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Evaluation of the Physical Condition of Pb Bhirawa Sidoarjo U-17 Athletes

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ABSTRACT

This study aims to evaluate the physical condition of PB Bhirawa Sidoarjo U-17 athletes as a basis for developing a more effective and targeted training program. Badminton is a sport that demands fast, explosive, and repetitive movements, making optimal physical condition crucial for supporting performance. This study uses a quantitative descriptive method. The research sample consists of 7 U-17 athletes who are actively training at PB Bhirawa Sidoarjo. Data collection was carried out through a series of physical tests including: 30-meter run (speed), push-ups (arm muscle strength), sit-ups (abdominal muscle strength), T-test (agility), Multi Fitness Test/MFT (aerobic endurance), seated medicine ball throw (arm muscle power), and sargent jump (leg muscle power). Data analysis used mean and percentage techniques. The results show that the physical abilities of PB Bhirawa Sidoarjo U-17 athletes fall into varied categories for each test component. Some athletes have demonstrated good ability in speed, muscle strength, agility, endurance, and explosive power; however, several athletes still fall into the fair to poor categories. These differences indicate that the athletes' physical condition is not uniform, necessitating more specific, structured, and sustainable physical evaluation and training programs. This ensures that all components of the athletes physical condition develop optimally to support the improvement of athlete achievement in competitions.

Keywords: U-17 Athletes; Badminton; Physical Evaluation; Physical Condition

Authors' Contribution: a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funds Collection

INTRODUCTION

Badminton is a hugely popular sport in Indonesia and demands a complex set of physical skills. As a dynamic sport, badminton relies on rapid and repeated bursts of physical energy, with players required to maintain constant acceleration throughout a match. Seth (2016) states that during a rally, various motor actions including racket strokes occur as a result of players movements and rapid tactical decisions. Therefore, proficiency in badminton cannot be achieved instantly but requires regular training that integrates physical, technical, tactical and mental aspects. Ihsan & Jayadi (2017) add that this sport pits all these aspects against one another in an intense head-to-head situation.

Physical fitness is the primary foundation for an athlete to be able to execute techniques and tactics to the fullest. Ar Rasyid et al. (2023) explain that physical fitness is a comprehensive structure comprising various interrelated components, where each element forms a cohesive whole to enhance the athlete's performance. Without excellent physical support, an athlete will not be able to carry out the coach's instructions perfectly on the pitch. This is reinforced by the view of Hermansyah (2017), who states that the development of comprehensive physical fitness is crucial, if physical fitness is not optimal, then the training instructions given will not be executed properly.

The urgency of this physical assessment stems from observations in the field, particularly amongst the athletes of PB Bhirawa Sidoarjo's U-17 team. Observations revealed that the athletes frequently experience significant fatigue during matches, leading to a drastic decline in strength and stamina when facing high-intensity matches. This indicates a limitation in the athletes' endurance capacity. Putera et al. (2022) emphasise that physical training is highly effective in enhancing sporting performance due to its comprehensive benefits in regulating motor and neuromuscular aspects. Furthermore, Wiyandono (2016) states that a thorough understanding of physical fitness levels is crucial for improving performance through structured training programmes.

The novelty of this study lies in its in-depth evaluation specifically targeting the under-17 (U-17) age category at PB Bhirawa Sidoarjo, a regional development club, with the aim of providing objective data for coaches to design evidence-based training programmes. This study aims to quantitatively evaluate the components of physical fitness, which include speed, strength, agility, endurance and power. The results of this study are expected to serve as a scientific reference for improving athletes' physical performance, thereby better preparing them to compete at a higher level.

METHODS

This study employs a quantitative descriptive research design, which aims to present phenomena systematically, factually and accurately based on objective field data. Prasetyo (2024) states that descriptive research emphasises the presentation of data in accordance with the facts currently obtained, without any manipulation of variables. Data collection was carried out at the Soerokromodengan Sports Hall during two training sessions to ensure the validity of the measurement results.

Population and Sample The population in this study comprised all active badminton athletes at PB Bhirawa Sidoarjo, totalling 18 athletes. Sampling was carried out using a purposive technique, whereby seven athletes in the U-17 age category who had been actively training for at least one year were selected as research subjects. Exclusion criteria were applied to athletes who were injured or ill at the time of data collection to maintain the accuracy of the physical evaluation results.

