FINE MOTOR SKILLS AND BMI ARE GOOD PREDICTORS OF ATHLETIC PERFORMANCE IN COLLEGE STUDENTS

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Abstract

Athletic performance is affected by numerous factors such as genetic makeup, environmental factors, and psychological factors. The goal of the present study was to examine the effects of fine motor skills and BMI on athletic performance of college students. The sample for this study consisted of 31 students (mean age 19 years, SD- 1.1 year; 7 females, 24 males) recruited from the Faculty of Kinesiology at the University of Sarajevo. The students were given Purdue Pegboard test of motor skills and Test of Athletic performance consisting of 8 tests: sprint running, high/low start, relay running, hurdle racing, high jump, long jump, shot put, and javelin throw. We assessed the impact of their BMI and fine motor skills on the Athletic performance. The results revealed a statistically significant effect of fine motor skills and BMI on Athletic performance. More specifically, these two factors explained around 30% of the variance in Athletic performance. These findings could be beneficial for designing more effective training programs that not only focus on general physical fitness but also consider the role of fine motor skills and body composition in improving overall athletic performance.

Keywords: college students, athletic performance, fine motor skills, BMI

Introduction

Athletic performance is a multifaceted construct that encompasses the context and magnitude in which an athlete completes specific tasks within their sport (Everson & Terjesen, 2023). Numerous factors affect athletic performance such as physical endurance, psychological readiness, emotional intelligence, and coaching behavior (Mäestu et al., 2005; Li, 2022; Pramesti et al., 2022; Khan et al., 2021). Obviously, it is not merely physical prowess that determines an athlete's success, but also a complex interplay of training, mental strength, nutrition, and genetics. Many studies have examined factors affecting athletic performance and have revealed numerous factors contributing to it. In a study by Eganov et al. (2021), authors have found that various mental health parameters have a strong effect on athletic performance including positive emotional attributes, self-confidence, mental disorders and chronic fatigue. In addition to mental health factors, nutrition plays a significant role in athletic performance as well. The effect of nutrition on athletic performance is a topic of significant interest and importance in the field of sports science. Optimal nutrition plays a crucial role in enhancing physical activity, athletic performance, and recovery from exercise Rodriguez et al. (2009).

Numerous studies have focused on the global decrease in physical activity (PA) and the corresponding rise in sedentary lifestyles and obesity rates. The issue of inactivity, including students, across various age groups presents a significant challenge for many countries (Fagaras et al., 2015). Although numerous studies have revealed the positive effects of exercise, there are still some obstacles in enhancing the duration of it in the schools. The review by Keayes and Allison (1995) examined studies on the impact of moderate to vigorous physical activity (MVPA), conducted three to five times a week, on children's health, academic performance, attitudes, and behavior in school. It concludes that enhancing school-based physical education programs, often criticized for insufficient intensity and frequency, is beneficial and feasible, highlighting the crucial role of MVPA in these programs for the benefit of both students and teachers. Other studies have focused on some demographic factors affecting physical activity. In a study by Bergier et al. (2014). a statistical analysis revealed that physical activity levels were notably higher in males than females, with males primarily participating in sports and females more engaged in household chores. Activity levels varied based on location, with residents of medium-sized towns and rural areas being more active than those in larger cities. A significant correlation was observed between self-reported physical fitness and physical activity levels in students, while no direct link was found between Body Mass Index (BMI) and physical activity levels.

Students attending kinesiology programs are often required to meet specific academic and physical standards due to the nature of the discipline, which focuses on human movement, physiology, and wellness. Typically, these programs entail a rigorous curriculum that covers anatomy, physiology, biomechanics, and nutrition. Students might also need to engage in practical training and internships to gain hands-on experience in areas like athletic training, physical therapy, or fitness coaching. In addition to academic prowess, a strong interest in sports, physical fitness, and health, as well as excellent communication and analytical skills, are crucial for success in these programs. Moreover, certain programs may require students to participate in physical activities or sports as part of their coursework. As we can see, students attending kinesiology programs at the university level are expected to have adequate level of physical fitness and it is the recommendation of

American Kinesiology Association to include practice of physical activity in undergraduate kinesiology degree programs (Twietmeyer & Johnson, 2019). Interestingly, while research on athletic performance is common among professional athletes, there's a growing interest in understanding how these principles apply to non-athletic populations, including regular students. This shift highlights a broader application of kinesiology principles, recognizing that the benefits of physical activity and wellness extend beyond elite sports to impact general health and lifestyle.

