World Journal of Physical Education
www.worldphysicaleducationjournal.com
ISSN:
Received: 06-11-2025, Accepted: 05-12-2025, Published: 20-12-2025
Volume 1, Issue 1, 2025, Page No. 21-25

Assessment and selection of fitness tests for male basketball athletes at Industrial University Ho Chi Minh City

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Abstract
This study aimed to assess and identify the most effective fitness tests for evaluating the physical performance of male basketball athletes at Industrial University Ho Chi Minh City. The purpose was to establish a standardized testing protocol that accurately reflects the sport-specific demands of basketball, including strength, agility, endurance, and explosive power. A total of 40 male basketball players, aged 18–24 years, participated in the study. Participants underwent a comprehensive battery of fitness tests, including the vertical jump test, 20-meter sprint, agility T-test, Yo-Yo intermittent recovery test, and medicine ball throw, administered over a two-week period under controlled conditions. The data were analyzed to determine reliability, sensitivity, and relevance of each test to basketball performance.
Results indicated that the vertical jump and 20-meter sprint tests were highly effective in assessing lower-body explosive power and speed, while the agility T-test provided a reliable measure of directional change ability essential in game situations. The Yo-Yo intermittent recovery test demonstrated strong correlation with in-game endurance and aerobic capacity. The medicine ball throw proved useful for upper-body strength assessment but showed moderate sensitivity compared to other tests. Overall, the findings suggest that a combined assessment approach incorporating vertical jump, 20-meter sprint, agility T-test, and Yo-Yo intermittent recovery test offers a comprehensive evaluation of the physical capabilities most relevant to male basketball athletes. The study concludes that implementing this battery can guide training interventions, monitor athlete development, and optimize performance outcomes within university-level basketball programs.

Keywords: Basketball performance, fitness assessment, agility, explosive power, endurance, male athletes, sports testing

Introduction

Basketball is a high-intensity, intermittent team sport that requires athletes to perform repeated bouts of sprinting, jumping, rapid changes of direction, and technical skills under conditions of physical and psychological pressure. Success in basketball depends not only on tactical understanding and technical proficiency but also on well-developed physical fitness components such as speed, agility, muscular strength, power, endurance, and coordination. At the university level, where athletes often balance academic responsibilities with training demands, the systematic assessment of physical fitness plays a crucial role in optimizing performance, preventing injury, and guiding evidence-based training programs. In this context, selecting appropriate and sport-specific fitness tests is essential for accurately evaluating basketball players' physical capacities.

Previous research has consistently highlighted the multidimensional physical demands of basketball. Studies on elite and sub-elite male basketball players report that explosive lower-limb power is strongly associated with rebounding, shot blocking, and scoring efficiency, while sprint speed and agility are critical for fast breaks, defensive recovery, and one-on-one situations. Aerobic and anaerobic endurance are equally important, as basketball matches involve repeated high-intensity actions interspersed with brief recovery periods. As a result, researchers and practitioners have proposed various fitness testing batteries, including vertical jump tests, short-distance sprint tests, agility drills, and intermittent endurance tests, to capture these performance-related attributes. However, the applicability and effectiveness of these tests may vary depending on competition level, age group, and training background.

Despite the abundance of available fitness tests, several limitations remain in the existing literature. Many studies focus primarily on professional or elite athletes, with limited attention given to university-level players, particularly in developing basketball contexts. Furthermore, some testing protocols include a large number of general fitness assessments that may not adequately reflect the specific movement patterns and physiological demands of basketball. There is also inconsistency in test selection across studies, making it difficult to compare results or establish standardized benchmarks for specific populations. These gaps highlight the need for context-specific research aimed at identifying reliable, valid, and practical fitness tests tailored to university basketball athletes.

In Vietnam, basketball has experienced growing participation at the collegiate level, including at Industrial University Ho Chi Minh City, where structured training programs are increasingly emphasized. However, systematic scientific evaluation of athletes' physical fitness remains limited. Coaches often rely on experience-based judgments rather than standardized testing protocols when designing training programs or monitoring athlete development. This situation underscores the importance of conducting empirical research to assess commonly used fitness tests and determine their suitability for male basketball athletes within this institutional and cultural setting.