Data Collection Instruments and Techniques Data collection techniques involve tests and measurements of physical conditions using standard instruments, including: a tape measure, a sound system, a cone, a stopwatch, a whistle and writing materials. Based on references from Wiriawan (2025), Permatasari (2023) and Pasaribu (2020), the series of tests used consists of:

1. Aerobic Endurance (VO_2max): Measured using the Multi Fitness Test (MFT) or bleep test over a 20 meter course.
2. Abdominal Muscle Strength: Measured via a 30 second sit-up test.
3. Arm Muscle Strength: Measured via a 30 second push-up test.
4. Speed: Measured using a 30 meter sprint.
5. Agility: Measured using the T-test to assess the ability to change direction rapidly.
6. Lower-body explosive strength: Measured using the Sargent jump test (vertical jump).
7. Upper-body explosive strength: Measured using the seated medicine ball throw test with a 3 kg ball.

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Data analysis techniques, the data collected were analysed using descriptive statistics, specifically the mean and percentage. The formula for the mean was used to determine the group average score for each test component, whilst the percentage formula was used to classify the athletes physical ability levels into the categories of very good, good, adequate, poor, and very poor, based on the applicable assessment standards.

RESULTS

This study produced findings aimed at addressing all the research questions that formed the focus of the study, namely the physical condition of the PB Bhirawa U-17 athletes, covering speed, strength, agility, endurance and power. The research data are presented based on the results of tests and measurements carried out using the MFT, 30 meter sprint, push-up, sit-up, T-test, sargent jump, and seated medicine ball throw as data collection instruments.

Measuring the Speed of PB Bhirawa U-17 Athletes Using the 30-metre Sprint Test

The 30 meter sprint test in this study aimed to measure the speed of the PB Bhirawa U-17 athletes as a key component of physical fitness in badminton. Speed plays a major role in an athlete's ability to move quickly to chase the shuttlecock, change position and respond to an opponent's attack within a short time.

Through this test, researchers can determine the athletes' maximum sprinting ability over short distances, thereby obtaining an objective picture of their speed levels. It is hoped that these measurement results will serve as a basis for coaches to develop more effective training programmes to enhance the athletes' performance.

Table 1. Results of the 30 meter Sprint Test for PB Bhirawa U-17 Athletes

Number	Athletes Name	Results
1	VI	6.3 seconds
2	BA	5 seconds
3	AF	5.82 seconds
4	SA	4.94 seconds
5	CI	6.21 seconds
6	AD	5.58 seconds
7	IN	6.67 seconds
Average		**5.72 seconds**

Table 2. Assessment of Categories and Frequency of the 30 meter Sprint Test

Category	Category Score	Frequency
Very Poor	> 6.94 seconds	0
Poor	6.41 – 6.94 seconds	1
Fair	6.01 – 6.40 seconds	1
Good	5.11 – 6.00 seconds	3
Very Good	< 5.11 seconds	2

Table 3. Table of 30 meter Sprint Test Results by Category

Athletes Name	Results	Category
VI	5.82	Good

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BA	4.94	Very Good
AF	6.21	Good
SA	5.58	Good
CI	6.67	Poor

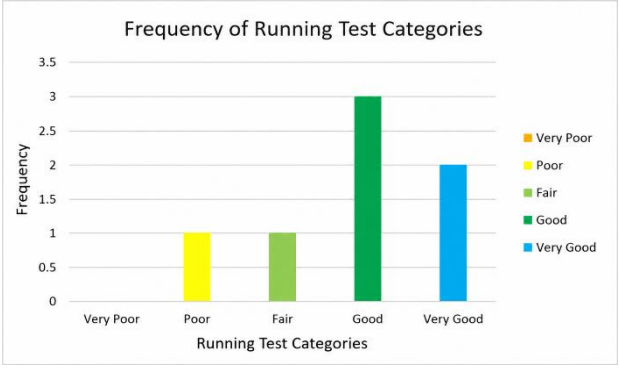

Figure 1. Frequency Chart of Categories for 30 meter Run Test Results

The results of the 30-metre sprint test for PB Bhirawa U-17 athletes revealed variations in speed levels amongst the athletes. The athlete with the fastest time was Satya, with a time of 4.94 seconds, indicating that SA possesses better speed than the other athletes.

