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Aerobic Capacity Profile (Vo_2Max) of Novice Athletes Aged 18-19 Years at the Pencak Silat Student Activity Unit

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Abstract. This study aimed to assess VO_2max using the bleep test in 33 SAU pencak silat athletes, comprising 17 male novice athletes and 16 female novice athletes aged 18–19 with survey design. The results of the VO_2max measurements in male and female novice pencak silat athletes showed that the majority of athletes had low aerobic capacity, particularly among male athletes, total of 58.82% of athletes are classified as very poor, followed by 29.41% in the poor category, and only 11.76 % reach the fair category, with (mean ± SD) of (32.9 ml/kg/min ± 3.68), were female athletes, total of 31.25 % of athletes were in the very poor category, 50.00 % were in the poor category, and 18.75 % of female athletes were in the fair category with (29.9 ml/kg/min ± 3.14). These findings indicate that the cardiorespiratory fitness levels of both male and female athletes remain below recommended fitness standards, thus requiring a more structured endurance training programme.

Keywords: Measurements; vO_2max capacity; pencak silat; novice athletes

INTRODUCTION

Student Activity Units (SAU) are a form of guidance that serves as a forum for developing interests and talents in sports within the scope of higher education (Abidin et al., 2022). This statement emphasizes that SAU can provide a space for students with athletic potential to channel and develop their skills (Rosyidah et al., 2023). Thus, SAU has a strategic role in supporting students to achieve excellence, while strengthening the quality of sports coaching at the university level. To achieve outstanding achievements, each athlete must have a good level of physical fitness (Bompa & Saradan, 2022). Thus, the synergy between a focused SAU coaching system and improving the physical fitness of athletes is an important key to realizing outstanding sports achievements in higher education institution.

Physical fitness is divided into two categories, health-related fitness and skill-related fitness both of which are closely related and complementary. Health-related fitness forms the physiological foundation, while skill-related fitness forms the foundation for movement performance (Setyawan, 2022). The two do not stand alone, but work synergistically to produce optimal physical abilities in athletes (Pasaribu, 2020). In this case, VO_2max is one of the physical fitness components related to health (health-related fitness). Aerobic capacity or maximal oxygen uptake (VO_2max) is a person's endurance ability in using their heart, respiratory, and circulatory systems effectively and efficiently (Bafirman & Wahyuri, 2019). Based on its requirements, according to Bompa & Buzzichelli, (2022), martial arts activities require 50% alactic, 30% lactic, and 20% aerobic energy. Therefore, the aerobic component is one of the components needed by athletes to achieve performance.

Based on the observation results, the training schedule implemented at the Pencak Silat SAU has been consistently carried out with a training frequency of three times a week. However, even though the training pattern runs regularly, many athletes still experience fatigue in the middle of the training session. This condition indicates a possible mismatch between the intensity of training and the physical capacity of athletes, particularly in terms of aerobic endurance, thus requiring further evaluation to ascertain the VO_2max capacity of athletes. Ideally, athletes are required to have a better VO_2max capacity than non-athletes (Srivastava et al., 2024). In line with this opinion, according to Bompa & Saradan, (2022), aerobic endurance must be trained to prevent the negative

effects of fatigue. In line with this urgency, according to the athletes' statements, VO_2max endurance measurements have never been carried out during their training at the SAU.

Meanwhile, based on literature findings, VO_2max measurement using the bleep test on pencak silat athletes has been conducted by Nurhidayah & Graha, (2017). The measurement was carried out on pencak silat students at Yogyakarta State University in the competition category, with the following results: excellent 13%, good 25%, fair 50%, poor 12%, and very poor 0%. Therefore, it can be concluded that there is a contextual gap between previous research and the actual conditions in the pencak silat at the University of Palangka Raya. The evaluation of the training program by measuring VO_2max through the bleep test has been conducted on pencak silat athletes at Yogyakarta State University. However, VO_2max measurement using the bleep test has never been conducted on pencak silat athletes at the University of Palangka Raya.

