

Anthropometric and Motor Performance of Junior Badminton Athlete

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Abstract— This study aims to describe the anthropometric and motor performance profile of junior male badminton athletes in South Kalimantan. The model of this research is descriptive quantitative. The used method is survey with data retrieval technique using test and measurement. This research was conducted on 14 badminton athletes from the Students Education and Training Center (PPLP) of South Kalimantan Province were 14.86 ± 1.41 years and 14.00 ± 1.63 years. Data were collected by measuring the anthropometry of athletes including height, weight, body mass index and foot length. In addition, motor performance data collection is done among hand eye coordination, agility, speed and aerobic performance such as VO₂ Max. Data were analyzed using mean and standard deviation. The mean values of anthropometry (height, weight, body mass index and foot length) of male badminton players in this study were 162.43 ± 4.69 cm, weight 53.14 ± 9.65 kg, body mass index of 20.13 ± 3.36 kg m², foot length of 25.06 ± 0.89 cm. The mean values of anthropometry (height, weight, body mass index and foot length) of female badminton athletes in this study were height 155.75 ± 5.74 cm, weight 55.0 ± 5.87 kg, body mass index 22.78 ± 3.27 kg m², foot length 24.33 ± 0.79 cm. Meanwhile for the physical condition of male badminton players (aerobic endurance, speed, agility, hand eye coordination) are as follows: aerobic endurance 37.12 ± 6.54 ml / kg / minute, speed 3.65 ± 0.56 s, agility 6.98 ± 0.44 s, eye hand coordination 12.71 ± 3.83 times. While the average value of female badminton players is as follows: aerobic endurance 26.10 ± 1.40 ml / kg / minute, speed 4.06 ± 0.24 s, agility 8.23 ± 0.15 s, hand eye coordination 9.00 ± 2.94 times. Badminton players in South Kalimantan have an average anthropometry score and lower motor performance compared to badminton players Nigeria, Brazil and the Philippines. The results of this study can provide information to the coaches and sport scientist in designing and developing training programs to improve the performance of badminton player.

Keywords—*anthropometric, motor performance, badminton, junior athlete*

I. INTRODUCTION

Badminton as a sport that carries the most achievements at the international level for Indonesia needs to be revived. The reason is, it is a common knowledge that badminton performance in Indonesia is on a downward trend [1] [2], besides that Indonesia is also no longer seen as the world badminton power [3]. The peak of the badminton achievement decrease is when none of the badminton players achieved gold medal at the 2012 Olympics in London. In fact, the tradition of gold has always been achieved by players since the 1992

Olympics in Barcelona which was won by Susi Susanti and Alan Budi Kusuma in the men single and women single numbers. In addition, several other failures that were in the spotlight were the failures to meet the achievement target at the SEA Games and the 2017 Asian Championships.

People's demands of Indonesia's sports achievement increase, especially badminton, and make the complexity of sports achievement problems become urgent and an immediate solution is needed. Serious efforts in sports coaching through a scientific approach by emphasizing the role of science and technology must be a top priority. Australia is one of examples of a country that has succeeded in increasing their sports achievement by carrying out scientific approach including identifying talent. Valuable experience that shows how important the role of science in the sports achievement coaching must be used as a reference in increasing sports achievement in Indonesia, including an effort to increase badminton achievement. The effort to develop sports achievements cannot be done only based on intuitive and speculative knowledge, because it is important to realize that the best athletic performance issues are multifactorial so that they are not only dependent on physical factors.

Sports performance is based on a variety of complex variables, including physical conditions (general and specific), psychological (personality and motivation) and body (body morphology), anthropometry and body composition [4] [5]. Physiological, anthropometric and psychological factors are several factors that are believed affect the athletes performance [6]. The relationship between variables related to sports morphology and performance is one of the objects of anthropometric study and is an important element for analysis. In addition, apart from demands for high levels of technical skills and mental acuity in badminton, there are important requirements that must be met in supporting performance including stamina, speed, endurance, strength and agility [7].

Differences in characteristics in each sport will lead to the need for conformity in comparison or the balance of body shape. A lot of empirical evidence shows that among champions in various sports have different physical and physiological characteristics. Even this difference is also found in athletes with the same sport depending on the difference in player position [8]. Several studies have shown the importance of physical characteristics for various sports such as handball [9] [10], rugby [11], volleyball [12] [13], but there are still few studies that reveal physical and physiological characteristics,

especially in badminton. The importance of identifying the characteristics and parameters that contribute to the ability to play badminton will have an influence on improving the performance of badminton players. Besides mapping the physical and physiological characteristics or motor performance of badminton players has an important role because in addition to know the physical and physiological characteristics or motor performance of athletes, can also be used as one of the input materials in athletic nurseries and increased sports performance [8].

