Fitness profiling and its association with academic and athletic achievement among Malaysian university student-athletes

Perfil de la condición física y su asociación con el rendimiento académico y deportivo entre los estudiantes-atletas universitarios de Malasia

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Abstract

Introduction: Comprehensive fitness profiling is essential for understanding student-athletes' performance capacities, yet limited evidence links physical fitness to academic and sports outcomes in Malaysian universities.
Objective: This study profiled the physical fitness of student-athletes at Sultan Idris Education University (UPSI) and examined associations with academic performance and sports achievement.
Methodology: A cross-sectional study of 153 student-athletes aged 18–21 years assessed anthropometry, cardiovascular endurance (VO_2 max), muscular strength (handgrip), muscular endurance (curl-ups), flexibility (sit and reach), agility (T-test), balance (Stork Balance Stand), and power (Standing Broad Jump). Academic performance was measured by cumulative grade point average (CGPA), and sports achievement was categorized based on highest achievement levels. Descriptive statistics and Pearson correlations were used for data analysis.
Results: Sprint time correlated negatively with handgrip strength ($r = –0.49$ left; $r = –0.48$ right; $p < 0.001$) and positively with agility ($r = 0.83$, $p < 0.001$), confirming interdependence among fitness attributes. However, no significant associations were found between overall fitness, CGPA, and sports achievement.
Conclusion: Physical fitness attributes were interrelated but not linked to academic or sports achievements. The findings establish localized benchmarks for Malaysian student-athletes and inform tailored training and educational strategies in university sport contexts.

Keywords

Academic performance; fitness profiling; physical fitness; sports achievement; student-athletes.

Resumen

Introducción: La elaboración integral de perfiles de condición física es esencial para comprender las capacidades de rendimiento de los estudiantes-atletas, aunque existe evidencia limitada que vincule la condición física con los resultados académicos y deportivos en universidades malasias.
Objetivo: Este estudio perfiló la condición física de los estudiantes-atletas de la Universidad de Educación Sultan Idris (UPSI) y examinó las asociaciones con el rendimiento académico y deportivo.
Metodología: Se realizó un estudio transversal con 153 estudiantes-atletas de entre 18 y 21 años. Las evaluaciones incluyeron antropometría, resistencia cardiovascular (VO_2 máx), fuerza muscular (dinamometría manual), resistencia muscular (abdominales), flexibilidad (sit and reach), agilidad (prueba T), equilibrio (Stork Balance Stand) y potencia (salto horizontal). El rendimiento académico se midió mediante el promedio acumulado de calificaciones (CGPA), y el logro deportivo se categorizó según el nivel más alto alcanzado. Los datos se analizaron mediante estadística descriptiva y correlaciones de Pearson.
Resultados: El tiempo de sprint se correlacionó negativamente con la fuerza de prensión manual ($r = –0.49$ izquierda; $r = –0.48$ derecha; $p < 0.001$) y positivamente con la agilidad ($r = 0.83$; $p < 0.001$), confirmando la interdependencia entre los atributos de la condición física. Sin embargo, no se hallaron asociaciones significativas entre la condición física global, el CGPA y el logro deportivo.
Conclusión: Los atributos de condición física estuvieron interrelacionados pero no vinculados a los logros académicos o deportivos. Los hallazgos establecen referencias locales para los estudiantes-atletas malasios y orientan estrategias de entrenamiento y educación en el deporte universitario.

Palabras clave

Rendimiento académico; perfil físico; condición física; logro deportivo; estudiantes-atletas.

Introduction

Physical fitness is a key determinant of health and performance, particularly for student-athletes who must balance academic and athletic demands. It encompasses components such as cardiovascular endurance, muscular strength, flexibility, agility, and body composition, all of which contribute to optimal function and sports performance (Myer et al., 2011; Simon & Docherty, 2017). High fitness levels are associated with numerous benefits, including enhanced strength, improved metabolic and cognitive function, and better academic outcomes (Hillman et al., 2008; Trudeau & Shephard, 2008). However, recent evidence presents mixed findings. Altaim et al. (2025) found no significant relationship between physical activity and GPA in health professional students, while Awang et al. (2022) reported a positive association between aerobic fitness and academic performance among Malaysian athletes. Beyond academic achievement, physical activity has also been linked to improved attention and cognitive processes (Alvarado-Melo et al., 2024).