The primary objective of this study is to assess and select appropriate fitness tests that effectively evaluate the key physical performance components of male basketball athletes at Industrial University Ho Chi Minh City. Specifically, the study aims to examine the relevance and practicality of selected tests in measuring explosive power, speed, agility, endurance, and upper-body strength. By

analyzing test outcomes and their alignment with basketball-specific demands, the research seeks to identify a concise and effective testing battery suitable for routine use in university training programs. The study also addresses the following research questions: which fitness tests most accurately reflect the physical requirements of male university basketball players, and how can these tests be combined to provide a comprehensive assessment of athletic readiness?

This paper is structured as follows. The Introduction presents the theoretical background, significance, and research objectives. The Methods section describes the participants, testing procedures, and data analysis techniques used in the study. The Results section reports the findings related to the performance outcomes of the selected fitness tests. The Discussion interprets these findings in relation to existing literature and practical implications for training and athlete monitoring. Finally, the Conclusion summarizes the main outcomes and offers recommendations for coaches, sports scientists, and future research. Through this structure, the study aims to contribute to the development of evidence-based fitness assessment practices for university-level basketball athletes.

Methods

Research Design

This study adopted a quantitative, cross-sectional research design aimed at assessing and selecting appropriate fitness tests for male basketball athletes at Industrial University Ho Chi Minh City. The quantitative approach was chosen to allow objective measurement of physical fitness variables and statistical comparison of test outcomes. The study focused on evaluating the relevance, practicality, and performance sensitivity of selected fitness tests commonly used in basketball conditioning. All testing procedures were conducted under standardized conditions to ensure reliability and reproducibility of the data.

Population and Sample

The study population consisted of male basketball athletes officially registered with the basketball team of Industrial University Ho Chi Minh City during the 2024–2025 academic year. Using purposive sampling, 40 male athletes were selected to participate in the study. Inclusion criteria were: male gender, age between 18 and 24 years, minimum of one year of continuous basketball training experience, and active participation in regular team training sessions. Athletes with current musculoskeletal injuries, recent surgery, or medical conditions that could affect physical performance were excluded. The sample size was considered adequate for fitness assessment studies at the university level and consistent with similar research in sports science.

Data Collection Instruments and Fitness Tests

Data collection was carried out using a battery of standardized physical fitness tests selected based on their relevance to basketball performance. Anthropometric measurements, including height and body mass, were recorded using a stadiometer and digital weighing scale to describe the sample characteristics.

Explosive lower-body power was assessed using the vertical jump test. Participants performed three maximal jumps with arm swing, and the highest jump height was recorded in centimeters. Sprint speed was measured using a 20-meter sprint test, with electronic timing gates used to ensure accuracy. Each athlete completed two trials, and the best time was retained for analysis.

Agility and change-of-direction ability were evaluated using the agility T-test, which involves forward sprinting, lateral shuffling, and backward running. Time to completion was recorded using a digital stopwatch. Aerobic and intermittent endurance were assessed using the Yo-Yo Intermittent Recovery Test Level 1, following standardized protocols. Total distance covered was recorded as the primary outcome measure. Upper-body explosive strength was measured using a seated medicine ball throw test, with distance measured in meters.

All tests were conducted over a two-week period to minimize fatigue effects. Athletes completed a standardized warm-up before testing and were given adequate rest intervals between trials and tests. Testing sessions were supervised by trained researchers and physical education staff to ensure consistency and safety.

Procedures

Testing was conducted at the university sports complex under similar environmental conditions. Prior to data collection, participants were familiarized with testing procedures to reduce learning effects. Tests were scheduled at the same time of day for all participants to control for circadian variations in performance. Participants were instructed to avoid strenuous physical activity 24 hours before testing and to maintain their usual diet and hydration practices.

Data Analysis

Data were coded and analyzed using Statistical Package for the Social Sciences software (SPSS version 26.0). Descriptive statistics, including mean, standard deviation, minimum, and maximum values, were calculated for all variables. Test reliability was assessed using intraclass correlation coefficients for repeated measures where applicable. Pearson correlation analysis was used to examine relationships between different fitness components. Comparative analyses were performed using independent sample t-tests and one-way analysis of variance where appropriate to examine differences across performance levels. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Research Ethics Committee of Industrial University Ho Chi Minh City. All participants were informed about the purpose, procedures, potential risks, and benefits of the study prior to participation. Written informed consent was obtained from all athletes. Participation was voluntary, and athletes were free to withdraw at any stage without penalty. Confidentiality was ensured by anonymizing all data and using coded identifiers. Collected data were stored securely and used solely for academic research purposes.