Kinesiology students often engage in diverse learning activities, from laboratory work and research projects to community outreach and wellness programs. These activities not only enhance their understanding of human movement but also develop their skills in areas such as leadership, teamwork, and community engagement. The curriculum is designed to be dynamic, responding to the latest trends and discoveries in the field. The programs also emphasize the importance of a holistic approach to health and wellness. Students learn to consider multiple factors affecting an individual's physical condition, including psychological, social, and environmental aspects. This comprehensive perspective is crucial in addressing contemporary health challenges, such as increasing sedentary lifestyles and chronic health conditions.

Thus, in this study we wanted to examine the predictors of athletic performance in a sample of kinesiology program students at the University of Sarajevo and to discover some additional, less examined, factors that might influence athletic performance.

Methods

Participants

The sample for this study consisted of 31 students attending the University of Sarajevo – Faculty of Kinesiology. There were 24 male students and 7 female students and the mean age was 19 years (standard deviation= 1.1 years). These students attended the first and second year of University. The participation was voluntary. The voluntary nature of participation ensured that the sample consisted of individuals genuinely interested and engaged in the subject matter of the study, potentially contributing to more insightful and relevant data.

Procedure

This was a cross-sectional correlational study. Students were tested individually. The fine motor test was performed in the classroom at the faculty while the athletic performance testing was performed on the faculty's outdoor sports field. Before the commencement of testing, anthropometric measurements of the students, including their weight and height, were recorded, and their Body Mass Index (BMI) was subsequently calculated.

Instruments

For the measurement of fine motor skills, we used Purdue Pegboard test of fine motor skills. The Purdue Pegboard Test is a psychomotor test designed to assess manual dexterity and hand-eye coordination. It is widely used in various settings, including:

- Clinical: To evaluate patients with neurological or musculoskeletal conditions impacting hand function.
- Occupational: To assess dexterity and coordination for job suitability and skills evaluation.
- Research: To measure changes in dexterity over time or compare different groups of individuals.

The test was found to be useful in various populations including preschool children (Memisevic et al., 2018) and in people over 60 years of age (Desrosiers et al. 1995). Lower scores indicate better performance.

Body Mass Index (BMI) was calculates using the standard formula: BMI = kg / m^2. Purdue Pegboard Test of fine motor skills and BMI were independent (predictor) variables in this study.

As the measure of athletic performance we used the Test of Athletic performance consisting of 8 tests: sprint running, high/low start, relay running, hurdle racing, high jump, long jump, shot put, and javelin throw. A composite measure of these tests was used as a dependent (outcome) variable.

Statistical analysis

We calculated mean values and standard deviations for all measures. To examine the effects of fine motor skills and BMI on athletic performance we conducted a regression analysis. An alpha level of .05 was used as a cut-off measure for statistical significance. A computer program SPSS v.27 (IBM, 2020) was used to perform statistical analysis.

Results

We first present correlations between all the measures in the study. These results are presented in Table 1.

Table 1. Correlations between Purdue Pegboard test of fine motor skills, BMI, and athletic performance

	Athletic performance	Purdue Pegboard	BMI
Athletic performance	1	-.47**	.36*
Purdue pegboard	-	1	-.01
BMI	-	-	1

Note. N = 31. ** p<.01; *p<.05.

As can be seen from Table 1, statistically significant differences were found between athletic performance and both, Purdue Pegboard test of fine motor skills and BMI. On the other hand, however, there was no statistically significant relationship between Purdue Pegboard test and BMI.

We next present the results of regression analysis with Purdue Pegboard test and BMI predicting the athletic performance scores. The results are shown in Table 2.