Despite these benefits, comprehensive data on the physical fitness profiles of Malaysian student-athletes remain scarce, particularly at Sultan Idris Education University (UPSI). While normative fitness data serve as benchmarks for performance monitoring (Mascherini et al., 2022), most existing references are based on Western populations (Mascherini et al., 2022; Nowak et al., 2024; Thomas et al., 2020). These benchmarks may not fully capture the physiological, cultural, and environmental characteristics of Malaysian athletes. Recent findings by Chan et al. (2025) further underscored the role of body composition, particularly muscle mass and fat percentage, in influencing agility and power among Malaysian student-athletes, reinforcing the need for localized reference data.

Fitness profiling, which systematically assesses multiple components, not only provides a multidimensional view of athletic performance but also identifies areas needing intervention. It can also provide insights on potential associations between physical fitness and academic success, with studies suggesting that cardiovascular endurance and agility may enhance cognitive function and academic performance (Haverkamp et al., 2021; Kalantari & Esmaeilzadeh, 2016; Redondo-Flórez et al., 2022). In Malaysia, the Malaysia-Juara program at UPSI was established to support student-athletes' dual pursuit of academic and athletic excellence. However, limited empirical evidence exists to guide performance evaluations or interventions within this context (Barbosa et al., 2020; Tomkinson et al., 2019).

Beyond academic and performance outcomes, comprehensive profiling is also critical for injury prevention, early detection of performance limitations, and personalized training prescriptions (Castro-Piñero et al., 2010; Myer et al., 2011). When informed by local data, such profiling enables coaches and practitioners to develop contextually relevant strategies to minimize overtraining and burnout (Shinnick & Filho, 2024). Considering that Malaysian student-athletes balance strong academic expectations alongside training systems distinct from Western models, examining this population presents a unique opportunity to advance understanding. Therefore, this study aims to profile the physical fitness characteristics of UPSI student-athletes and examine associations with both academic performance and sports achievement. Findings are expected to generate the first localized normative benchmarks for UPSI, thereby informing evidence-based strategies for athlete development and education policy within the Malaysian university sports context.

Method

This study utilized a cross-sectional research design to evaluate the physical fitness profiles of Malaysia Juara student-athletes at Sultan Idris Education University (UPSI). This approach provided a comprehensive assessment of the athletes' physical fitness levels at a specific point in time, allowing for comparisons across different sports disciplines. The study adhered to the ethical principles outlined in the Declaration of Helsinki for research involving human participants. Ethical approval was granted by the Research Ethics Committee of Sultan Idris Education University (Reference Number: 2024-0092-106-01), and all participants provided written informed consent before taking part in the study.

Participants

A convenience sampling approach was used to recruit 153 student-athletes from various sports disciplines, including team and individual sports. This method ensured accessibility and representation across different sports, providing a practical way to gather a large sample within the available timeframe. However, it may reduce the generalizability of results. Participants must have been full-time students at UPSI, actively participating in university-affiliated sports, aged between 18 and 25, and willing to provide informed consent. They must also be free from pre-existing medical conditions that could impair their ability to complete the fitness tests safely. Non-full-time students and those not actively involved in sports programs were also excluded.

Procedure

Data collection was conducted over a period of three months at UPSI sports facilities under standardized conditions to ensure reliability and accuracy. Prior to testing, participants were provided with an Informed Consent Form and a Participant Information Sheet, detailing the objectives, procedures, potential risks, and benefits of the study. Written informed consent was obtained from all participants before their involvement. A briefing session was conducted to explain the study protocol, followed by a standardized warm-up session to minimize the risk of injury and ensure optimal performance. Testing was conducted in the following sequence: anthropometric assessments, cardiovascular endurance tests, muscular strength and endurance tests, flexibility tests, speed and agility tests, balance tests, and power tests. To mitigate the effects of fatigue, a 3- to 5-minute rest period was provided between physical performance tests (Willardson, 2006). Each test was administered by trained personnel following standardized protocols to ensure consistency across participants. Equipment was calibrated before each session to guarantee precise measurements. Participants were advised to refrain from strenuous physical activity 24 hours prior to testing and to maintain their usual hydration and nutrition routines.