Meanwhile, BA also achieved a fairly good result with a time of 5 seconds. Other athletes, such as AF (5.82 seconds) and AD (5.58 seconds), fall into the average category, whilst VI (6.3 seconds), CI (6.21 seconds) and IN (6.67 seconds) recorded slower times than the other athletes. Overall, these results indicate that the speed levels of the PB Bhirawa U-17 athletes still vary, so more targeted training is required to improve speed, particularly for athletes with slower times.

Measuring the Upper Limb Muscle Strength of PB Bhirawa U-17 Athletes Using the Push-Up Test

The measurement of arm muscle strength in PB Bhirawa U-17 athletes in this study was conducted using a 30-second *push-up* test. This test aimed to objectively assess the athletes' arm and shoulder muscle strength and endurance. Arm muscle strength is a crucial component of physical fitness in badminton, as it plays a key role in generating powerful and effective shots, maintaining movement stability, and supporting athletes' performance during matches. By conducting this measurement, researchers can gain an insight into the athletes' physical capabilities, particularly regarding their arm and shoulder muscles.

The *push-up* test is used to measure the strength and endurance of the arm and shoulder muscles, which play a vital role in various badminton activities, such as executing *smashes*, *drives* and serves, as well as maintaining balance whilst moving across the court. It is hoped that the results of this measurement will serve as a basis for coaches to develop more targeted training programmes tailored to the needs of the PB Bhirawa U-17 athletes in terms of improving their arm muscle strength.

Table 4. Results of the 30 Second Push-Up Test for PB Bhirawa U-17 Athletes

Number	Athletes Name	Results (Reps)

1	VI	23
2	BA	22
3	AF	28
4	SA	22
5	CI	10
6	AD	12
7	IN	19
Average		**Rounded to 20**

Table 5. Category and Frequency Assessment of the 30 Second Push-Up Test

Category	Category Score	Frequency
Very Poor	< 11 repetitions	1
Poor	11–15 repetitions	1
Fair	16–20 repetitions	1
Good	21–26 repetitions	3
Very Good	> 26 repetitions	1

Table 6. Table of Categories for the 30 Second Push-Up Test Results

Athletes Name	Result (Reps)	Category
VI	23	Good
BA	22	Good
AF	28	Very Good
SA	22	Good
CI	10	Very Poor
AD	12	Poor
IN	19	Fair

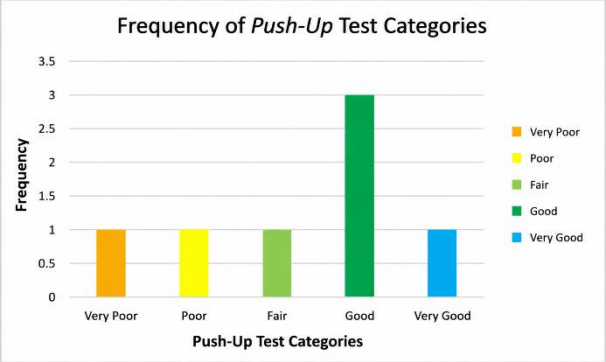

Figure 2. Frequency Chart of Categories for the 30 Second Push-Up Test Results

The results of the 30 second *push-up* test on PB Bhirawa U-17 athletes revealed differences in upper-body strength and endurance amongst the athletes. Athlete AF achieved the highest result with 28 repetitions, indicating that AF possesses better upper body strength and endurance than the other athletes. VI also performed quite well with 23 repetitions, followed by BA and SA, who each achieved 22 repetitions.

Meanwhile, IN recorded 19 repetitions, which is still considered moderate, whilst AD and CI achieved the lowest results, with 12 and 10 repetitions respectively. Overall, these results indicate that the upper arm muscle strength of the PB Bhirawa U-17 athletes still varies considerably; therefore, a more structured training programme is required to improve strength, particularly for athletes with lower results.

Measurement of Abdominal Muscle Strength in PB Bhirawa U-17 Athletes Using the 30 Second *Sit-Up* Test

The measurement of abdominal muscle strength in PB Bhirawa U-17 athletes in this study was conducted using a 30-second *sit-up* test. This test aimed to objectively assess the athletes' abdominal muscle strength and endurance. Abdominal muscle strength is a crucial component of physical fitness in badminton, as it plays a role in maintaining body balance, stabilising movements, and supporting athletes' performance during matches. By conducting this measurement, the researchers were able to gain an insight into the athletes' physical capabilities, particularly regarding their abdominal muscles.

