Anthropometry Profile and Physiological Characteristics of Athletes from Education and Sports Training Centre (PPLP) Lampung Province

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Abstract

Anthropometry and physical characteristics of an athlete represent an important pre-requisite for determining the success of an athlete in many sports fields. This study was aimed to determine the anthropometric profile and physiological characteristics of athletes from the Education and Sports Training Centre (PPLP) Lampung Province. This study used an observational study method, where the researchers did the one-time observation, without giving intervention on the research variables. The subjects of this research involved 32 male athletes from PPLP Lampung Province consisting of 4 different sport fields category, such as: wrestling (n = 8 athletes), taekwondo (n = 8 athletes), karate (n = 8 athletes) and athletics (n = 8 athletes) with average age 17.7 ± 1.1 years; body height, 165.1 ± 6.7 cm; weight, 56.9 ± 8.3 kg; body fat percentage 8.5 ± 2.8%; and body mass index (BMI) 17.2 ± 2.1. This study shows that the average body height of taekwondo athletes (170.75 cm) and athletics has an average value (169.50 cm) which is at the normal values set by WHO. Meanwhile, the average value on body weight, body fat percentage, and BMI are at normal values for all athletes. Furthermore, for aerobic and anaerobic endurance measurements, only the athletic athlete's category had an average value of (3.07 seconds for the 20 m sprint and 45.51 ml.kg-1 for VO2max). However, for sit and reach measurements all athletes are at normal values. This research concludes that anthropometric measurements and the physiological characteristics of athletes can be used as parameters in determining superior athlete candidates and could become the basis for determining an appropriate training program for the characteristics of each athlete

Keywords

Anthropometry, physiology characteristic, body fat percentage, body mass index, VO2max

1. Introduction

Anthropometry and physical characteristics of an athlete represent an important prerequisite for determining the success of an athlete in many sports fields (Duncan et al., 2006).

Based on previous researches, it can be assumed that the anthropometric characteristics of an athlete make an effect on his level of performance, while at the same time it encourages determining the suitable body shape for a certain sport (Giannopoulos et al., 2017; Ross etal, 2015). Thus, measuring the basic aerobic and anaerobic abilities of athletes becomes the important point for the training programs development, both in the athlete's abilities and athlete's achievements (Douda et al., 2008).

Anthropometry is the initial data that correlated to body dimensions or human body composition (Art et al., 2019; Williams and Reilly, 2000). Besides, physical abilities which consist of several variables, such as endurance, strength, speed, flexibility, and co-ordination are basic components that must be trained at the beginning of the exercise program (Singh, 2016). Anthropometric characteristics and physical abilities aim to evaluate the results of training and the selection of sports athletes (Sterkowicz-przybycie, 2017).Lifestyle identification and physical activity are the main things that need to be considered whether it can affect a person's physical abilities and health (Chen et al., 2005).

Lampung is a province that has the eighth largest population in Indonesia, which has experienced a drastic decline in sports achievements. Many sports fields grab attention due to their great achievements, such as weightlifting and gymnastics. Meanwhile, games and fighting (martial arts) are still experiencing difficulties in getting the quality of athletes who can compete at the national and international levels. In the search for sports talents to foster and improve the achievements of Indonesian athletes, it has been carried out, among others, to search for talented athletes through the Student Education and Training Center (PPLP) who are considered potential in certain sports.

Therefore, to obtain the good athletes in the future, especially for PON 2024 and 2028, specific data on the physiological characteristics of athletes are needed to design training programs that are suitable for athlete's abilities. However, the previous research which focuses on examining the anthropometric profile and physiological characteristics of PPLP athletes still limited. Several authors have reported about their research on the physical and the physiological profile of PPLP athletes, specifically for sepak takraw players (Jawis et al., 2005; Kubo et. al., 2016; Rezaei et al., 2013). However, the comprehensive report about the physical and physiological profile of PPLP athletes from several sport fields, such as wrestling, taekwondo, karate, and athletic haven't been reported yet. In this research, we are trying to recognize that physiological profiles may help out the sports practitioners in talent identification, athlete selection, and training monitoring.