Physical fitness was assessed using a battery of standardized tests covering anthropometry, cardiovascular endurance, muscular strength and endurance, flexibility, speed, agility, balance, and power. Anthropometric measurements (height, weight, arm span, sitting height, and leg length) were taken with a stadiometer and measuring tape, while body composition was assessed using Bioelectrical Impedance Analysis (BIA), providing reliable estimates of muscle mass, body fat percentage, and basal metabolic rate (McLester et al., 2020). Cardiovascular endurance was evaluated with the Yo-Yo Intermittent Recovery Test and the Beep Test, both widely used for aerobic capacity; the Beep Test shows excellent test–retest reliability (ICC = 0.93–0.95) and validity with VO_2 max (r = 0.84–0.92) (Bangsbo et al., 2008; Mayorga-Vega et al., 2015). Muscular strength was assessed via the Handgrip Strength Test using a Jamar Plus+ dynamometer (Lafayette, IN, USA), with excellent reliability (ICC = 0.95–0.98) (Cildan Uysal et al., 2022; Cronin et al., 2017). Muscular endurance was measured using the 1-Minute Curl-Up Test, which has acceptable reliability (ICC = 0.82–0.90) (ICC = 0.82–0.90)(Castro-Piñero et al., 2010). Flexibility was evaluated with the Sit-and-Reach Test, demonstrating good reliability (ICC = 0.89–0.95) and validity for hamstring extensibility (r = 0.71–0.88) (Mayorga-Vega et al., 2014). Speed was assessed using the 30 m Sprint Test, measured with the Brower Timing System (Draper, UT, USA) for precision (Fernandes-Da-Silva et al., 2021). Agility was evaluated using the Agility T-Test, also timed with the Brower system, which demonstrates excellent reliability (ICC = 0.94–0.98) and construct validity in differentiating competitive levels (Lockie et al., 2016; Sassi et al., 2009). Balance was measured via the Stork Stand Test, with moderate-to-good reliability (ICC = 0.72–0.89) (Brachman et al., 2017; Hrysomallis et al., 2006). Lower-limb power was assessed with the Standing Broad Jump, showing high reliability (ICC = 0.91–0.96) and validity with explosive power measures (r = 0.78–0.88)(Castro-Piñero et al., 2010; Thomas et al., 2020). Academic performance was measured using Cumulative Grade Point Average (CGPA) from official university records, while highest sports achievement was self-reported and categorized as university, state, national, or international level.

Data analysis

The data collected were analyzed using XLSTAT (Addinsoft, Paris, France). Descriptive statistics, including means and standard deviations, were used to summarize the physical fitness characteristics of the participants.

Percentile ranks (e.g., 10th, 25th, 50th, 75th, and 90th percentiles) were also computed to support the profiling of fitness performance across various physical components, allowing for comparison among

student-athletes with different abilities. These profiles provided insights into the distribution and variability of fitness levels within the sample, offering valuable information for identifying strengths and areas for improvement among individuals or sport-specific groups.

To examine the relationships between physical fitness attributes, academic performance, and highest sports achievement, Pearson correlation analysis was conducted. Participant characteristics such as sex, sport type, and weekly training hours were recorded but not statistically controlled for in the analysis, which should be noted as a limitation. The fitness profiling results were presented in tabular format to illustrate performance trends and support data-driven decision-making in training and academic support programs. All statistical analyses were conducted with significance set at $p < 0.05$ for inferential tests.