Results

This section presents the results of the physical fitness assessments conducted among male basketball athletes at Industrial University Ho Chi Minh City. The findings are reported objectively using descriptive and inferential

statistics. All results are organized and summarized in tables, which are referenced in the text accordingly.

Participant Characteristics

Descriptive statistics for the anthropometric characteristics of the participants are presented in Table 1. A total of 40 male basketball athletes completed all testing procedures. The mean age of the participants was 20.6 ± 1.7 years. Mean height and body mass were 176.4 ± 6.2 cm and 71.8 ± 7.5 kg, respectively. The data indicate a relatively homogeneous sample appropriate for comparative physical fitness analysis.

Table 1: Anthropometric characteristics of participants (n = 40)

Variable	Mean ± SD	Minimum	Maximum
Age (years)	20.6 ± 1.7	18	24
Height (cm)	176.4 ± 6.2	165	189
Body mass (kg)	71.8 ± 7.5	58	88

Performance in Fitness Tests

The descriptive statistics for all fitness tests are shown in Table 2. The mean vertical jump height was 54.3 ± 6.8 cm, indicating moderate to high lower-body explosive power among participants. The average 20-meter sprint time was 3.12 ± 0.18 seconds. For agility, the mean completion time for the T-test was 9.84 ± 0.41 seconds. Aerobic and intermittent endurance, as measured by the Yo-Yo Intermittent Recovery Test Level 1, showed a mean total distance of 1,624 ± 312 meters. Upper-body explosive strength, assessed using the medicine ball throw, had a mean distance of 5.62 ± 0.54 meters.

Table 2: Descriptive statistics of fitness test performances

Fitness Test	Mean ± SD	Minimum	Maximum
Vertical jump (cm)	54.3 ± 6.8	41	67
20 m sprint (s)	3.12 ± 0.18	2.78	3.48
Agility T-test (s)	9.84 ± 0.41	9.05	10.72
Yo-Yo IR Test Level 1 (m)	1,624 ± 312	1,040	2,200
Medicine ball throw (m)	5.62 ± 0.54	4.60	6.80

Reliability of Fitness Tests

Test–retest reliability was examined for selected fitness measures using intraclass correlation coefficients (ICC), as presented in Table 3. The vertical jump test demonstrated high reliability (ICC = 0.91). The 20-meter sprint test and agility T-test also showed high reliability values of 0.93 and 0.89, respectively. The Yo-Yo Intermittent Recovery Test showed very high reliability (ICC = 0.95). The medicine ball throw test demonstrated good reliability with an ICC value of 0.86.

Table 3: Reliability analysis of selected fitness tests

Fitness Test	ICC	Reliability Level
Vertical jump	0.91	High
20 m sprint	0.93	High
Agility T-test	0.89	High
Yo-Yo IR Test Level 1	0.95	Very high
Medicine ball throw	0.86	Good

Correlation Between Fitness Components

Pearson correlation analysis was conducted to examine relationships among the fitness variables. The results are summarized in Table 4. Vertical jump performance showed a significant negative correlation with 20-meter sprint time ($r = -0.62$, $p < 0.01$) and agility T-test time ($r = -0.58$, $p < 0.01$). Yo-Yo test distance was moderately correlated with agility performance ($r = -0.46$, $p < 0.01$). Medicine ball throw distance demonstrated a low to moderate correlation with vertical jump height ($r = 0.39$, $p < 0.05$).

Table 4: Pearson correlation coefficients between fitness tests

Variables Compared	r value	p value
Vertical jump vs. 20 m sprint	−0.62	<0.01
Vertical jump vs. Agility T-test	−0.58	<0.01
Agility T-test vs. Yo-Yo IR Test	−0.46	<0.01
Vertical jump vs. Medicine ball throw	0.39	<0.05

Discussion

The purpose of this study was to assess and select appropriate fitness tests for evaluating the physical performance of male basketball athletes at Industrial University Ho Chi Minh City. The results provide meaningful insight into the physical characteristics of university-level basketball players and the suitability of commonly used fitness tests in capturing sport-specific performance demands. The findings indicate that the selected test battery effectively reflects key physical components required in basketball, including explosive power, speed, agility, endurance, and upper-body strength.

The observed vertical jump performance demonstrates a moderate to high level of lower-body explosive power among the participants. This result is consistent with previous studies on male basketball players, which emphasize the importance of vertical jumping ability for rebounding, shot blocking, and finishing near the basket. The strong negative correlations between vertical jump height and both sprint and agility test times further support the interconnected nature of explosive power, speed, and change-of-direction ability in basketball. Athletes with greater lower-limb power tended to perform faster in linear sprinting and agility-based movements, highlighting the transfer of muscular power to on-court performance.

