health, and psychological well-being (2,3). Furthermore, regular exercise positively affects the human body, from controlling cardiorespiratory and cardiovascular fitness to enhancing glycemia and insulin response (11). A previous study described that PA improves AP by increasing the secretion of serotonin, hormone level alterations, enhanced cerebral circulation, and increased self-esteem (1). In addition, some studies have shown a positive association between the level of physical activity and intellectual functioning, particularly the working memory capacity, reaction time, and acuity which influence academic achievements (12).

PA is a huge influencer of cognitive health, such as enhanced visual memory performance, improved verbal memory, attention, and decision-making (12). Exercise triggers neural circulation vital for learning and memory using molecular systems linked with synaptic plasticity and energy metabolism (13). A significant initiator in the molecular machinery stimulated by exercise is a Brain-Derived Neurotrophic Factor (BDNF), which acts at the interface of metabolism and plasticity (13). Exercise improves the creation of Brain-Derived Neurotrophic factors in the area needed for learning and memory (13). So it is hypothesized that most active individuals can process and memorize information more quickly (1).

AP is defined as to what extent a student, teacher, or school has fulfilled their academic goals. AP is influenced by numerous factors, including individual facets (enthusiasm, perception of wellbeing, quality of life), factors of the university (human and material resources, number of students in a batch, lectures, rewards, extra-curricular activities, technology, evaluation system, and other facilities), family factors (home environment, provision of facilities, the attitude of family members, education, socioeconomic status, family size) and community factors (14).

A previous study described a significant positive association between PA and Academic AP. The odds of achieving a good Grade Point Average (GPA) score were twice as high among undergraduates who were doing vigorous PA at least 3 days per week achieving a minimum of 3 hours per week/performing at least a light-intensity activity for a minimum of 15 hours per week than inactive undergraduates (1). In contrast, one study reported no significant correlation between GPA and PA (4). In this mini review we aimed to summarize the results from published research in recent years about the correlation between PA and AP among university students.

Methods

This mini-review aimed to provide an overview of the correlation between PA and AP among university undergraduates around the globe.

Inclusion and exclusion criteria

Eligibility criteria for the inclusions were: original research articles in English, published in the year 2017 onwards, article type should be journal articles and the research articles must have assessed the correlation between PA and AP among university undergraduates and provided quantitative results. Letters, editorials, books, reviews, viewpoints, and dissertations, systematic reviews were excluded.

Search Strategies

The PUBMED, PEDro, and Google scholar databases were used to conduct a comprehensive search for the articles. In August 2022, a non-systematic search for search terms included in the title, abstract, or keywords using the following syntax ("physical activity" OR "exercise") AND ("academic performance" OR "academic achievement" OR "GPA" OR "grade" OR "score") AND ("university students" OR "graduates" OR "college students" OR "academic") NOT ("school" OR "pupil" OR "Elite Athletes") was carried out for PUBMED and Google Scholar databases. MeSh terms were used where appropriate while searching from the PUBMED database. Multiple searches were performed using the following search terms "Physical Activity" and "Academic Performance"/ "exercise" and "academic performance"/ "physical Activity" and "GPA"/ "Exercise" and "GPA" for the PEDro database. Journal articles published since 2017 were reviewed to avoid publication lag and outdated data (15).