Results

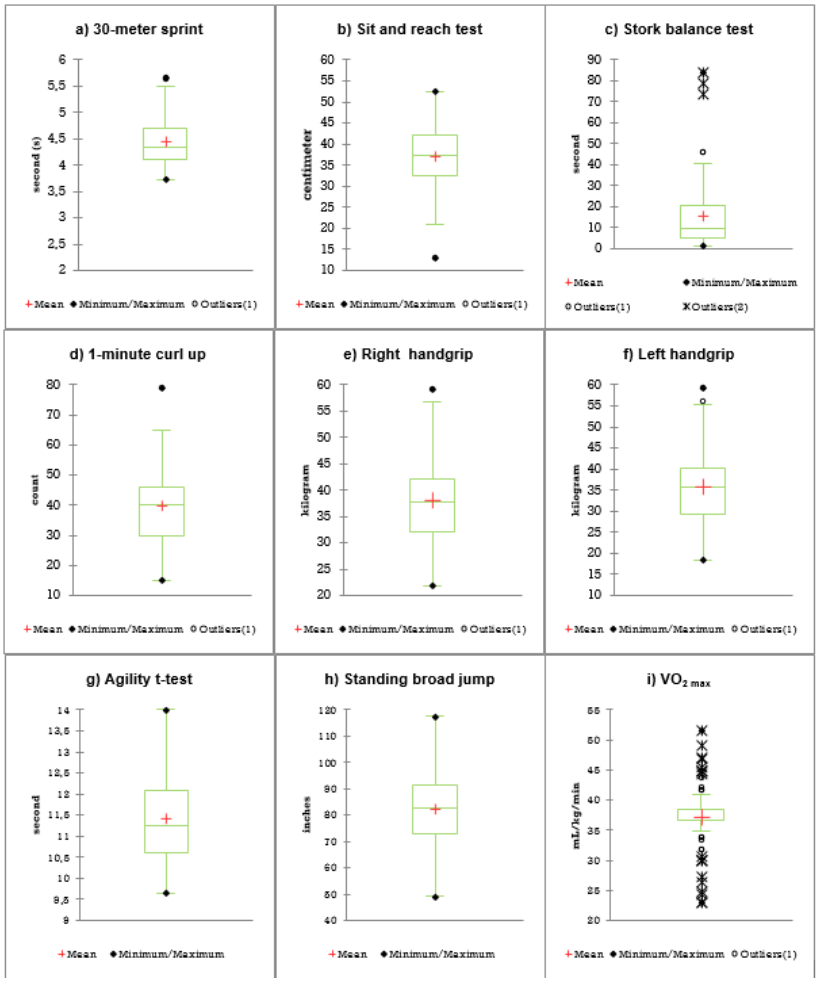
The descriptive statistics of the study participants, including demographic data, anthropometric measurements, and physical fitness test results, are presented in Table 1. The mean age of the participants was 18.58 ± 0.64 years, with a range between 18 and 21 years. The mean cumulative grade point average (CGPA) was 3.45 ± 0.20, with values ranging from 2.84 to 3.75. Anthropometric data indicated a mean height of 167.8 ± 8.2 cm and a mean weight of 64.2 ± 12.6 kg. The average arm span was 171.5 ± 9.6 cm, while the mean sitting height and leg length were 87.5 ± 4.5 cm and 80.2 ± 5.0 cm, respectively. In terms of body composition, the average muscle mass was 27.9 ± 5.5 kg, with a mean body fat percentage of 21.9 ± 7.7%. The basal metabolic rate (BMR) had a mean value of 1444 ± 195 kcal.

Table 1. Participants sociodemographic, anthropometric, and fitness profiles

Outcome Measures	Min	Max	Q1	Median	Q3	Mean	Standard deviation
Age (year)	18	21	18	19	19	18.58	0.64
Academic performance (CGPA)	2.84	3.75	3.37	3.45	3.54	3.45	0.20
Height (cm)	142.5	185.6	162.4	168.2	174	167.8	8.2
Weight (kg)	38.3	106.7	55.8	61.0	71.0	64.2	12.6
Arm span (cm)	145.0	192.0	164.5	171.5	177.5	171.5	9.6
Sitting height (cm)	74.6	99.1	84.9	87.2	90.9	87.5	4.5
Leg length (cm)	66.2	92	76.7	80.1	83.9	80.2	5
Muscle mass (kg)	14.5	42.9	23.1	28.1	31.7	27.9	5.5
Body fat (%)	8	45.3	15.5	21.3	27.1	21.9	7.7
Basal metabolic rate (kcal)	976	1980	1275	1450	1572	1444	195
30-meter Sprint (sec.)	3.73	5.66	4.10	4.35	4.7	4.45	0.45
Left handgrip strength (kg)	18.2	59.3	29.4	35.6	40.1	35.6	8.6
Right handgrip strength (kg)	21.7	59.0	32.2	37.8	42.2	38.0	8.3
Stork stand (s)	1.43	84	5.31	9.56	20.58	15.2	14.68
Sit and reach (cm)	13.0	52.5	32.5	37.4	42.0	37.0	6.3
Standing broad jump (inches)	49.0	117.5	72.8	82.5	91.5	82.2	13.0
Agility t-test (s)	9.64	14	10.62	11.24	12.1	11.43	1.03
Curl up 1 minute (count)	15	79	30	40	46	40	11
VO2 max (ml/kg/min)	23	51.4	36.6	36.8	38.4	37.1	4.3

Figure 2 presents boxplot distributions, illustrating the spread and central tendencies of each test result. The fitness profiling of student-athletes revealed diverse performance distributions across various physical fitness components.