Based on these conditions, this study attempts to measure VO_2max capacity using the bleep test on athletes from the Palangka Raya University Student Activity Unit (SAU). The results of these measurements can be used as consideration in the planning, evaluation, injury prevention, and performance improvement stages. Thus, this study contributes to strengthening the sports coaching process at the Palangka Raya University SAU in a more focused planned.

METHOD

A survey was used in this study, to measure VO_2max with bleep test on 33 pencak silat athletes, comprising 17 male and 16 female athletes aged 18–19 years. The instrument used was the bleep test with descriptive analysis in the form of percentages and average VO_2max scores. The population and sampling used were saturated sampling, considering that a census or saturated sampling is a sample determination technique when all members of the population are used as samples. This is often done when the population size is relatively small (Sugiyono, 2022). Therefore, this survey was conducted to measure the average, standard deviation, and percentage. After the measurements were taken, the raw data was adjusted to the existing norms. The norms used are listed in Tables 1 and 2 below :

Table 1. Bleep test norms for male

Age	Very poor	Poor	Fair	Average	Good	Very good	Excellent
18-25	< 5/2	5/2-7/1	7/2-8/5	8/6-10/1	10/2-11/5	11/6-13/10	> 13/10

Source : (Tomkinson et al., 2017)

Table 2. Bleep test norms for female

Age	Very poor	Poor	Fair	Average	Good	Very good	Excellent
18-25	< 4/5	4/5-5/7	5/8-7/2	7/3-8/6	8/7-10/1	10/2-12/7	> 12/7

Source : (Tomkinson et al., 2017)

RESULT AND DISCUSSION

Result

The data presentation will show the percentage of VO_2max capacity according to the following categories: 1) Very poor, 2) Poor, 3) Fair, 4) Average, 5) Good, 6) Very good, 7) Excellent. Based on the findings of the VO_2max measurements of male and female pencak silat athletes, the results are presented in Tables 3 and 4 as follows.

Table 3. VO_2max score of male pencak silat athletes

Category	Frequency	Pecentage	Average	Standard deviation
Very poor	10	58.82 %	32.9	3.68
Poor	5	29.41 %	ml/kg/min	
Fair	2	11.76 %		
Average	0	0 %		
Good	0	0 %		
Very good	0	0 %		
Excellent	0	0 %		

The results of VO_2max measurements in male pencak silat athletes show that most athletes are in the low aerobic capacity category. A total of 58.82% of athletes are classified as very poor, followed by 29.41% in the poor category, and only 11.76 %reach the fair category. Therefore, it can be concluded that there are no male athletes in the average, good, very good, or excellent categories. These findings indicate that the cardiorespiratory fitness level of male athletes is still below the standard expected for optimal performance in pencak silat, thus requiring a more structured endurance training program. The measurement results for female pencak silat athletes are presented in Table 4 below.

Table 4. VO_2max scores of female pencak silat athletes

Category	Frequency	Pecentage	Average	Standard deviation
Very poor	5	31.25 %	29.9	3.14
Poor	8	50.00 %	ml/kg/min	
Fair	3	18.75 %		
Average	0	0 %		
Good	0	0 %		
Very good	0	0 %		
Excellent	0	0 %		

Discussion

The VO_2max measurement results for female pencak silat athletes showed a similar pattern. Total of 31.25 % of athletes were in the very poor category, 50.00 % were in the poor category, and 18.75 % of female athletes were in the fair category. Therefore, it can be concluded that no athletes reached the average to excellent category. This condition confirms that most female athletes also have low aerobic capacity, requiring consistent training intervention to improve heart and lung endurance. Overall, the VO_2max measurement results for both male and female novice athletes at the SAU were dominated by the very poor and poor categories. The dominance of the very poor category among male athletes (58.82%) and the poor category among female athletes (50.00%) indicates that the training program may not have optimally developed the aerobic energy system. This condition can impact their competitive performance, especially in competitions that require high intensity and long duration. However, based on the theory by Bompa & Buzzichelli, (2022), even though pencak silat (martial art) is an anaerobic-dominant sport, the contribution of the aerobic system remains significant, especially in supporting the recovery process between rounds and maintaining performance consistency.