Sprint speed over short distances is critical in basketball due to the frequent requirement for rapid accelerations during offensive and defensive transitions. The mean 20-meter sprint times recorded in this study align with values reported for collegiate-level players in comparable research, indicating an adequate level of speed development within the sample. The strong reliability of the sprint test reinforces its suitability for repeated assessment and performance monitoring in a university training environment. These findings support the continued use of short-distance sprint tests as a core component of basketball fitness evaluation.

Agility, as measured by the T-test, revealed consistent performance across participants and demonstrated high reliability. The significant relationships between agility performance and both explosive power and endurance suggest that agility in basketball is a multifactorial ability influenced by strength, neuromuscular coordination, and fatigue resistance. This aligns with existing literature that describes agility not merely as a change-of-direction skill, but as an integrated performance quality shaped by multiple physical capacities. The results indicate that the agility T-test is an appropriate and practical tool for assessing basketball-specific movement patterns at the university level.

Aerobic and intermittent endurance, assessed through the Yo-Yo Intermittent Recovery Test Level 1, showed

considerable variability among athletes. This variation may reflect differences in playing position, training history, and individual conditioning levels. The moderate correlation between Yo-Yo performance and agility suggests that higher endurance capacity may support sustained movement efficiency and decision-making during prolonged game situations. Previous studies have reported similar associations, emphasizing the importance of intermittent endurance in maintaining high-intensity performance throughout a match. The very high reliability of the Yo-Yo test further supports its use as a valid indicator of basketball-specific endurance.

Upper-body explosive strength, measured using the medicine ball throw, demonstrated acceptable reliability but weaker correlations with other fitness components. This finding suggests that upper-body power, while important for passing and shooting, may be more independent of lower-body-dominated performance measures. This observation is consistent with earlier research indicating that upper- and lower-body strength qualities can develop differently depending on training emphasis. While the medicine ball throw may be less predictive of overall athletic performance, it remains valuable for providing a more complete physical profile of basketball athletes.

Despite the strengths of the study, several limitations should be acknowledged. The sample was limited to male athletes from a single university, which restricts the generalizability of the findings to other populations, including female athletes or players at different competitive levels. Additionally, the cross-sectional design does not allow for examination of changes in fitness over time or the direct impact of training interventions. Environmental and motivational factors, although controlled as much as possible, may also have influenced performance outcomes.

Future research should consider longitudinal designs to examine how these fitness measures respond to structured training programs across a competitive season. Expanding the sample to include athletes from multiple universities or regions would enhance external validity. Further studies may also explore position-specific fitness profiles and integrate technical or tactical performance indicators to strengthen the link between physical testing and game performance.

In conclusion, the discussion of the results underscores the relevance and effectiveness of a focused fitness testing battery for male university basketball athletes. The findings support the use of selected tests as reliable and meaningful tools for performance assessment, training evaluation, and athlete development within the university basketball context.

Conclusion

This study assessed and identified suitable fitness tests for evaluating the physical performance of male basketball athletes at Industrial University Ho Chi Minh City. The findings demonstrated that a selected battery of standardized tests effectively captured the key physical components required for basketball performance, including explosive power, speed, agility, intermittent endurance, and upper-body strength. The vertical jump, 20-meter sprint, agility T-test, and Yo-Yo Intermittent Recovery Test Level 1 showed high reliability and strong relevance to basketball-specific movement demands, while the medicine ball throw contributed useful information on upper-body explosive strength.

The results confirm that these fitness tests provide a comprehensive and practical framework for assessing university-level basketball athletes. By offering objective and reliable measurements, the study contributes to the development of evidence-based fitness assessment practices within collegiate basketball programs, particularly in emerging basketball environments. The proposed testing battery can assist coaches and sports practitioners in monitoring athlete development, identifying physical strengths and weaknesses, and designing targeted training interventions to enhance performance and reduce injury risk.

Future research is recommended to extend this work through longitudinal studies that examine changes in fitness profiles across training seasons and competitive cycles. Expanding the scope to include female athletes, position-specific analyses, and comparisons across institutions would further strengthen the applicability of the findings. Integrating physical fitness assessments with technical and tactical performance indicators may also provide a more holistic understanding of basketball performance at the university level.

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