Figure 2. Boxplot of fitness testing



These distributions classified participants into five performance levels: excellent, very good, good, moderate, and weak, highlighting the variation in physical capacity. Table 2 summarizes the physical fitness performance profiles. For instance, the 30-meter sprint (speed) ranged from 3.55 to 5.22 seconds, indicating wide variation in sprinting ability. The sit and reach test (flexibility) scores varied from below 18.7 cm to above 44.9 cm, suggesting variability in lower back and hamstring flexibility. Balance ability (Stork Balance Stand) ranged from under 17 seconds to over 69 seconds, while core muscular endurance (1-minute curl-up test) varied from 24 to 67 repetitions. Upper body strength (handgrip strength) ranged from under 28 kg to over 53 kg (right hand) and from 20.1 kg to over 50.3 kg (left hand).

Agility T-test results showed elite agility levels (under 10.02 seconds) in some athletes and significantly lower levels (above 13.09 seconds) in others. Explosive power (standing broad jump) exhibited substantial variability, with jump distances ranging from 55.6 inches to over 102.3 inches. Cardiovascular fitness (VO_2 max estimates) spanned from below 26.5 mL/kg/min to values exceeding 50 mL/kg/min.

Table 2. Normative Data of Fitness Profiles

Norm	Excellent	Very Good	Good	Moderate	Weak
30m sprint (s)	< 3.55	3.53 – 4.10	4.11 – 4.66	4.67 – 5.21	> 5.22
Sit and Reach (cm)	> 44.9	36.2 – 44.8	27.5 – 36.1	18.8 – 27.4	< 18.7
Stork Balance Stand (s)	> 69.00	52.00 – 68.00	35.00 – 51.00	18.00 – 34.00	< 17.00
Curl Up 1-minute	>67	53 – 66	39 – 52	25 – 38	< 24
Right Handgrip Strength (kg)	> 53.0	45.0 – 52.0	37.0 – 44.0	29.0 – 36.0	< 28.0
Left Handgrip Strength (kg)	> 50.3	40.2 – 50.2	30.1 – 40.9	20.1– 30.1	< 20.1
Agility T-Test (s)	< 10.02	10.03 – 11.04	11.05 – 12.06	12.07 – 13.08	> 13.09
Standing Broad Jump (inches)	> 102.3	86.7 – 102.4	71.3 – 86.8	55.7 – 71.2	< 55.6
VO2 Max (mL/kg/min)	>50	39.6 – 45.9	33.1 – 39.5	26.6 – 33.0	< 26.5

Pearson correlation analysis was conducted to explore the relationships among physical fitness components, academic performance, and highest sports achievement (Table 3).

Table 3. Correlation Matrix of Physical Fitness, Academic Performance and Highest Sports Achievement

	Highest Sport Achievement	Academic Performance (CGPA)	30m Sprint (s)	Left Handgrip Strength	Right Handgrip Strength	Stork Stand (s)	Sit And Reach (cm)	Standing Broad Jump (Inches)	Agility T-Test (s)	Curl Up 1 Minute	VO2 max (ml/kg/min)
Highest Sport Achievement	1										
Academic Performance (CGPA)	0.11	1									
30m Sprint (S)	0.05	0.03	1								
Left Handgrip Strength	-0.01	-0.11	-0.49**	1							
Right Handgrip Strength	0.07	-0.08	-0.48**	0.80**	1						
Stork Balance Stand (S)	-0.17	-0.12	-0.12	0.13	0.15	1					
Sit And Reach (Cm)	-0.09	-0.08	-0.06	0.16	0.09	0.05	1				
Standing Broad Jump (Inches)	-0.19	-0.15	-0.74**	0.46**	0.46**	0.12	0.20*	1			
Agility T-Test (s)	-0.01	0.10	0.83**	-0.57**	-0.49**	-0.09	-0.08	-0.69**	1		
Curl Up 1 Minute (count)	0.12	-0.07	-0.40**	0.30**	0.26**	0.08	0.16	0.44**	-0.46**	1	
VO2 max (ml/kg/min)	0.05	-0.13	-0.55**	0.26**	0.22*	0.08	0.08	0.47**	-0.56**	0.37**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.01 level (2-tailed).