2. Methods

This study used an observational study design, in which the researcher only made observations at one time, without giving intervention on the variables to be studied. The sub-

jects in this study consisted of 32 male athletes from PPLP Lampung Province consisting of several sports. Among them, namely; Wrestling (n = 8 athletes), Taekwondo (n = 8 athletes), Karate (n = 8 athletes) and athletics (n = 8 athletes) with a mean age of 17.7 ± 1.1 years; Height, 165.1 ± 6.7 cm; Weight, 56.9 ± 8.3 kg; body fat percentage, $8.5 \pm 2.8\%$; and BMI, 17.2 ± 2.1. The average training experience for PPLP Lampung Province athletes was 3-4 years. Before the test, all participants were asked not to change their dietary habits and were prohibited from doing physical activity within 24 hours before the test was carried out.

Testing Procedures

Measurements made in this study contained 5 test items. Among them; Anthropometry which includes body weight (kg) and body mass index (BMI) was measured using the OMRON Karada Scan HBF-375. The fitness test using the 2.4 KM cooper test with the fastest record time will be converted to the VO2max table. Flexibility is measured using sit and reach, anaerobic endurance using a 20 m sprint.

The procedure in this study was that participants took an initial measurement (anthropometry) of height, weight, body fat percentage, and BMI. Furthermore, participants are allowed to test Flexibility, Anaerobic Endurance, then proceed with aerobic endurance with the VO2max test using the Cooper Test 2.4 KM method.

Data Analysis

The results of the data are displayed in the form of an average and standard of deviation meanwhile, significant analysis per group using One Way ANOVA or one-way test. All statistical analyzes used the SPSS app (version 22, IBM Corp., Somers, NY) with a significance level ($p < 0.05$ or $p < 0.001$). Researchers used the one-sample T-test statistical test to see the results of quantitative descriptive anthropometric data without comparing the variables.

3. Result

The results of anthropometry data showed the mean ($\pm$ SD) of height, weight, body fat percentage, and BMI. All sports are in the average age range of 17.7 ± 1.1 years, but in the height variable, it is found that wrestling and karate athletes are below the normal value (less good) than the value range set by WHO, while for taekwondo and athletic athletes for the variable height is in normal numbers. Furthermore, for body weight, body fat percentage, and BMI of the four sports athletes of PPLP Lampung were in the normal ranges. The complete results can be seen in Table 1.

Table 1. Anthropometry Data

Anthropometry	Sampling Total	Group	Normal

Variables		Wrestling (n=8)	TKD (n=8)	Karate (n=8)	Athletic (n=8)	value range (WHO)
Height (cm)	165.19 ± 6.7	160.25 ± 3.2^	170.75 ± 3.9	160.25 ± 7.2^	169.50 ± 3.1	169 – 180
Weight (kg)	56.94 ± 8.3	56.56 ± 6.7	62.88 ± 9.2	49.63 ± 7.7	58.69 ± 3.5	55 - 73
Body Fat (%)	8.52 ± 2.8	9.11 ± 2.4	10.10 ± 3.1	6.12 ± 2.6	8.75 ± 1.5	9 – 15
BMI	17.20 ± 2.1	17.64 ± 1.9	18.39 ± 2.5	15.44 ± 2.1	17.32 ± 1.1	19 – 23

Note: The Normal anthropometric range values refer to the World Health Organization (WHO)

Table 2. Performance Characteristics Data (Aerobic and Anaerobic) and Flexibility of Wrestling Athletes

Variables name	Group		Reference
	Wrestling (n = 8)	Standard Value	
20 m Sprint	3.56 ± 0.21^	3.33 – 3.35	(Alemdaroğlu et al., 2017)
VO$_2$max	37.95 ± 3.72^	44.9 – 49.0	(Riebe et al., 2018)
Sit and Reach	18.78 ± 1.19	18 – 20	(Physipedia, 2019)

Note: *Results are above normal values (Very Good);

^Results are under average value (Bad)

Table 2 describesthe results of measuring aerobic endurance using the 2.4 KM cooper test and anaerobic using the 20 m sprint test, it was found that the average VO2maxand 20 m sprint scores for wrestling athletes were (37.95 ml.kg-1 for VO2max and 3.56 seconds for 20 m sprint). The average value when compared with reference is still below normal values. Meanwhile, the average value of sit and reach for wrestling athletes is at the normal value level.