The *sit-up test* was used to measure abdominal muscle strength and endurance, which play a vital role in supporting various badminton activities, such as maintaining body stability whilst moving, changing position, and enhancing movement efficiency when striking the shuttlecock. It is hoped that these results will serve as a basis for coaches to develop more targeted training programmes tailored to the needs of the PB Bhirawa U-17 athletes in improving their abdominal muscle strength.

Table 7. Results of the 30 Second Sit-Up Test for PB Bhirawa U-17 Athletes

Number	Athletes Name	Results (Reps)
1	VI	28
2	BA	28
3	AF	24
4	SA	33
5	CI	24
6	AD	27
7	IN	24
Average		**Rounded to 27**

Table 8. Category and Frequency Assessment of the 30 Second Sit-Up Test

Category	Category Score	Frequency
Very Poor	< 18 repetitions	0
Poor	18–21 repetitions	0
Fair	22–25 repetitions	3
Good	26–30 repetitions	3
Very Good	> 30 repetitions	1

Table 9. Table of 30 Second Sit-Up Test Result Categories

Athletes Name	Result (Reps)	Category
VI	28	Good

BA	28	Good
AF	24	Fair
SA	33	Very Good
CI	24	Fair
AD	27	Good
IN	24	Fair

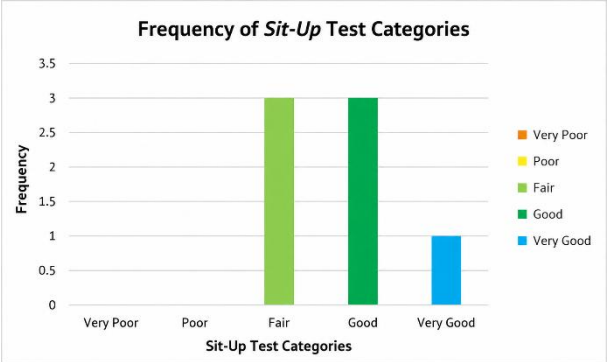

Figure 3. Frequency Chart of Results Categories for the 30 Second Sit-Up Test

The results of the 30-second *sit-up* test for PB Bhirawa U-17 athletes indicate variations in abdominal muscle endurance capacity among the athletes. Athlete SA achieved the highest result with 33 repetitions, indicating that SA has better abdominal muscle endurance than the other athletes. VI and BA also achieved good results with 28 repetitions each, followed by ADt with 27 repetitions.

Meanwhile, AF, CI and IN achieved the same result of 24 repetitions, indicating relatively comparable ability, though still below that of the athlete with the highest result. Overall, these results illustrate that the abdominal muscle endurance of the PB Bhirawa U-17 athletes falls within a fairly varied range; therefore, increased training is required, particularly for athletes with lower results, to ensure a more even level of physical ability.

Measurement of Agility in PB Bhirawa U-17 Athletes Using the *T-test*

The measurement of agility among PB Bhirawa U-17 athletes in this study was conducted using *the T-test*, which aims to assess the athletes' ability to change direction quickly, accurately and in a controlled manner. Agility is a key component in badminton as it relates to the ability to move in various directions to reach the shuttlecock within a short time.

Through this test, the researchers were able to obtain an objective picture of the athletes' agility levels, so that the results could be used as a basis for evaluation in devising more effective training programmes to improve the athletes' performance on court.

Table 10. T-test Results for PB Bhirawa U-17 Athletes

Number	Athletes Name	Result
1	VI	7.02 seconds
2	BA	7.12 seconds
3	AF	8.08 seconds
4	SA	6.85 seconds

5	CI	8.71 seconds
6	AD	8.77 seconds
7	IN	7.83 seconds
Average		**7.76 seconds**

Table 11. T-test Assessment of Categories and Frequencies

Category	Category Score	Frequency
Very Poor	> 8.40 seconds	2
Poor	8.01 – 8.40 seconds	1
Fair	7.21 – 8.00 seconds	1
Good	6.80 – 7.20 seconds	2
Very Good	< 6.80 seconds	1

Table 12. Table of 30 Second Sit-Up Test Result Categories

Athletes Name	Result (Seconds)	Category
VI	7.02	Good
BA	7.12	Good
AF	8.08	Poor
SA	6.85	Very Good
CI	8.71	Very Poor
AD	8.77	Very Poor
IN	7.83	Fair

