Physical Conditions as an Instrument for Monitoring and Evaluating the Effectiveness of Training Programs in Youth Male Athletes

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Abstract

Introduction: Physical condition is an important parameter used to assess the physical readiness of athletes to face the competition. Aspects of endurance, speed, strength, coordination, and flexibility are some of the physical components that determine the quality of an athlete's physical condition. Having a good level of the physical condition provides a positive contribution both to the quality of technical movements and mental strength while participating in competitions. On the other hand, profile data related to the athlete's physical condition is also very necessary in the training process which can be used for the process of monitoring and evaluating the effectiveness of the training program that has been given.

Objectives: This study aims to carry out test and measurement tests as well as data collection related to the profile of physical condition of track and field, pencaksilat, boxing, and judo athletes in PPLP Banten, where the mentioned profile has not been held to date.

Methods: This study was a quantitative descriptive method with a cross-sectional approach. Total sampling methods were implemented on 54 of male athletes, who were prepared to compete in POPNAS 2019. The instrument test of physical condition was prepared by the Sports Science team of the Ministry of Youth and Sports.

Result: The measurement shows that the physical condition of PPLP Banten as a general show that 4% are in the Excellent criteria, 11% are in the Good criteria, while 47% are in the Medium criteria, 24% are in the fewer criteria and 14% are in the Very Fewer criteria.

Conclusion: The conclusion of the study state the Physical Condition of Athletes of PPLP Banten is in good with a percentage of 58%.

Keywords: Physical, Endurance, Speed, Strength, Body mass index, PPLP

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INTRODUCTION

Sports achievements in Indonesia are currently experiencing unstable fluctuations that can be seen from the achievements achieved at the national or regional levels. In connection with these records, it is necessary to pay attention to the process of sports coaching in Indonesia so that the achievements that have been achieved in the past few decades can be realized again. To accomplish this achievement, it is necessary to pay attention to the athlete coaching process starting from the development program which must be carried out in a structured and continuous manner, development patterns and management concepts as well as monitoring evaluation to obtain information on the progress of the athlete coaching process that has been carried out (1). Sports coaching centers for students while at the Student Education and Training Center (PPLP) or Sports School (SKO) is where this coaching program running in a structured and continuous manner. PPLP Banten is one of the centers for coaching student-athletes.
which has had a very significant increase in achievement in the last 2 decades marked by the achievement of achievements at the Asian School, the Asian Student Championships, and at other national level championships. The development of talented athletes is very dependent on the training system at the training center. PPLP is one form of a coaching center that carries out structured training that aims to improve sports performance. To achieve the expected achievements, the coaching process must be carried out in an orderly, planned, and measured manner concerning physical, technical, mental, and health training programs (2). PPLP has implemented long-term athlete coaching methods with a well-organized training program and has strong planning. However, there are still other steps that should be carried out regularly, namely the implementation of tests and measurements related to the athlete's condition regularly (3). This measurement starts with measuring physical abilities, followed by measurements of skills, mental, and health. Having reliable data related to the overall physical condition will help the trainer see the progress of the training as well as make an appropriate follow-up program. Several literature reviews explain that the documentation of the training program that explains the complete profile of the athlete including test results and physical condition measurements must be well prepared to facilitate the coach in monitoring and evaluating the training program that has been given (4). Determination of training load in the form of volume, intensity, and rest in the given training program must be adjusted to the ability of each athlete based on test results and measurements of physical condition so that the training load given is in a predetermined training zone to avoid the effect of overtraining or undertraining (5)(6).

