

# Determine fitness of UNNES basketball players using sport-specific tests and measurements

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**Abstract.** Individual fitness levels can affect team performance. The problem of this study is to describe the fitness level of male basketball players at Negeri Semarang University. A total of 19 male athletes participated in this study. A descriptive quantitative method with sport-specific tests and measurements was used in this study. His average BMI is 2.52. Average agility he is 12.92 seconds. His average balance is 9.03 seconds. Average aerobic endurance is 39.20 ml/kg/min. His average arm strength is 33.94. The average abdominal muscle strength is 26.52 times. The average explosive force is 58.57cm. Flexibility averages him 15.78 cm, and eye-hand coordination averages 17.68 catches. As a result, male basketball players at Negeri Semarang University reported an average of 55.7% of their fitness levels.

**Keywords:** physical condition, test and measurement, basketball.

## 1 Introduction

The basketball game demands excellent physical condition from every athlete. According to Barth and Boesing (2010: 41), basketball players need good endurance to meet the demands of the game with total concentration and in the best physical condition without weakening due to fatigue because basketball players should be able to maintain their performance throughout the game.

Basketball is included in the intermittent game category, which means that it involves high-intensity physical activity interspersed with low-intensity physical activity and periods of rest (amir-Vicen et al., 2014; ba, Coetzee, & Asadi, 2012). Games at high intensity require physical endurance that can last during the match. Competitive basketball games also involve physical contact between players. If the player's physical condition cannot answer the challenges of the current game, the player or team concerned will inevitably fail to compete. Studies on elite players reveal that success in playing basketball from the physical side is more determined by anaerobic capacity (Klausemann, Pyne, Foster, & Drinkwater, 2012). However, aerobic capacity also remains a basketball player's need (McInnes, Carlson, Jones, & McKenna, 1995).

In general, McKeag (2008) revealed that there are at least several components of physical fitness that every basketball player must possess, including (1) aerobic capacity, (2) anaerobic capacity, (3) strength, (4) speed, (5) agility, (6) flexibility, and (7) body mass profile. Without physical development related to the above components, the development of basketball athlete achievement will not be able to run optimally. It is because the physical is the basis for

developing sports skills. Physical conditions will affect the appearance of athletes on the playing field (Kuroda et al., 2015).

The advantage of this research is that it includes physical attributes directly related to basketball to be measured and evaluated using a specific set of tests and measurement methods. This study's physical attributes include body mass index, agility, balance, aerobic endurance, arm muscle strength, abdominal muscle strength, explosive power, flexibility, and hand-eye coordination. Physical tests and measurements should depart from the goal and be designed in such a way as to suit the needs of basketball players so that sports tests and measurements can be used as a means of predicting athlete achievement as well as talent scouting recruitment programs (Zhannisa & Sugiyanto, 2015). Morrow (2015) states that at least four things must be met to create quality tests and measurements, including objectivity, reliability, relevance, and validity. Relevance means that the test items and measurements must be adapted to the physical needs of the sport in question.

This study aimed to determine the physical condition of basketball athletes at Universitas Negeri Semarang in 2022 using test and measurement methods relevant to the sport of basketball. The subjects of this study were 19 male basketball athletes from Universitas Negeri Semarang. At the same time, the object of this research is the physical component related to basketball, which includes body mass index, agility, balance, aerobic endurance, arm muscle strength, abdominal muscle strength, explosive power, flexibility, and hand-eye coordination. This research can complement the study of tests and measurements, especially regarding the sport of basketball. It can be used as a reference for coaches or basketball stakeholders in screening, selecting, and evaluating the physical condition of basketball athletes.

## **2 Method**

Nineteen basketball athletes from Universitas Negeri Semarang were recruited for this study as research subjects. This research is quantitative and descriptive. Determination of the research sample was taken by using the total sampling method. This study uses a cross-sectional test and measurement technique, which means that data collection is carried out simultaneously over time.

The variables measured included: a) body mass index, b) agility, c) balance, d) aerobic endurance, e) arm muscle strength, f) abdominal muscle strength, g) explosive power, h) flexibility, i) hand-eye coordination. The data collection instruments used to measure the above variables in succession are as follows: a) Semo agility, b) Standing stork, c) Multi-stage Fitness, d) Push-up and sit-up test, e) Vertical jump, f) V-sit and reach, g) Alternate hand wall toss test.