II. METHODS

This study was conducted on potential players who practice at the Student Sports Education and Training Center (PPLP) or non-PPLP athletes (male $n = 14$, average age 14.86 ± 1.41 years, female $n = 4$, average age 14.00 ± 1.63 years) in the South Kalimantan Province. Before carrying out the entire series of tests, players are informed about the implementation procedure. The test was carried out by PPLP Mulawarman, Banjarmasin, South Kalimantan Province. Anthropometric measurements consist of height (cm), weight (kg), body mass index (kg m^2), and the length of the feet. The body mass index is determined by calculating (body mass (kg) / height (m^2)). Height and weight are measured using a stadiometer. During the measurement, players only wear shorts and t-shirts without using shoes. Physical performance was measured using hand eye coordination, agility, speed, and aerobic endurance. Hand eye coordination is tested using a tennis ball catching test for the preferred hand and an unwelcome hand. Agility measured using a badminton step test measures the ability to move quickly in all directions with badminton specific foot work techniques. Speed is measured using a running test with a distance of 20 meters. Aerobic endurance (VO_2max) was measured using the Multistage Fitness Test (MFT). Data were analyzed and presented using an average \pm Standard Deviation ($X \pm \text{SD}$).

III. RESULTS AND DISCUSSION

Anthropometric characteristics and performance of badminton players in South Kalimantan are shown in Tables 1 and 2.

TABLE I. ANTHROPOMETRIC CHARACTERISTICS OF BADMINTON PLAYERS IN SOUTH KALIMANTAN PROVINCE

Variable	Male	Female
Age (years)	14.86 ± 1.41	14.00 ± 1.63
Height (cm)	162.43 ± 4.69	155.75 ± 5.74
Weight (kg)	53.14 ± 9.65	55.0 ± 5.87
Body mass index (kg m^2)	20.13 ± 3.36	22.78 ± 3.27
Foot length (cm)	25.06 ± 0.89	24.33 ± 0.79

TABLE II. MOTOR PERFORMANCE CHARACTERISTIC OF BADMINTON PLAYERS IN SOUTH KALIMANTAN PROVINCE

Variable	Male	Female
VO_2Max (ml/kg/minute)	37.12 ± 6.54	26.10 ± 1.40
Running Speed (s)	3.65 ± 0.56	4.06 ± 0.24

Variable	Male	Female
Agility (s)	6.98 ± 0.44	8.23 ± 0.15
Hand Eye Coordination	12.71 ± 3.83	9.00 ± 2.94

This study was conducted to determine the results of anthropometric measurements and motor performance in junior badminton players in the South Kalimantan Province. The results showed that the average age of male and female badminton players were 14.86 ± 1.41 years with a range of 12-17 years and 14.00 ± 1.63 with a range of 12-16 years. The mean values of anthropometry (height, weight, body mass index and foot length) of male badminton players in this study were 162.43 ± 4.69 cm with a range of 152-169 cm, weight 53.14 ± 9.65 kg with a range of 36-72.5 kg, body mass index of 20.13 ± 3.36 kg m^2 with a range of 12.68-31.22, foot length of 25.06 ± 0.89 cm with a range of 23.9-26.7. The mean values of anthropometry (height, weight, body mass index and foot length) of female badminton athletes in this study were height 155.75 ± 5.74 cm with a range of 151-164, weight 55.0 ± 5.87 kg with a range of 47.5-61, body mass index 22.78 ± 3.27 kg m^2 with range 19.92-26.75, foot length 24.33 ± 0.79 cm with a range of 23.8-25.5.

Meanwhile for the physical condition of male badminton players (aerobic endurance, speed, agility, hand eye coordination) are as follows: aerobic endurance 37.12 ± 6.54 ml / kg / minute with a range of 27.6-49 ml / kg / minute, speed 3.65 ± 0.56 s with a range of 3.1-5.41 s, agility 6.98 ± 0.44 s with a range of 7.31-7.49, eye hand coordination 12.71 ± 3.83 times with a range of 6-19 times. While the average value of female badminton players is as follows : aerobic endurance 26.10 ± 1.40 ml / kg / minute with a range of 24.4-27.6 ml / kg / minute, speed 4.06 ± 0.24 s with a range of 3.91-4.42 s, agility 8.23 ± 0.15 s with a range of 8.06-8.38 s, hand eye coordination 9.00 ± 2.94 times with a range of 6-12 times.