Physical condition is one of the integral elements of bio-motor components that cannot be separated from one another, where each bio-motor component has a role to influence each other, both increase and decrease, so that maintenance must be developed together to get an increase in physical conditions which are expected (7). The definition of physical fitness is a multidimensional condition, which consists of several physical components such as speed, strength, endurance, flexibility, and coordination (8). The profile of the physical condition level of an athlete can be obtained by taking measurements of each component in general or specifically according to the needs of the sport (9). This explains that to get a high level of strength, endurance, or coordination is also needed, as well as to have a high level of flexibility or speed. In other words, an athlete will have a high physical condition, if the profile of each bio motor component is at a balanced level (10). Parallels, if an athlete has a good condition only in the aspect of strength or speed, it will cause an imbalance in strength so that sports activities tend not to be optimal and have the potential to experience injury due to unbalanced physical conditions between the biometric components (11)(12). The same thing is also described in the sports science literature where if you have basic bio motor components at a good level, it will be easy for the trainer to increase advanced physical abilities such as strength endurance, agility, or explosive power, which requires interrelation between each bio motor component such as strength with speed or strength with endurance and flexibility (13)(11). Documentation data related to the physical condition profile and health status of athletes is a must-have element, otherwise, it will be a big challenge for PPLP Banten to carry out the monitoring and evaluation process on the training program that has been provided including monitoring the achievements that have been achieved. This is confirmed by the number of athletes who have dropped out due to injury factors experienced by giving training loads and resting that are not suitable for the athlete's condition (14). Therefore, the implementation of tests and measurements for aspects of physical condition and health is something that must be done regularly so that the results can be used as a guide in providing training recommendations that are in accordance with the athlete's abilities. This is believed to help make it easier for coaches to determine an appropriate training program with the right load, and at the same time it is hoped that it can reduce the number of sports injuries that occur due to the provision of training that is not in accordance with their abilities (15). This study aims were to determine the profile of physical condition for junior athletes of Track and Field (TF), PencakSilat (PS), Boxing (BX) and Judo (JD).

METHOD

The study is experimental research with quantitative descriptive with a cross-sectional approach (16). The study was implemented at PPLP Banten, while here the population is retrieved from Track and Field (TF), PencakSilat (PS), Boxing (BX) and Judo (JD).
Boxing (BX), and Judo (JD). The sample was taken using purposive sampling to 80 male athletes followed with inclusion and exclusion criteria (17). The test started with delivering informed consent and physical activity questionnaire (IPAC) (18), followed with measurement of anthropometrical profile such body weight, -height and basal pulse rate, and completed with physical condition test. The physical condition of speed, power, agility, and endurance will be taken through 30m sprint, vertical jump, shuttle run, and completed with a multistage fitness test (19). The data analysis will scientifically be interpreted in percentages as a quantitative descriptive.

RESULTS

The study has been executed by collecting body mass index and physical condition followed by calculating the correlation between both variables. Table 1 will be shown in the description of each variable in a different type of sport.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Criteria</th>
<th>Track &amp; Field</th>
<th>PencakSilat</th>
<th>Boxing</th>
<th>Judo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass index</td>
<td>Overweight</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>13</td>
<td>5</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Underweight</td>
<td>6</td>
<td>10</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Speed</td>
<td>Excellent</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Less</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Very Less</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Strength</td>
<td>Excellent</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Less</td>
<td>11</td>
<td>9</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Very Less</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Endurance</td>
<td>Excellent</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>7</td>
<td>1</td>
<td>3</td>
<td>2</td>
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<tr>
<td></td>
<td>Less</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Very Less</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>9</td>
</tr>
</tbody>
</table>

The overview of the ability or physical condition of PPLP Bantenathletes could be seen in Table 1. In athletic athletes, the majority have body mass index in the normal category with 13 athletes, while for the overweight category there is 1 athlete and 25% of the total athletes are underweight. This is possible because in athletics several numbers require excessive body composition such as throwing numbers, as well as long-distance running and marathon numbers where it is very important to have less fat. Therefore, it can be concluded that the average composition of athletic athletes is in normal condition with a percentage of around 65%. The body composition profiles of PencakSilat, Boxing, and Judo athletes can be seen in the table that the majority are in the Underweight category with the average number of athletes reaching half of the total number of athletes. For athletes who have normal body categories, only about 1/4 of the total number of athletes and the rest are in the overweight category. Boxing has the highest number of athletes who have an overweight composition of 6 athletes, followed by Pencaksilat with 3 athletes or 15% of the total number of athletes. In the variable speed, athletics has the highest number of athletes who have very good categories, namely 3 athletes (65%), and 1 athlete from Pencaksilat. Meanwhile, the athletic average category has the highest number of athletes with 11 athletes as well as Pencaksilat with almost the same number. The average speed of boxing and judo athletes is in the poor category with an average number of 7 athletes or about 30% of the total number of athletes. However, boxing and judo also have the largest number of athletes with sub-standard speed, with nearly half of the total number of athletes. In the variable of
strength, the profile of the athletes has more diversity. The average strength of the athletes is in the medium category with 5 and 11 athletes in the less category.