These results differ from those of a study conducted by Nurhidayah & Graha, (2017), which found that the aerobic endurance component analysis of male athletes in the Pencak Silat Student Activity Unit at Yogyakarta State University showed 13% in the excellent category, 25% in the good category, 50% in the fair category, 12% in the poor category, and 0% in the very poor category. This difference in results confirms the variation in the quality of physical training, particularly in terms of aerobic endurance training. The difference in VO_2max capacity between student activity units is likely influenced by differences in training program design, intensity, and training volume.

Some negative effects resulting from poor VO_2max levels in athletes include a relationship between VO_2max capacity and anaerobic power with a significance value of ($0.003 < 0.05$). With a correlation coefficient of ($r = 0.781$), this means that the correlation between VO_2max capacity and anaerobic power capacity has a strong correlation strength and a positive correlation direction (Nabila et al., 2025). Thus, it can be interpreted that athletes with poor VO_2max tend to show lower anaerobic power capacity. In addition, based on the performance of athletes in other sports. The regression

analysis results show that VO_2max has a significant effect on performance, with a Sig. F Change value of 0.000 (< 0.05). Furthermore, the R Square value of 0.934 indicates that VO_2max contributes 93% to athlete performance (Sambora & Ismalasari, 2021).

According to Bompa & Buzzichelli, (2022), martial artists require flexibility, strength, agility, and quick reflexes, all of which depend on energy supplied by three energy systems: anaerobic alactate 50%, anaerobic lactate 30%, and aerobic 20%. Therefore, in general, training objectives are focused on power, maximum strength, power endurance, and short muscular endurance to support the physiological demands and characteristics of martial arts competitions. Although the aerobic energy system is only needed by 20%, good aerobic capacity will play a role in supporting energy resynthesis, accelerating recovery, and maintaining the quality of anaerobic work in high-intensity activities (Nabila et al., 2025). Increasing VO_2max capacity can be achieved in several stages. According to Bompa & Buzzichelli, (2022), it can begin with anatomical adaptation and the development of aerobic capacity as a foundation, then continue to maximum strength and power, before being converted into muscular endurance and specific competition abilities. As the competition approaches, training focus shifts to maintaining primary physical quality and optimizing the anaerobic energy system, which dominates during competition. Meanwhile, the transition phase serves for recovery and compensation, ensuring athletes remain ready to enter the next training cycle without the risk of overtraining.

Several training patterns aimed at increasing VO_2max capacity in pencak silat athletes have been conducted by Monoarfa et al., (2022), which found that hollow sprint training had an effect on increasing VO_2max, with a significance value of 0.008 < 0.05. Additionally, the application of shadow fighting in pencak silat athletes showed a significant effect with a sig. value of 0.020 < 0.05. Therefore, this training can be used as an alternative aerobic training that is specific and contextual to the characteristics of pencak silat. Then, another study mentioned that the training pattern with circuit training and fartlek in pencak silat athletes showed a value of 0.00 < 0.05 for circuit training and 0.01 < 0.05 for fartlek training (Kamarudin et al., 2024). The interval training method, applied over 16 sessions, increased the VO_2max capacity of pencak silat athletes by 22.58% (Nofriyantoni et al., 2025), while in other martial arts such as taekwondo, interval training for 16 sessions resulted in a 4.52% increase in VO_2max (Dhuha et al., 2023). A

significant increase in VO_2max capacity was also achieved with the HITT training method (Ma et al., 2023).

CONCLUSION

These findings indicate that the cardiorespiratory fitness levels of male and female athletes are still below standard, requiring a more structured endurance training program. Several recommendations point to the design of a VO_2max improvement program with anatomical adaptation and aerobic capacity development as a foundation, followed by maximum strength and power, before converting to muscle endurance and specific match skills. Ahead of competition, training focuses on maintaining key physical qualities and optimizing the anaerobic energy system, which is dominant in competition. Meanwhile, the transition phase serves for recovery and compensation, so that athletes remain ready to enter the next training cycle without the risk of overtraining. In this regard, several training patterns recommended for increasing VO_2max capacity include hollow sprints, shadow fighting, circuit training, fartlek, interval training, and HITT.

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