The tests and measurements in this study were selected based on their suitability for basketball (McKeag, 2008). All players in this study were in good health and understood every test item being tested. Subjects were given time to warm up before testing and measuring. The study's results were processed using statistical analysis descriptive percentage techniques to show the subject's achievements on all test items and measurements taken.

### 3 Result

The data collection results summarize the physical condition scores for UNNES basketball athletes. There are at least 8 test items and one measurement item carried out. Information on the types of tests and their results can be seen in Table 1.

**Table 1.** UNNES basketball athlete physical test scores in 2022.

No	Test	Measured	Result (Mean±SD)	Norm
1	Body Mass Index	Body mass profile	20.52±2.36	Fair
2	Semo Agility	Agility	12.92±0.71	Average
3	Standing Stork	Balance	8.58±7.82	Poor
4	Multi-stage Fitness	Aerobic endurance	39.20±5.38	Fair
5	Push-up	Arm muscle strength	33.94±10.89	Above Average
6	Sit-up	Abdominal muscle strength	26.52±5.97	Poor
7	Vertical Jump	Explosive power	58.57±8.26	Above Average
8	V-sit and Reach	Flexibility	15.78±8.79	Fair
9	Alternate Hand Wall Toss Test	Hand-eye coordination	17.68±2.84	Fair

The tests indicate that the level of the physical condition of the basketball athletes at the State University of Semarang can be considered moderate. It can be seen through the data presented in Table 1. Several parameters, such as arm muscle strength and explosive power, obtained above-average achievements with an average value of 33.94 repetitions and 58.57 cm. Agility is in the average category (12.92 s). Three other physical parameters were at a poor level, namely aerobic endurance (39.20 ml/kg/min), flexibility (15.78 cm), and eye-hand coordination (17.68 catches). However, two physical parameters fall into the poor category: balance (8.58 s) and abdominal muscle strength (26.52 repetitions). Body mass profiles of all athletes were within normal limits, with an average BMI of 20.52 (kg/m)<sup>2</sup>.

### 4 Discussion

The level of strength and explosive power affects the competitiveness of a basketball athlete in a match. Explosive power in basketball is manifested through various variants of jumps, acceleration starts, sudden changes in direction, decelerations, sudden stops, and passing. Explosive power is an essential characteristic of professional basketball players and one of the most critical factors for achieving the best results. Explosive power is not only influenced by the default coefficient. Explosive power development can be realized through planned, rational, and well-organized training. Positive correlations were determined between explosive power and short-distance running, jumping, and throwing and between explosive strength and lean body mass in basketball players of different ages. The size of the explosive power obtained in this study showed an achievement above- average (58.57±8.26 cm). It

means that it is good enough but must be continuously improved because explosive power contributes positively to the efficiency of basketball players.

Basketball is a game that demands the dominance of hand skills in processing the ball. Arms and shoulders muscular endurance is a crucial component in basketball. How long a player can process the ball will determine a team's success. Therefore, this aspect is essential for every player to survive at a competitive level of competition. In this study, the average value of upper extremity muscular endurance for UNNES basketball athletes obtained through a one-minute push-up test was in the above-average category ( $33.94 \pm 10.89$ ). These results are still not entirely satisfactory, so they must continue to be improved to increase the game's level. Increased muscular endurance can be obtained through strength training both with internal loads (bodyweight exercise) and external loads (free weight exercise).

Furthermore, the agility of the UNNES basketball athletes showed unsatisfactory results. Through the semo agility test, the average time recorded by the players was  $12.92 \pm 0.71$  seconds; this figure was categorized as average. Agility is one of the essential instruments that basketball athletes must have. Agility is a common athletic maneuver that requires the athlete to possess a combination of physical, technical, and tactical attributes to avoid or catch up to an opponent. Agility affects the athlete's ability to change direction. Implementation of efficient change of direction both with and without the ball often determines the playing performance of basketball athletes. Therefore, athletes need a combination of perceptual-cognitive factors and strength characteristics to sustain rapid changes in direction and gain a positional advantage during competition.