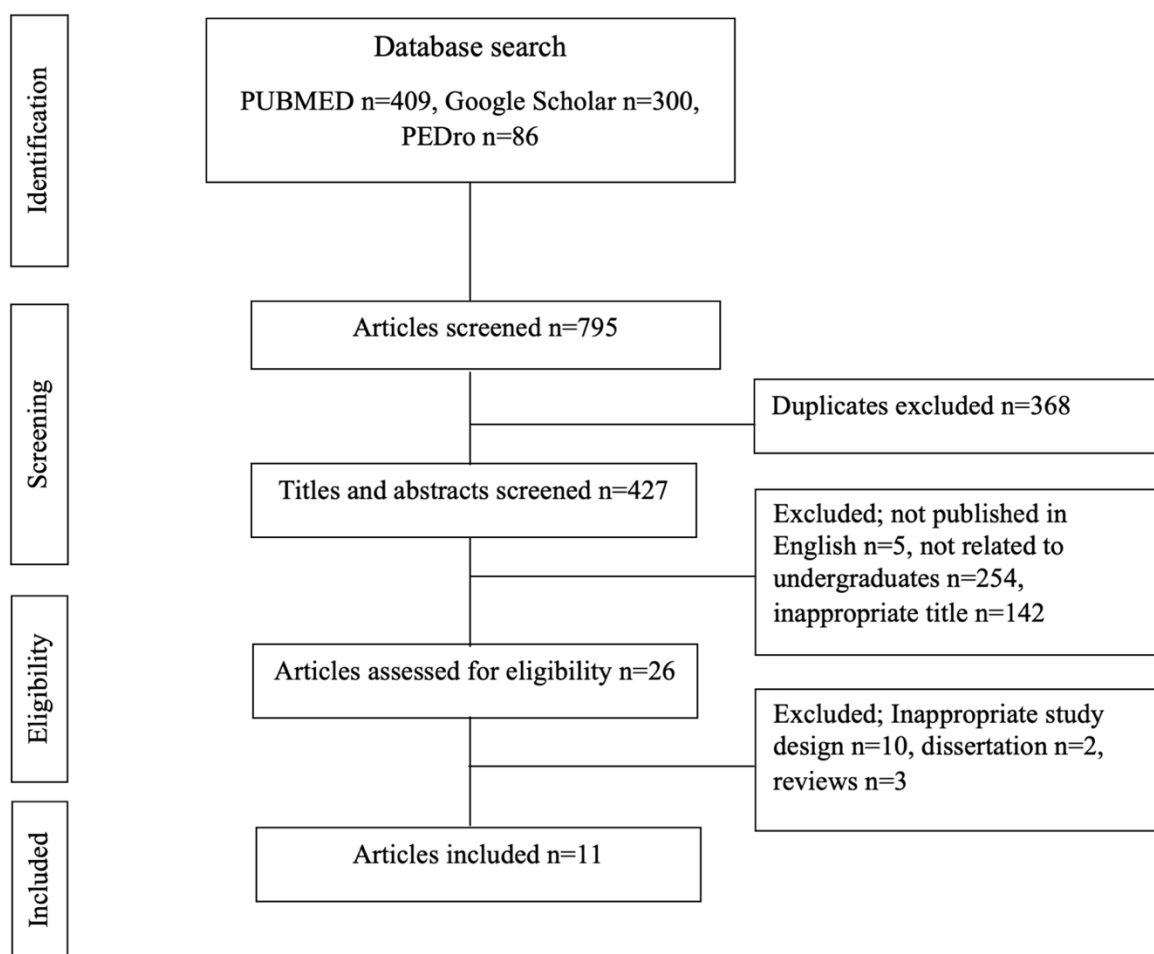


Figure 1: Research screening process of mini review

PRISMA guidelines were followed for this mini-review (16). The eligibility criteria for the review are summarized in Figure 1. Only original articles (abstracts and full text) published in English over the last five years were screened and checked by two investigators separately. An initial search resulted in 795 citations, which were limited to 11 articles at the end of the process. The eligibility criteria for the inclusions were: original research articles published in English in 2017.

Results

In total, 11 articles were included. The search was conducted on 4th August 2022, and 795 articles were identified. Of them, 368 duplicates were removed. After the authors had reviewed all the abstracts

and titles, 26 studies were judged as possibly applicable to the objectives of this review, and the full texts were obtained and judged independently by two reviewers.

After evaluating the 26 studies for eligibility, 11 met the inclusion criteria. The other articles were excluded for the following reasons: 10 articles did not comprise an appropriate study design, two dissertations, and three were review articles.

Characteristics of studies and participants

The characteristics of the studies selected in this review are shown in Table 1. All the studies were cross-sectional. Articles that examined the correlation between PA and AP among university undergraduates were reviewed. These studies were conducted in 11 different settings: two studies were conducted in Pakistan, two in Spain, three others were in Saudi Arabia, and four were from Malaysia, Iran, Slovenia, and the Philippines. The number of participants enrolled in the studies ranged from 100-418. Three studies included only female participants in their studies and the other studies included both genders. The age range was 18-30 years.

Measurement of Physical Activity

The studies varied in their approaches to measuring PA and primarily relied on self-administrated questionnaires. Among the reviewed articles, four studies used the International Physical Activity Questionnaire (IPAQ) and three used the Global Physical Activity Questionnaire (GPAQ). The remaining studies used a self-administrated short-form version of the International Physical Activity Questionnaire with the third version of the behavioral regulation in exercise questionnaire (BREF-3). This Self-administered questionnaire included questions regarding movement time. In addition, of the studies included one study used an online self-administrated questionnaire that assessed the student's Physical Activity pattern and Non- Physical Activities, and one study used the ActivPAL device for measuring PA.

Measurement of Academic Performance

Studies reported different definitions and instruments to assess AP. Seven studies used GPA. One study used students' raw semester averages. Other studies used marks obtained in the most recent Pathology class test and average grade marks in all subjects conducted by the students.

Correlation between Physical Activity and Academic Performance

The articles included in the review revealed varied findings for the correlation of PA with AP. The summary of the findings of the included articles is presented in Table 1.

Discussion

The main aim of the mini-review was to determine the correlation between AP and PA. PA is defined as any body movements produced by skeletal muscles that result in energy expenditure above the resting level (9). It is measured by different tools (IPAQ, GAPQ, and self-administered short-form versions of the international physical activity questionnaire with a third version of behavioral regulation in exercise questions (BREF-3) and online self-administered questionnaire that assess physical activity patterns and non-physical activities (12).

AP is defined as to what extent a student, teacher, or school has fulfilled their academic goals. Many factors influence it (14). Previous studies used different definitions and instruments to assess AP. GPA is the most popular way to assess AP. Seven reviewed studies used GPA to measure AP among university students (12,17,1,18,19,20,21). In addition, some studies used students' raw semester average (22), marks obtained in the most recent pathology class test (23), and the average grade marks in all subjects conducted by the students (24).