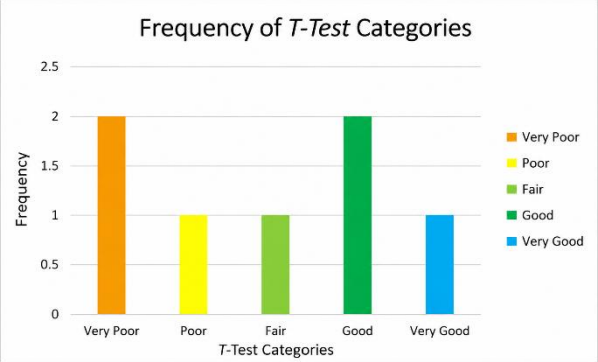

Figure 4. Frequency Chart of T-Test Results by Category

The results of the t-test on PB Bhirawa U-17 athletes indicate differences in agility ability amongst the athletes. Athlete SA recorded the fastest time of 6.85 seconds, indicating that SA possesses a higher level of agility compared to the other athletes. VI and BA also achieved fairly good results with times of 7.02 seconds and 7.12 seconds respectively.

Meanwhile, IN recorded a time of 7.83 seconds, which still falls within the moderate category. As for AF, CI and AD, they recorded slower times of 8.08 seconds, 8.71 seconds and 8.77 seconds respectively, indicating that their agility still needs to be improved. Overall, these results illustrate that the agility levels of the PB Bhirawa U-17 athletes still vary and require further training to optimise their ability to change direction and movement speed.

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Measurement of Endurance in PB Bhirawa U-17 Athletes Using the MFT (Multi-Fitness Test)

Endurance measurements for the PB Bhirawa U-17 athletes in this study were conducted using the MFT (Multi Fitness Test), which aims to determine the athletes' aerobic endurance capacity or VO_2max. Endurance is a crucial component in badminton as it relates to an athlete's ability to maintain performance during matches characterised by high intensity and considerable duration.

Through this test, researchers can obtain an objective picture of the athletes' cardiorespiratory capacity, so that the results can be used as a basis for coaches to evaluate and devise more effective training programmes to improve the athletes' overall physical condition and performance.

Table 13. Results of the MFT (Multi-Fitness Test) for PB Bhirawa U-17 Athletes

Number	Athletes Name	Result	*VO₂max* (ml/kg/min)
1	VI	10.5	48.53
2	BA	11.3	51.30
3	AF	6.3	34.00
4	SA	10.4	48.18
5	CI	6.1	33.31
6	AD	7.1	36.77
7	IN	5.3	30.54
	Average		**40.37**

Table 14. Assessment of Categories and Frequency of the MFT (Multi-Fitness Test)

Category	Category Score	Frequency
Very Poor	< 33 ml/kg/min	1
Poor	33–35 ml/kg/min	2
Fair	36–40 ml/kg/min	1
Good	41–46 ml/kg/min	0
Very Good	> 46 ml/kg/min	3

Table 15. Table of 30 Second Sit-Up Test Result Categories

Athletes Name	VO_2max (ml/kg/min)	Category
VI	48.53	Very Good
BA	51.30	Very Good
AF	34.00	Poor
SA	48.18	Very Good
CI	33.31	Poor
AD	36.77	Fair
IN	30.54	Very poor

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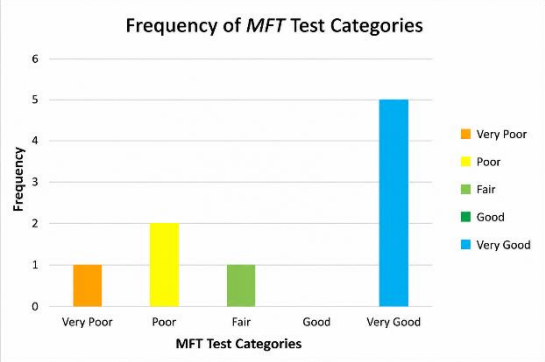

Figure 5. Frequency Chart of MFT (Multi Fitness Test) Result Categories

The results of the MFT (Multi Fitness Test) for PB Bhirawa U-17 athletes indicate differences in aerobic endurance levels (VO_2max) amongst the athletes based on the 17-year-old age assessment category. Athlete BA achieved the highest result with a VO_2max of 51.30, which, by international standards, falls within the "Very Good" category (51–55), indicating that BA possesses a Very Good level of aerobic endurance. VI (48.53) and SA (48.18) fell into the "Good" category (45–50), indicating a good level of fitness and approaching the "Very Good" category. AD, with a VO_2max of 36.77, falls within the "Fair" category (35–40), indicating a fair level, whilst AF (34.00), CI (33.31), and IN (30.54) fall within the "Poor" (33–35) to "Very Poor" (<35) categories, indicating that their aerobic endurance remains low.