The analysis revealed a negative but non-significant correlation between CGPA and highest sports achievement, $r = –0.11$, $p > 0.05$, suggesting that academic achievement was not significantly related to the level of sports achievement attained by the student-athletes. Similarly, no significant associations were observed between the highest sports achievement and any of the measured physical fitness parameters, indicating that sports success in this cohort was not directly linked to fitness attributes. Furthermore, CGPA showed no significant correlations with any physical fitness measures, reinforcing the notion that academic and physical performance were independent of each other in this sample. In contrast, several strong and significant correlations were identified among the physical fitness variables. Faster 30-meter sprint times were significantly associated with greater lower-body power (Standing Broad Jump, $r = –0.74$, $p < 0.001$), better agility (Agility T-Test, $r = 0.83$, $p < 0.001$), higher aerobic capacity (VO_2 max, $r = –0.55$, $p < 0.001$), stronger handgrip strength (Left: $r = –0.49$, $p < 0.001$; Right: $r = –0.48$, $p < 0.001$), and greater core endurance (Curl-Up 1 Minute, $r = –0.40$, $p < 0.001$).

Agility performance was also significantly correlated with faster sprint times ($r = 0.83$, $p < 0.001$) and negatively correlated with Standing Broad Jump ($r = –0.69$, $p < 0.001$), VO_2 max ($r = –0.56$, $p < 0.001$), core endurance ($r = –0.46$, $p < 0.001$), and handgrip strength (Left: $r = –0.57$, $p < 0.001$; Right: $r = –0.49$, $p < 0.001$). The Standing Broad Jump showed significant positive correlations with Right Handgrip Strength ($r = 0.46$, $p < 0.001$), Curl-Up ($r = 0.44$, $p < 0.001$), VO_2 max ($r = 0.47$, $p < 0.001$), and Sit and Reach flexibility ($r = 0.20$, $p = 0.020$). A strong bilateral relationship was observed between Left and Right Handgrip Strength ($r = 0.80$, $p < 0.001$), indicating consistency in upper body strength. Notably, the Stork Balance Stand did not exhibit any significant correlations with the other variables, suggesting that balance was a distinct component within this fitness profile. Overall, the results highlight the interrelatedness of physical fitness attributes such as strength, power, endurance, agility, and aerobic capacity, while academic performance and sports achievement appeared to function independently of physical fitness in this group of student-athletes.

Discussion

This study addresses the critical necessity for comprehensive fitness profiling among Malaysian student-athletes by evaluating essential components of physical performance, including cardiovascular endurance, muscular strength and endurance, flexibility, agility, speed, balance, and power. Such profiling provides a holistic assessment of an athlete's physical capabilities, enabling coaches and sport scientists to identify individual strengths and weaknesses, tailor training programs accordingly, and monitor performance adaptations over time (Mascherini et al., 2022). Fitness profiling is instrumental in aligning an athlete's physical attributes with the specific demands of their sport, thereby enhancing the efficiency of training interventions. For instance, an athlete with strong lower-body power but low aerobic capacity can be targeted with conditioning strategies to address this imbalance. Additionally, fitness profiling supports evidence-based decision-making in talent identification, performance tracking, and long-term athlete development (Nowak et al., 2024). The fitness profile generated in this study can serve as a reference framework for evaluating the fitness levels of student-athletes at Sultan Idris Education University (UPSI) in Malaysia.