Table 2. Effects of Purdue pegboard test and BMI on athletic performance of students

Variable	B	SEB	β
Purdue Pegboard	-0.12	0.04	-0.46**
BMI	0.61	0.27	0.34*

Note. **p<.01; *p<.05. R^2 = .34; R^2 (adjusted) = .29.

The model presented in Table 2 was statistically significant, F (2, 28) = 7.2; p<.001 and explained around 30% of the variance in the scores. Given that the independent (predictor) variables were not statistically correlated, we can conclude that there was an independent contribution of both, fine motor skills and BMI on athletic performance of students.

Discussion

The goal of the present study was to examine the effects of fine motor skills and BMI on athletic performance of students attending the University of Sarajevo- Faculty of Kinesiology. The results of this study showed a statistically significant and independent effect of both fine motor skills and BMI on athletic performance. The model was able to predict 30% of the variance in athletic performance scores. Current research has identified numerous factors, such as balance abilities, that affect athletic performance. Balance abilities were found to correlate with athletes' levels of competition in certain sports, with higher-level athletes demonstrating superior balance (Hryosomallis, 2011). Additionally, several performance metrics showed significant correlations with balance abilities. According to Hryosomallis (2011), prospective studies suggest that incorporating balance training as a supplemental part of non-elite athletes' regular training regimens can enhance specific motor skills. However, this should not replace other essential conditioning forms, such as resistance training. Balance skills can also be improved through various exercise programs (Vranesic-Hadzimehmedovic & Memisevic, 2018). In line with other studies, we expected to find negative relationship between BMI and athletic performance (Sherman et al., 1996). That is lower the BMI, better the athletic performance. However, we found positive relationship within the category of normal BMI (BMI = 18.5 – 24.9, 29 students were in this category) and athletic performance. That is, there was a statistically significant positive correlation between BMI (in normal range) and athletic performance. It might be the case that some athletic performance tasks required greater strength and on which students with higher BMI (still less than 25) had some advantage. In our sample, there were only two students who were in the category of overweight students (BMI = 26 in one student, and BMI = 27 in one student) and none in the category of obese students. Additional explanation might be that the findings were sample specific and not representative of larger population of students. Maintaining an appropriate body weight is crucial for athletic performance, but using BMI alone can be misleading for athletes due to their typically higher lean body mass (Jonnalagadda, 2004). Instead, a combination of BMI and body composition assessments is recommended to accurately evaluate weight status. In any case, studies with larger sample sizes are needed to further elucidate these relationships.

Fine motor skills were not much studied in relation to athletic performance. On the other hand, a plethora of studies has examined relationships between fine motor skills and cognitive, social, and academic skills. It has been established that fine motor skills are correlated with cognitive development (Pitchford et al., 2016). This study has also found that fine motor skills are correlated with athletic performance.

Given this relationship, it might be the case that training in fine motor skills can positively impact athletic performance. Building on the findings of this study, it's evident that the integration of fine motor skills training could substantially benefit physical performance, particularly in sports where precision and coordination are paramount. The correlation between fine motor skills and athletic performance is not just isolated to high-level athletes; it extends to all levels, suggesting a broader applicability of such training methods.

This study's findings suggest a novel approach to athletic training, emphasizing the importance of integrating fine motor skills into regular athletic routines. These skills, traditionally associated with cognitive and social development, now present a unique opportunity for enhancing athletic performance across various skill levels. The impact of fine motor skills training in sports, particularly those requiring precision and coordination, could be significant, opening new avenues for athletic development and research. Of course, this study is not without limitations and here we will mention some of them. The first obvious limitation is the small sample size which prevent us to make any generalizations beyond this sample. Future studies should use larger sample size and include students from other faculties as well, not just students attending Faculty of Kinesiology. Next, it would be beneficial if we used more measures to capture the construct of fine motor skills. One test cannot capture the whole heterogeneity of the fine motor skills. Finally, it would be beneficial to employ some other instruments measuring attitudes of students towards physical activity and their nutritional habits.

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