Likewise, for Pencaksilat, boxing, and judo, the average strength profile that is owned is in the middle to lower category with a percentage ranging from 25%-35%. Pencaksilat and boxing have the highest number of athletes with fewer strength categories with an average number of 8 athletes or about 25% of the total number of athletes. For the endurance variable, almost half of all athletes have moderate to low endurance ability. It can be seen from the number of athletic athletes who have moderate to lower endurance of 75% or as many as 16 athletes, while in Pencaksilat the number of athletes with moderate to lower endurance is around 10 athletes. This spread also occurs in boxing and judo, where the number of athletes with low endurance is also nearly half of the total number of athletes. It can be concluded that in the endurance variable, the number of athletes who have good endurance is only around 25% or as many as 5 people, while 55% or half of the athletes in each sport have low endurance categories. The correlation between each variable to endurance ability could be seen in the below table 2.

<table>
<thead>
<tr>
<th>Tabel2. The value of the correlation between variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body mass index</td>
</tr>
<tr>
<td><strong>Endurance (VO2Max)</strong> Pearson correlation</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>N</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed)

The results of the correlation analysis are presented in table 2, which explains that there is a significant relationship between BMI and VO2max as evidenced by the r-value of -0.177 and a significance value of 0.042 (α <0.05). The negative r value indicates that the pattern of the relationship between BMI and VO2max is negative, which means that an increase in the BMI value will be followed by a decrease in the VO2max value and vice versa, a decrease in the BMI value will be followed by an increase in the VO2max value (20). These results are in line with research conducted by which explains that body mass index contributes significantly to the endurance status of athletes, both for male and female athletes (21). The same opinion is also explained by a study in the field of sports nutrition, which explains that having too much fat will slow down the body's metabolic performance and make the heart work harder, the blood and oxygen supply is reduced so that it slows down the process of breaking down energy during aerobic activity (22). In other words, having an excess body mass index will burden the performance of the heart and slow down the process of blood and oxygen metabolism throughout the body, so that aerobic performance will not be optimal (23). The second statistical test on the velocity variable found that there was no significant relationship between speed and VO2max, as evidenced by the r-value of -0.163 and a significance value of 0.062 (α > 0.05). The second statistical test on the velocity variable found that there was no significant relationship between speed and VO2max, as evidenced by the r-value of -0.163 and a significance value of 0.062 (α > 0.05). This is in line with research in the field of sports physiology, which explains that endurance is a bio-motor element which is dominantly influenced by the performance of the heart, oxygen supply, and slow muscle fiber work system so that it cannot produce large amounts of power, while the element of speed is influenced by the performance of the fast muscle system and the amount. mitochondria in muscles, which do not require much oxygen at the time of speed (24). Even though the results are not significant, a negative r value indicates that the shorter (faster) athlete's travel time will be followed by an increase in the VO2max score, and vice versa, an increase in the athlete's score or travel time will be followed by a decrease in the VO2max score. The results of the third statistical test on the power variable found that there was a significant relationship between strength and VO2max as evidenced by the r value of 0.312 and a significance value of 0.000 (α < 0.05). This indicates that the pattern of the relationship between strength and VO2max is positive. This explains that an increase in the value of strength will be followed by an increase in the value of VO2max, and vice versa, a decrease in the value of strength will be followed by a decrease in the value of
VO2max. The significance of the correlation between strength and endurance occurs both at the 5% (0.05) level and also at the 1% (0.01) level.

DISCUSSION

Physical condition is an important parameter used to assess the physical readiness of athletes to face the competition. Aspects of endurance, speed, strength, coordination, and flexibility are some of the physical components that determine the quality of an athlete’s physical condition(25). Having a good level of the physical condition provides a positive contribution both to the quality of technical movements and mental strength while participating in competitions. Of the three independent variables tested, two variables had a significant relationship with the athlete's VO2max, namely BMI and strength. Although the velocity variable has an R-value of 0.06 or it means that there is no statistically significant relationship, it does not mean that this variable is not at all related to athletes’ VO2max. The r-value of 0.062 is a value that is almost close to a significant relationship. Besides, both the physical components of speed and VO2max are very important physical aspects concerning the achievements of athletes in the field. Regular physical exercise is known to improve cardiovascular fitness, increase VO₂ Max, and decrease body fat percentage leading to a better quality of life (26). Besides, the high and low levels of VO2 Max are also influenced by several supporting components such as the ability of the heart, lungs, blood quality, blood vessels, and the ability of the skeletal muscles to consume this oxygen(27).