The study also investigated the relationship between physical fitness and academic performance, finding no significant correlation between CGPA and physical fitness components. Our findings align with Altaim et al. (2025), who reported no significant relationship between physical activity and academic performance among health professional students. However, contrasting evidence exists; Awang et al. (2022) observed that aerobic fitness correlated with better academic outcomes among Malaysian athletes. This inconsistency may reflect contextual differences. This suggests that academic achievement is independent of physical capabilities, conflicting with previous research linking aerobic and skill-related fitness to cognitive enhancements such as memory, attention, and executive function (Haverkamp et al., 2021; Kalantari & Esmaeilzadeh, 2016; Redondo-Flórez et al., 2022). These discrepancies indicate that academic performance is likely influenced by multifactorial elements, including mental aptitude, learning environments, motivation, and social support, rather than fitness levels alone (Gragg & Flowers, 2014; Shinnick & Filho, 2024). Additionally, the study examined whether physical fitness was associated with the highest level of sports achievement attained, finding no significant relationships between fitness parameters and sports achievement. This implies that while fitness is a foundational element of performance, other factors such as technical skill, sport-specific training, tactical knowledge, and psychological attributes may play a more defining role in competitive success (Farley et al., 2020; Tassi et al., 2024). These findings highlight the importance of sport-specific profiling, in addition to general fitness profiling, to better predict and support athlete development. Additionally, no significant correlation was observed between academic performance and highest sports achievements, aligning with previous research that suggests athletic success does not necessarily lead to improved academic outcomes (Trudeau & Shephard, 2008). While student-athletes may develop transferable skills such as discipline, time management, and perseverance, these traits may not directly impact academic metrics like CGPA. Moreover, the demands of elite sports training and competition could interfere with study time and academic focus (Thompson et al., 2024). Future studies should explore how different sports, training intensities, or institutional supports influence the academic trajectories of student-athletes.

Although there is no substantial correlation between academic or athletic performance and fitness components, several physical fitness components exhibited significant associations. The 30-meter sprint time was significantly associated with agility, lower-body power, aerobic capacity, core endurance, and grip strength. Agility was linked to nearly all major performance domains, including grip strength, power, and endurance, underscoring its importance in multidirectional sports. Flexibility demonstrated a modest yet significant correlation with lower-body power, reinforcing its importance in enhancing movement mechanics and reducing injury risk. These findings align with existing literature indicating that muscular strength and agility are key determinants of sprinting performance (Suchomel et al., 2016). Lower-body power, assessed through the standing broad jump, was significantly associated with both sprint speed and aerobic capacity, underscoring the role of explosive strength in anaerobic and aerobic performance (Hammami et al., 2015). Similarly, the positive association between flexibility measured through the Sit and Reach test and standing broad jump performance supports previous findings that flexibility facilitates improved force production and movement efficiency (Hammami et al., 2015). Given the strong correlations between sprint performance, grip strength, and lower-body power, targeted training interventions should prioritize the development of these specific attributes. This can

be effectively achieved through integrated programs that include plyometric drills, resistance training, and sprint mechanics work (Hammami et al., 2015; Suchomel et al., 2016). Additionally, agility should be a primary focus of training due to its widespread influence across multiple fitness domains. Agility-specific exercises can enhance movement precision, change of direction, speed and reaction time skills which are essential in most competitive sports (Young et al., 2002). Collectively, these interrelationships underscore the importance of a comprehensive and balanced fitness development approach. Training programs for student-athletes should prioritize the simultaneous enhancement of strength, power, speed, agility, flexibility, and endurance to achieve optimal athletic performance, rather than concentrating on isolated components.

Several limitations warrant consideration. This study has several limitations that should be acknowledged. The cross-sectional design limits the ability to determine causal relationships between physical fitness, academic performance, and sports achievement, highlighting the need for longitudinal research to explore how these variables evolve and interact over time. Additionally, important external factors such as training history, nutrition, recovery habits, and psychological well-being were not assessed, despite their potential influence on both athletic and academic outcomes. Including these variables in future studies would provide a more comprehensive understanding of student-athlete development. The sample was also limited to student-athletes from Sultan Idris Education University (UPSI), which may restrict the generalizability of the findings. Broader studies involving athletes from multiple institutions and a variety of sports disciplines are recommended to enhance the applicability of results. Moreover, future research should investigate the effects of specific training interventions on fitness outcomes to identify the most effective strategies for optimizing performance in university-level athletes.

Conclusions

In summary, this study compiled localized physical fitness profile data for student-athletes at Sultan Idris University, thereby providing valuable benchmarks for assessing and monitoring fitness levels. The findings elucidate significant correlations between fitness components, yet neither academic performance nor the highest sports achievement is associated with any specific fitness component. These findings suggest that while physical fitness is crucial for enhancing athletic capabilities, it alone does not determine academic success or competitive excellence. By providing localized normative data and exploring fitness–academic–sport achievement relationships, this study contributes practical benchmarks for Malaysian coaches, educators, and policymakers, moving beyond Western-based references.

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