Table 3. Data on Performance Characteristics (Aerobic and Anaerobic) and Flexibility of Taekwondo Athletes in PPLP Lampung

Variables name	Group		Reference
	Taekwondo (n =8)	Standard Value	
20 m Sprint	3.58 ± 0.27^	3.33 – 3.35	(Alemdaroğlu et al., 2017)
VO$_2$max	44.21 ± 1.92^	44.9 – 49.0	(Riebe et al., 2018)
Sit and Reach	20.93 ± 1.37	18 – 20	(Physipedia, 2019)

Note: *Results are above normal values (Very Good);

^Results are under average value (Bad)

The results of measuring aerobic endurance using the 2.4 KM cooper test and anaerobic using the 20m sprint test shown in Table 3d. It was found that the average VO2max and sprint values for taekwondo athletes are (44.21 ml.kg-1 for VO2max and 3.58 seconds for 20m sprint). If compared to previous study, this average value is still under the normal values. The average value of the sit and reach variable of Taekwondo athletes is at the normal values.

Table 4. Data on performance characteristics (aerobic and anaerobic) and flexibility of PPLP Lampung Karate Athletes

Variable	Group		Reference
	Karate (n =8)	Standard Value	
20 m Sprint	3.69 ± 0.12^	$3.33 - 3.35$	(Alemdaroğlu et al., 2017)
VO$_2$max	39.81 ± 3.11^	$44.9 - 49.0$	(Riebe et al., 2018)
Sit and Reach	20.06 ± 4.52	$18 - 20$	(Physipedia, 2019)

Note: *Results are above normal values (Very Good);

^Results are under average value (Bad)

The data from aerobic endurance measurement using the 2.4 KM cooper test and anaerobic using the 20m sprint test described in Table 4. Based on the above-mentioned data, it is shown that the average VO2max and sprint values for karate athletes are (39.81 ml.kg-1 for VO2max and 3.69 seconds for 20 m sprint). Compared with previous report, the average value is still under the normal values. This finding which mentioned the average value of sit and reach for karate athletes, indicating at normal values position.

Table 5. Data on performance characteristics (aerobic and anaerobic) and flexibility PPLP Lampung Athletic Athletes

Variable	Group		Reference
	Athletic(n =8)	Standard Value	
20 m Sprint	3.07 ± 0.12	$3.00 - 3.36$	(Nikolaidis et al., 2016)
VO$_2$max	45.51 ± 4.05	$44.9 - 49.0$	(Riebe et al., 2018)
Sit and Reach	20.68 ± 2.397	$18 - 20$	(Physipedia, 2019)

Note: * Results are above normal values (very good);

^ Results are below average (not good)

Table 5 shows that the results of aerobic endurance measurements using the 2.4 KM cooper test and anaerobic using the 20 ms print test found that the average value of these two variables is (45.51 ml.kg-1 for VO2max, 3.07 seconds for the 20m sprint and 20.68 cm for sit and reach). Where the average value is included in the predetermined normal value category.

Discussion

This study was aimed to determine the average level of characteristics anthropometry, average aerobic endurance characteristics (VO2max), anaerobic endurance (20m sprint), and flexibility in athletes in Wrestling, Taekwondo, Karate, and Athletic fields. Besides, this study also compares the obtained results with the normal values that have been set in previous studies. In line with these objectives, this study has succeeded in revealing the average anthropometry, aerobic, and aerobic endurance in wrestling, taekwondo, karate, and athletic athletes, especially for PPLP Lampung province.