One important aspect of sports achievement is the stabilization of body weight at the peak of performance. Athletes in general need the right body composition, not heavy and not too much fat. Anthropometric measurements are needed to determine the physical condition of the athlete. The study of applied anthropometry in the field of sports will address the proportion of body, performance (optimal, minimum and maximum weight) and biomechanics. Researchers compared the results obtained in badminton players in South Kalimantan with several studies which have the same characteristics including anthropometric characteristics and motor performance of Nigerian badminton players, the result of which is a significant correlation between anthropometric characteristics and motor performance in Nigerian badminton players [14]. In the study conducted on 20 male badminton players and 9 female badminton players with an average age of 21.24 ± 6.41 years, measurements were taken on several anthropometric components including height (cm), weight (kg), body fat (%), body mass index (kg m^2) and average arm length (cm). While the motor performance of several physical components that are measured are Running Speed (s), Flexibility (Sit and reach) [cm], Muscular endurance (Push up) [x / 1 min], Muscular endurance (Sit up)

[x / 2 min], Explosive power (Vertical jump) [W], Explosive power (Long jump) [W]. If there is a comparison of several anthropometric components and the same motor performance as the South Kalimantan badminton players, the Nigerian badminton players have a higher height and weight compared to South Kalimantan badminton players. But the Nigerian male badminton player's body mass index is lower than the South Kalimantan badminton player. The difference in mean values in anthropometric components is also seen when compared with some other research results, including Brazil badminton players [4] and Philippines [15] who also have a higher height and weight compared to South Kalimantan badminton players. In female badminton players women to have a body mass index that is almost the same for badminton players Nigeria, Brazil and the Philippines.

Low weight, long legs and a slim body are more beneficial because they allow far range. A good badminton player's height is around 175 cm with an estimated shoulder height as high as a net (between 152.5-155.0 cm) so that allows a lot of stroke variations. Based on Rahmawati et al., [16] research in Yogyakarta in 1994 and 1995 in 19 male badminton players aged between 16-27 years, the results showed that badminton players had the shortest height, the lightest weight, low Basal Metabolic Index (BMI), the smallest and slimmer four limbs, and have the highest Z-triceps skin folds when compared to soccer athletes and volleyball.

Comparison of motor performance profiles was also carried out between badminton players in South Kalimantan and several other countries. The study by Diniz Campos [4] describes the characteristics of motor performance for junior badminton players in Brazil with an average male player age of 17.24 ± 1.18 years and an average female player age of 15.21 ± 2.06 years. In his study Diniz Campos [4] measured the motor performance characteristics with several components including VO₂Max (ml / kg / minute), running speed (s), countermovement vertical jump (cm), vertical squat jump (cm), countermovement vertical jump with upper limbs contribution (cm), abdominal strength / resistance (n), medicine ball throw (m). Based on the comparison of several physical components similar to other studies, South Kalimantan badminton players have durability (VO₂Max) and a lower speed than Brazil badminton players.

Success in achieving badminton at all levels of competition depends on many physical factors. Characteristics of badminton as a branch of a very heavy sport [17] [18] [19], requires elite players to perform above the limits of their speed, agility, flexibility, endurance and strength [20]. The match is usually won by athletes who have a combination of perfect physical conditions, mental attitude, courage, intelligence, and player technical skills and tactical efficiency [21]. When viewed from the energy system used, badminton games require a combination of aerobic and anaerobic systems and the involvement of the system will depend on the length or shortness of the rally and the duration of the game (short set or long break) [22].

A study conducted by Chi [23] to determine the specific motor performance for badminton, especially for single players. The results of the study show that male elite badminton players must have muscle strength, muscle endurance and agility. While elite female badminton players must have good footwork, cardiorespiratory function, power and agility. The study conducted by Phomsoupha & Laffaye [19] on game characteristics, anthropometry, physiology, visual fitness and biomechanics showed that the physical characteristics of badminton have provided an understanding of the anthropometric and physiological characteristics of the player. The results of investigating the physical characteristics of badminton players show lean body composition and physiological requirements during the match.

The time needed in an international badminton match consisting of 3 games can take from 40 minutes to 1 hour. Physical activity requires a lot of power done in a short time and followed by a short rest period. It is estimated that 60-70% of the energy used during the game comes from the aerobic energy system and the remaining 30% uses an anaerobic system [7] [19]. Miao and Wang [24] reported that the mean value of maximal oxygen volume (VO₂max) for top male and female players in China including Thomas Cup and All England champions were 63.4 (4.0) and 53.3 (3.6) ml / kg / minute. Meanwhile Riley et al. [25] stated that 68.0 ml / kg / minute is the average VO₂max for Britain's top badminton players.

IV. CONCLUSION

The results of the study have described the anthropometric profile and motor performance of badminton players in South Kalimantan and set some data that needs to be considered by players, trainers, and some researchers related to anthropometric profiles and badminton motor performance. Badminton players in South Kalimantan have an average anthropometry score and lower motor performance compared to badminton players Nigeria, Brazil and the Philippines. The results of this study can provide information to the coaches and sport scientist in designing and developing training programs to improve the performance of badminton player.

ACKNOWLEDGMENT

This research was supported supported by Ministry of Youth and Sport, the provincial government through the South Kalimantan youth and sports service and junior badminton athlete. We thank our colleagues from Universitas Negeri Malang who provided insight and expertise that greatly assisted the research, although they may not agree with all of the interpretations/conclusions of this paper.

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