In the term of sport, cardiovascular endurance is one of the bio motor components which also affects the quality of other bio motor components. Besides, having good endurance can also help athletes to be able to have a faster recovery process after doing sports so that athletes do not have problems with fatigue for a long time (28). Several previous studies have also explained that the ability of the heart-lung endurance to help the fatigue recovery process be faster, due to the ability of the heart to flow the amount of dirty blood to the lungs which will then be replaced with clean blood becomes large, thereby accelerating the process of breaking down lactic acid in the blood (29). The explanation from the same study also reinforces this result, which states that cardiovascular endurance ability significantly influences the increase in strength, agility, and even speed (30). Performing complex circuit training based on low intensity and high volume by involving the upper, middle, and lower body parts of the body, has been shown to significantly increase cardiovascular endurance and local muscle endurance better, compared to low-intensity running-based endurance training at high volume (28). In other definition can be explained that having a high level of endurance can help athletes to carry out sports activities for a longer time, be able to display techniques and skills better and help in maintaining endurance concentration for a longer time, which is due to the supply of oxygen sent to the brain has a greater amount compared to athletes who have low endurance abilities (31). The results above show that the endurance abilities of overall athletes are generally in the average category. High endurance abilities are shown in athletics, where more than 50% of athletes are in the good and excellent category. On the other hand, the endurance profile of Pencaksilat shows that the majority of athletes have low endurance abilities. It is assumed that because Pencaksilat requires a high level of skill so that in daily practice, it often emphasizes the skill element so that it does not pay attention to the aspects of improving the physical condition of the athletes.

This is explained in similar studies where it explains that in in-game sports, the element of endurance is the dominant determining factor, compared to the elements of technique and skill (32). By having the ability to be in good physical condition, the athlete will be able to display the maximum and long-lasting ability of skills and techniques, so that a decrease in the quality of movement and technical errors caused by fatigue can be avoided (33). Therefore, the recommendation given to Pencaksilat based on the results obtained is to provide a larger portion of individual physical training, in an appropriate portion without having to reduce skill and skill training. The form of exercise that can be given such a complex circuit training that involve the limbs and whole body by emphasizing a lot of volumes but with low intensity.
Boxing and Judo seem to have similar results. It can be concluded that the athletes have an average category of endurance ability with almost the same spread. The same thing is also explained by sports studies which explain that in martial arts, physical condition is a very dominant factor affecting achievement. The demand to be able to perform fast, explosive movements by moving quickly in martial arts athletes, demands that they have good endurance abilities, both cardiovascular endurance and local muscle endurance (34). Similar studies have shown that complex training that combines physical training and skills is proven to provide more results in improving overall physical condition than a form of exercise that focuses on just one bio motor component (35). This opinion is supported by other studies which state that using skills training in advance with a form of the game to improve physical condition, yields more significant results in increasing endurance and skills than providing a separate form of exercise (36). Having an average level of physical conditions particularly in the form of cardiovascular endurance, create several difficulties that can be encountered in the process of performance development itself including the inability of the body to accept an increased training load, have a high level of fatigue, take a long time to recover and increasing the possibility to occur the injury due to the limited ability of the body to adapt to training loads (37). This is assumed to be one of the factors causing the high number of teenage athletes who experience drop-out so that they are unable to improve sports performance at a further stage. This is in line with research that explains the phenomenon associated with the high number of sports injuries in adolescents in sports games and martial arts, where 33% are structural injuries to joints, and 47% are injuries caused by metabolic disorders due to overtraining which is also as a contributing factor to the decreased number of junior athletes to be able to increase performance at a later stage (38). Therefore, recommendations that can be given based on the results of this measurement are to provide more forms of physical training starting from the general phase, then accompanied by a form of skill and skill training so that in addition to getting results from improving basic physical conditions, also obtaining increased skills and skills simultaneously (39). The form of physical exercise that is given can be in the form of complex training which is a form of combined between physical training and skills with an emphasis on high volume, accompanied by low intensity and short recovery time to provide stimulation for increased endurance better (6).

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