From the results of anthropometric measurements of the four sports fields, it was found that the height of the taekwondo and athletic athletes was at the normal values category set by WHO. As for the height of the athletes in karate and wrestling, the values were under thenormal values category. Furthermore, the measurement of aerobic and anaerobic endurance in the four sports presents that the average value is under the normal category which determined by previous researches (Art et al., 2019; Alemdaroğlu et al., 2017; Riebe et al., 2018), whereas for athletics field has an average value and involve set normal category as mentioned before(Art et al., 2019). However, the results of measuring flexibility in the four sports have a predetermined normal value level.

The results of this study are similar with previous report by Aziz et al., 2012 for the Pencaksilat field category. Based on his research, the average height of Malaysian Pencak Silat athletes was 177 cm for the male pesilat. This means that Malaysian athletes include in the predetermined normal value category. Although there are some other martial arts athletes such as wrestling and karate who do not reach normal scores. Because of this finding, researchers suspect that the similarities in regional topological characteristics, as well as the culture in the development of martial arts between Indonesia and Malaysia, are one of the main factors that make height or anthropometry between Indonesian and Malaysian martial arts athletes have similarity.

Another phenomenon that occurs in this study is the anaerobic endurance measurement for the 20 m sprint variable. The result shows that only male athletic athletes fall into the predetermined normal value range, and the 20 m sprint average value of the athletic athletes is parallel with previous study from Nikolaidis et al., 2016.At the same time, athletes in other sports do not fall into the normal value range. These results show that skill and technique are the other factors that can determine the difference in results when sports performance are held. This is well explained by Lesinski et al., 2016 who revealed that the role and relationship between anthropometry, skill ability, and physical performance are three important component characteristics that must be include in sports success achievement.

Three factors that mentioned before (i.e. anthropometry, skill ability, and physical performance) is proven through this study in detail, where all of the physiological characteristics measurements (sit and reach and anthropometry) from the four sports fields (Wrestling, Taekwondo, Karate, and Athletic) show the same average trend results. But there is a difference where athletic athletes can fit into the preset normal value ranges, only at 20 m sprint and the average VO2max value. We believe that the based on the previous literature described by Lesinski et al., 2016 is the best answer to this phenomenon, considering that only athletic athletes which have running skilled better than other athletes.

This research is expected to be a description for athletes, coaches, and sports practitioners about the importance of anthropometry for PPLP Lampung athletes to support achievement and can be used as a basis for designing training programs that are suitable for athletes' abilities. Researchers also encourage coaches to pay attention to training protocols or

testing methods such as the cooper 2.4km test for measuring aerobic endurance, 20 m sprint, and sit and reach as a measure of anaerobic endurance and flexibility, as training protocols or testing methods that have to be applied when the process of searching for athlete seeds and the evaluation process in every coaching process carried out in PPLP in Lampung Province or other PPLP throughout Indonesia. This can be happened due to the evidence from this study which proof that the 2.4 km cooper test, 20msprint and sit and reach can answer quantitatively for aerobic and anaerobic metabolic needs, which observed from several sports such as wrestling, Taekwondo, Karate, and Athletics

4. Conclusions

The results of this study provide evidence that from the four sports (Wrestling, Taekwondo, Karate, and Athletic), only athletics and taekwondo which have a normal average value on the anthropometric variable. Meanwhile karate and wrestling athletes are still under the average value category which set by WHO. Furthermore, for VO2maxand 20 m sprint measurements, athletic athletes are at normal values category compared to previous studies, while the average scores for wrestling, Taekwondo, and Karate athletes are still below normal values level. However, the sit and reach variables of the four sports are at the normal values. Anthropometry and physiological characteristics measurement of athletes can be used as parameters in determining superior athlete nominee and should be the consideration for determining an appropriate training program following with the characteristics of each athlete.

Acknowledgements

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