Table 1: Summary table of included studies

Reference, year	Country, sample size (N), age (years), gender	PA Assessment Tool	AP Assessment	Results
(12), 2021	Saudi Arabia N=379 Age- 18-30 Only females	The online self-administrated questionnaire	Overall Cumulative GPA - standard 5 scales	Positive association between PA and AP $p = 0.023$
(17), 2017	Saudi Arabia N=310 Age 18-25 Only females	GPAQ	GPA	PA appears to not be related to AP among students of Humanist and Medical colleges $p > 0.05$. PA related with AP among students of Sciences college $p < 0.01$
(24), 2021	Spain, N= 172 Age 23.5 ± 5.4 Males & Females	Self-administered questionnaire	Average grade marks in all subjects	No significant differences in the movement time habits of the students with both higher and lower AP groups, $p = 0.54$
(1), 2018	Malaysia, N=244 Age 21 Males & Females	IPAQ-SF and BREF-3	GPA records of the previous semester	PA positively associated with undergraduates, $p = 0.023$
(18), 2019	Iran, N=418 Age 18 Males & Females	GPAQ	GPA	No significant difference between the GPA of students and PA level, $p = 0.701$
(19), 2018	Spain, N=132 Age 21.2 Males and Females	ActivPAL device	GPA	Light PA and moderate to vigorous PA were not correlated with the academic achievement, $p \geq 0.05$
(20), 2018	Pakistan, N=358, Mean age 20.30 Males & Females	IPAQ-SF	Cumulative GPA of the last consecutive semesters	PA, AP, and self-esteem positively correlated ($p < 0.001$, coefficient = 0.932). PA, AP and depression negatively correlated ($p < 0.001$, coefficient = -0.389)
(25), 2019	Slovenia N=297 Age 20-22 Males & Females	IPAQ with certain modifications	Regular admission to the second study year	2-3 hours of weekly PA positively associated with academic success, $p = 0.009$ while 4 or more resulted no contribution, $p = 0.051$
(21), 2020	Saudi Arabia N=100 Average age 21 Females only	IPAQ	GPA of the last 3 consecutive semesters	Significant correlation between moderate and high PA with AP, $p < 0.001$. No correlation between low PA and AP, $p = 0.09$
(22), 2021	Philippines N=287, Age 19 - 22 Males & Females	Adapted online IPAQ	Students' raw semester average	No significant correlation between PA and AP, $p = 0.960$
(23), 2019	Pakistan N=219 Males & Females	GPAQ	Marks in the most recent Pathology test	Significant correlation between PA and AP $p < 0.000$

BREF 3 - Behavioral Regulation in Exercise; GPAQ - Global Physical Activity Questionnaire; IPAQ-SF - Short form version of the International Physical Activity Questionnaire

In the literature, few studies showed the direct effects of PA on AP (12,1,23). PA increases blood supply to the brain, facilitates the growth of neurons, blood vessels and protein brain-derived neurotrophic factors (BDNF), synaptic plasticity, and increased levels of neurotransmitters (noradrenaline, adrenaline, and serotonin) and neurotrophins (1,21). Thus, enhancing cognitive functions that affect arousal and influence AP. Exercise enhances long-term memory, but excessive PA is often discouraged because it reduces energy and adversely affects concentration on studies (1). Minor exercises and aerobics have shown positive effects on the human brain (20). Thus, minor exercises are recommended for developing students' cognitive activity.

Among the reviewed articles, three studies showed a significant positive correlation between physical PA and AP (12,1,23). One study concluded that PA, AP, and self-esteem were positively correlated (20). Another study showed a highly significant correlation between moderate and high PA and AP. Also, Lipošek et al., showed that PA seems to be correlated to AP among Science college students. One study showed the time duration of PA effects on the AP (25).

Three studies revealed no statistical significance between PA and AP (18,22,24). One study concluded that PA, AP, and depression were negatively associated (20). Another study concluded that there was no significant correlation between low PA and AP (21). Among reviewed articles, one study showed that moderate to vigorous PA was not correlated to academic achievement (19). Also, Almoajel et al. described no relationship between PA and AP among Medical and Humanist college students (17).

Limitations and Recommendations

The present review did not consider the different tools for assessing AP and PA used in different studies. Thus, results cannot be generalized. All the studies were cross-sectional designs. Longitudinal studies are needed to assess these parameters among university students. Only a few studies investigated the relationship between PA and AP among university students. Useful information may be added by conducting RCTs with different PA interventions in addition to a non-active control group.

Conclusions

PA is essential among university students. From the few studies that were identified, it is revealed that PA when performed adequately has a positive influence on AP. However, different types of PA have been shown to have different effects. Therefore, more longitudinal studies are needed to explore the relationship between PA and AP using reliable and valid measurement methods to assess this relationship precisely. Also, interventional studies involving PA in undergraduate students with a comparator with AP as an outcome measure will provide in-depth information about the association.

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