Overall, these results indicate that the aerobic endurance levels of the PB Bhirawa U-17 athletes still vary. Some athletes are already in the "Good" to "Very Good" categories, but there are still athletes in the "Poor" and "Very Poor" categories who require improved endurance training. These differences highlight the need for a more systematic and targeted training programme so that all athletes can improve their VO_2max to a higher category, thereby supporting their performance in badminton matches.

Measurement of the Vertical Jump Height of PB Bhirawa U-17 Athletes Using the *Sargent Jump* Test

The measurement of the jumping ability of PB. Bhirawa U-17 athletes in this study was carried out using the *Sargent Jump* test, which aims to determine the athletes' lower-limb muscle power. Muscle explosive power is the ability of muscles to generate force rapidly within a short period of time, making it a crucial component of physical fitness in badminton, particularly when performing jumps, *smashes* and rapid positional changes on the court. By carrying out this measurement, the researchers were able to obtain an objective picture of the athletes' physical capabilities, specifically regarding their vertical jump ability.

The *Sargent jump* test is used to measure lower-limb muscle power, which plays a vital role in supporting athletes' performance during jumps and vertical movements throughout a match. This ability is essential in badminton as it relates to the effectiveness of both attacking and defensive manoeuvres. It is hoped that these results will serve as a basis for coaches to develop more targeted training programmes tailored to the needs of the PB Bhirawa U-17 athletes in improving their jumping ability.

Table 16. Sargent Jump Test Results for PB Bhirawa U-17 Athletes

Number	Athletes Name	Result
1	VI	49 cm
2	BA	49 cm
3	AF	49 cm
4	SA	49 cm
5	CI	36 cm
6	AD	40 cm
7	IN	31 cm
Average		**43 cm**

Table 17. Assessment of Categories and Frequency of the Sargent Jump Test

Category	Category Score	Frequency
Very Poor	< 31 cm	0
Poor	31–35 cm	1
Fair	36–40 cm	2
Good	41–45 cm	0
Very Good	> 46 cm	4

Table 18. Table of Sargent Jump Test Result Categories

Athletes Name	Result (Seconds)	Category
VI	7.02	Good
BA	7.12	Good
AF	8.08	Poor
SA	6.85	Very Good
CI	8.71	Very Poor
AD	8.77	Very Poor
IN	7.83	Fair

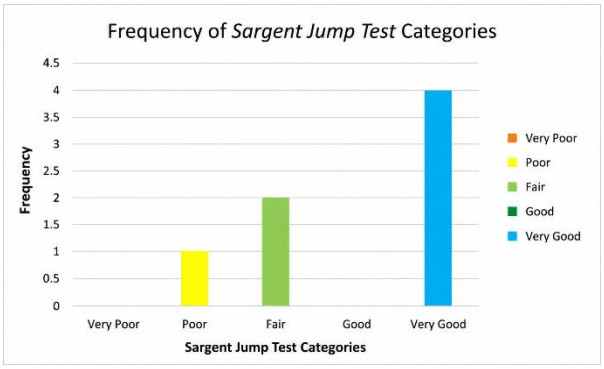

Figure 6. Frequency Distribution of Sargent Jump Test Results

The results of the *Sargent* jump test for PB Bhirawa U-17 athletes indicate variations in lower-limb explosive strength between athletes. Athlete SA achieved the best result with a jump of 49 cm, followed by VI, BA and AF, who also achieved the same distance of 49 cm;

thus, all three demonstrated relatively good and stable lower-limb *power*. CI achieved a jump of 36 cm, AD 40 cm, whilst IN achieved the lowest distance of 31 cm, indicating that Indy's lower-limb explosive power is still the lowest compared to the other athletes.

Overall, these results illustrate that the lower-body *power of* the PB Bhirawa U-17 athletes still varies considerably. Some athletes have already shown fairly good results with high differences, but there are still athletes with lower results who therefore require improved training. This highlights the need for a more targeted training programme to enhance leg *power*, so that all athletes possess more evenly distributed explosive ability to support their badminton performance.