Endurance is an essential asset for every basketball player. Athletes with good endurance will be able to maintain their performance on the court and have a higher fatigue threshold to have superior competitiveness. Athletes can have a good appearance in a high-level basketball competition if supported by excellent cardiorespiratory and muscular endurance. Physical components such as power and agility are also crucial for basketball athletes (Alemdaroğlu, 2012). The highly competitive level of competition at the University level requires basketball athletes to have good endurance to compete at their level. Movement in a basketball game, dominated by high-intensity movements such as jumping, running, and changing direction, certainly requires excellent stamina that can be formed from exercise routines (Abdelkrim, El Faza, & Jaila, 2007). The results in the field showed that the endurance of UNNES basketball athletes was at a fair level ( $39.20 \pm 5.38$ ).

Several physical aspects also require improvement efforts because the results are unsatisfactory. The physical aspect is flexibility and hand-eye coordination. The modified V-sit and reach test showed that the average result was  $15.78 \pm 8.79$  cm, which was included in the fair category. Flexibility is the ability of the joints of the body to move within the range of motion (ROM), the more flexible a body part is, the greater the ROM that can be generated from the movement of that body part. Optimal flexibility and improving the quality of motion can reduce the risk of injury while moving. Shrier (2004) states that increased flexibility can positively impact other physical components, including speed, agility, and jumping height. Flexibility can be increased through stretching activities before and after exercise. Flexibility can be easily increased if stretching activities have been accustomed to athletes from an early age because, with increasing age, anatomically, the obstacles to increasing flexibility will undoubtedly be more significant (Bompa & Carrera, 2015, p. 67).

On the other hand, the level of hand-eye coordination obtained in the alternating hand-to-wall throw test yielded an average score of  $17.68 \pm 2.84$ , an unsatisfactory result for inclusion in the "fair" category. Hand-eye coordination is one of many important components of physical fitness. Coordination is the movement to perform motor movements quickly and

directly, determined by the control and regulation of movement and the cooperation of the central nervous system. A multi-handed basketball game requires movement control and coordination, as well as eye-hand nervous system cooperation, to enable the rapid and deliberate execution of motor tasks such as shooting, dribbling, and passing. In performing movements, the eye is the visual organ that provides information while the hand performs the task. Balance is the ability to keep the body's center of gravity above the base of support and results from neuromuscular activity that responds to continuous visual, vestibular, and somatosensory feedback. In basketball, players regularly have to deal with a variety of situations related to physical contact and imbalance. These actions are often performed in tight spaces and require quick movements, a high degree of coordination, and good strength. For this reason, balance components are required to minimize imbalance when performing movements that can increase the risk of injury. As a result, the balance level obtained in the stork standing test showed a poor result with a score within the bad category ( $8.58 \pm 7.82$ ).

Abdominal muscle strength is also included in the poor category. The results of the one-minute sit-up test showed the results of  $26.52 \pm 5.97$ . These results indicate that the component of abdominal muscle strength must be considered in order to be able to support the athlete's physique as a whole. The average BMI of UNNES basketball athletes is in the ideal category of  $20.52 \pm 2.36$ . An integrated intake control scheme can ensure adequate nutrition for athletes and maintain an ideal weight-to-height ratio.

Physical capacity building is carried out through the periodization of training carried out by trainers. Periodization of exercise is used to adjust the training load in such a way as to get optimal results. Excellent physical condition is necessary for all athletes involved in the game, both as starters and substitutes. It means a structured and planned exercise program so that an increase in physical capacity can be achieved.

## **5 Conclusion**

This study concluded that the average physical condition of UNNES basketball athletes was in an average condition of 55.7%. There are still many minor results that need to be improved to increase the competitiveness of athletes to achieve maximum performance at the university level.

The results in this study can be used to evaluate exercise programs by rearranging physical exercises to improve the athlete's physical condition. So that they can compete in a competitive competition in every match held. Coaches and related stakeholders can also use the test items and measurements in this study to monitor the level of the physical condition of basketball athletes.

Although this study uses nine test and measurement variables which include: a) body mass index, b) agility, c) balance, d) VO2 Max, e) arm muscle strength, f) abdominal muscle strength, g) explosive power, h) flexibility, i) hand-eye coordination, the development of this research is still needed so that all the specific physical components of basketball can be fully identified as evaluation material in the training program. Suggestions for the development of further research are to test and measure other physical components needed in basketball games, such as speed and specific other physical components.

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