Measurement of Throw Distance Among PB Bhirawa U-17 Athletes Using the Seated Medicine Ball Throw Test

The measurement of throwing ability among PB. Bhirawa U-17 athletes in this study was carried out using the seated medicine ball throw test, which aimed to determine the athletes' arm muscle explosive power. Muscle explosive power is the ability of muscles to generate force rapidly within a short period of time, making it an important component of physical fitness in badminton, particularly when executing powerful shots, smashes and serves. By conducting this measurement, the researchers were able to obtain an objective picture of the athletes' physical abilities, particularly regarding the strength of their arm and shoulder muscles.

The seated medicine ball throw test is used to measure the explosive strength of the arm and shoulder muscles, which play a vital role in generating powerful and effective shots during a badminton match. This ability is essential for supporting the speed and power of an athlete's shots, whether attacking or defending on the court. It is hoped that the results of these measurements will serve as a basis for coaches to develop more targeted training programmes tailored to the needs of the PB Bhirawa U-17 athletes in improving their arm muscle strength.

Table 19. Results of the Seated Medicine Ball Throw Test for PB Bhirawa U-17 Athletes

Number	Athletes Name	Result
1	VI	4.20 m
2	BA	3.38 m
3	AF	4.20 m
4	SA	3.40 m
5	CI	1.81 m
6	AD	2.58 m
7	IN	2.10 m
Average		**0.39 cm**

Table 20. Assessment of Categories and Frequency of the Sargent Jump Test

Category	Category Score	Frequency
Very Poor	< 2.00 m	1
Poor	2.00 – 2.59 m	2
Fair	2.60 – 3.19 m	0
Good	3.20 – 3.80 m	2

Very Good	> 3.80 m	2

Table 21. Table of Sargent Jump Test Result Categories

Athletes Name	Result (metres)	Category
VI	4.20	Very Good
BA	3.38	Good
AF	4.20	Very Good
SA	3.40	Good
CI	1.81	Very Poor
AD	2.58	Poor
IN	2.10	Fair

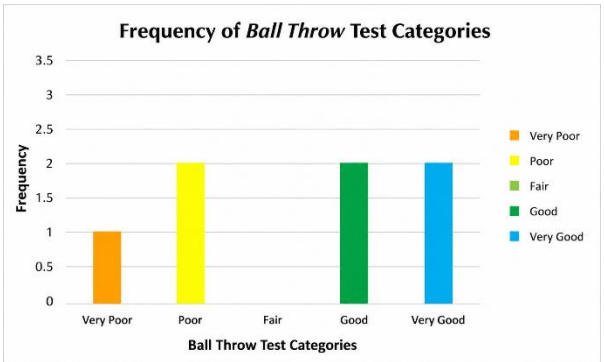

Figure 7. Frequency Categories of Seated Medicine Ball Throw Test Results

The results of the seated medicine ball throw test for PB Bhirawa U-17 athletes indicate differences in upper-body explosive strength between athletes. Athletes VI and AF achieved the same highest result of 4.20 m, indicating that both possess superior upper-body explosive strength compared to the other athletes. BA and SA achieved fairly similar results of 3.38 m and 3.40 m, respectively, placing them in the moderate category. Meanwhile, AD (2.58 m), IN (2.10 m) and CI (1.81 m) recorded lower results, with CI achieving the lowest score among all athletes. Overall, these results indicate that the upper-body explosive strength of the PB Bhirawa U-17 athletes still varies considerably; therefore, specialised training is required to enhance upper-body power and optimise the athletes' performance.

DISCUSSION

The discussion of these research findings is based on an analysis of data from the entire series of physical fitness tests, which included speed, strength, agility, endurance and *power* among the PB Bhirawa U-17 athletes.

Analysis of Speed Measurements for PB Bhirawa U-17 Athletes (30 meter Sprint Test)

The results of the analysis show that the athletes speed levels still vary and are not yet consistent. Athletes SA and BA fall into the "very good" category with the fastest times. Conversely, some of the other athletes are still in the "fair" to "poor" categories, indicating the need for more structured acceleration and *sprint* training programmes to support their ability to chase *the shuttlecock* on the court.

Analysis of Upper Limb Muscle Strength (*Push-up* Test)

The strength and endurance of the athletes' arm muscles showed significant differences, ranging from the "very good" category (AF athlete with 28 repetitions) to "very poor" (CI athlete with 10 repetitions). Given the importance of arm muscles in generating a powerful *smash*, coaches need to provide a specific strengthening programme for athletes who are still in the lower categories.

Analysis of Abdominal Muscle Strength Measurements (*Sit-Up* Test)

The abdominal muscle strength of the majority of athletes fell into the "adequate" and "good" categories, with SA athletes achieving the "very good" category (33 repetitions). Although no athletes fell into the "poor" category, further training is still required so that body stability and efficiency, as well as coordination of movement when striking or changing position, can be more consistent and optimal.

Analysis of Agility Measurements (*T-test*)

The athletes agility was found to vary considerably the SA athlete recorded the fastest time (6.85 seconds) in the "very good" category, whilst the CI and AD athletes fell into the "very poor" category. This disparity highlights the need for more structured training in changing direction, so that all athletes are able to respond to an opponent's attack from a more appropriate position.

Analysis of Endurance Measurements (MFT Test)

The aerobic capacity (VO_2max) of the athletes showed a wide disparity, with athletes from the BA, VI and SA groups falling into the "very good" category, whilst those from the IN group were in the "very poor" category. This disparity necessitates systematic physical training to improve cardiorespiratory capacity, so that all athletes are able to maintain high performance levels throughout long matches.

Analysis of Jump Height Measurements (*Sargent Jump* Test)

The lower-body explosive strength of most athletes (VI, BA, AF and SA) is already in the "very good" category. However, there are still athletes in the "fair" and "poor" categories (athlete IN), so lower-body explosive training needs to be continuously improved to support the effectiveness of vertical attacking movements on the pitch.

Analysis of Throw Distance Measurements (*Seated Medicine Ball Throw* Test)

An analysis of upper-body muscle power revealed varying results, with athletes VI and AF achieving the highest scores in the "very good" category. In contrast, athlete CI fell into the "very poor" category, indicating that explosive upper-body strength is not yet consistent, thus requiring specialised training to support attack and serve speed.

CONCLUSION

Based on the results of the research and discussion regarding the evaluation of the physical condition of the PB Bhirawa Sidoarjo U-17 athletes, it can be concluded that the athletes' physical abilities fall into varying categories and are not yet consistent across all test components. Firstly, in terms of speed, some athletes have achieved a "good" to "very good" rating, whilst others remain in the "fair" to "poor" categories. Secondly, arm muscle strength

shows a wide disparity, ranging from the "very good" to the "very poor" categories. Thirdly, the abdominal muscle strength of the majority of athletes falls within the "fair" to "very good" categories, with none falling into the "poor" category. Fourthly, agility was found to be uneven, ranging from the "very good" to the "very poor" categories. Fifthly, aerobic endurance (VO_2max) shows significant variation, ranging from the "very good" to the "very poor" categories. Sixthly, the explosive strength of the lower limbs was in the "very good" category for the majority of athletes, although some athletes were still in the "poor" category. Seventhly, the explosive strength of the upper limbs showed varying results, with some athletes still in the "low" category. Overall, these differences in results indicate that the athletes' physical condition is not yet uniform; therefore, a more specific training programme is required so that all physical components can develop optimally to support the athletes' performance in competition.

As a recommendation, coaches are advised to implement an Individualised Training Programme to address physical disparities amongst athletes, particularly by placing special focus on those still classified as "below par" or "adequate". Top priority should be given to improving aerobic endurance through interval or circuit training methods to address fatigue issues during matches. Furthermore, regular physical assessments every two to three months are essential to objectively monitor physical progress. For future researchers, it is recommended to expand this study towards experimental methods to test the effectiveness of specific training programmes, as well as to broaden the research variables by examining the relationship between physical condition and the technical, tactical and psychological aspects of athletes, using a larger sample size.

AUTHOR CONTRIBUTIONS

All authors contributed to the topic selection and drafting of the article.

DECLARATION

This manuscript was prepared by the authors without the involvement of artificial intelligence in the research design, data collection, analysis, or interpretation process. The authors are fully responsible for the accuracy, originality, integrity, and overall content of the manuscript. All authors have reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the research.

TRANSPARENCY STATEMENT

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CONFLICT OF INTEREST

Related to this article publication, there were no interest conflicts.

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ETHICAL CONSIDERATIONS

This study obtained ethical approval from the relevant bodies or institutions prior to its commencement. All athletes involved were provided with information regarding the research procedures and participated in accordance with applicable research ethics principles. The confidentiality of the data obtained was maintained, and the entire process of data collection and analysis was carried out systematically to ensure the validity and reliability of the research findings.

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