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The effect of speed training on the physical performance of adolescent futsal players

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Abstract

High intensity and good acceleration speed are distinct advantages in a futsal team, thus the purpose of this study is to determine the effect of speed training on the physical performance of futsal players in West Java. The method used in this research is experimental, with a pretest–posttest one group design approach. A purposive sampling technique with inclusion criteria was used in selecting subjects. The total subjects were 30 male futsal players with an average (age of 18.18 ± 2.11 years, height of 168.20 ± 5.32 cm, weight of 60.49 ± 4.23 kg, and fat of 10.19 ± 1.65 %). Data were analyzed using the SPSS version 22 application with a significance level of $p < 0.05$. The results showed that speed training carried out for 10 weeks significantly impacted aerobic Capacity ($p=0.005$) and agility ($p=0.008$). While for the vertical jump and 20-meter sprint, there was an increase, but not significant. Thus the findings in this study can be used as a recommendation for coaches and athletes to train in the basic components of speed to help their physical performance properly.

Keywords: Futsal, physical performance, aerobics, speed.

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INTRODUCTION

Futsal athletes of various levels must possess good physical abilities, considering that futsal is a type of intermittent sport with high intensity (Barbero-Alvarez et al., 2015; Juniarsyah et al., 2019; Ramos-Campo et al., 2014). Previous research stated that in an elite-level match, the average futsal player produces an intensity of 85-90% of maximum heart rate (HRmax) and 75% of VO2max (Naser et al., 2017; Ramos-Campo et al.,

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2014). Other research results stated that 22% of the total time in a professional futsal match is spent running at an extremely high intensity (Lago-Peñas et al., 2011; Ramos-Campo et al., 2016).

In contrast to football, which is played on a large open field, futsal is played on an indoor area with smaller dimensions so that the smaller sizes of the field cause the defensive and attacking schemes in the game of futsal to be carried out by all players on the field and require the players to involved playing on the field to perform a series of movements such as running and sprinting throughout the match in a short time (Ramos-Campo et al., 2016). Therefore, to deal with a series of exercises, such as running and sprinting throughout a match in a futsal match, a player must have excellent physical abilities.

Recent research states that the average aerobic Capacity of semi-professional futsal players participating in the Bandung City Porda championship is around 49 ml/kg/min (Juniarsyah et al., 2021). In addition, other research examining professional futsal athletes from Indonesia has an aerobic capacity of 52 ml/kg/min (Juniarsyah et al., 2017). Meanwhile, the characteristics of professional-level futsal players who play in elite competitions from Europe and Latin America have aerobic capacities above 60 ml/kg/min (Berdejo-del-Fresno et al., 2015; Caetano et al., 2015; De Oliveira Bueno et al., 2014; Nakamura et al., 2016; Ramos-Campo et al., 2014; Sekulic et al., 2020). The results of some research stated that optimal and excellent physical condition was a fundamental element and essential requirement for a futsal athlete in supporting them in futsal training and matches, besides technical and tactical aspects (Álvarez et al., 2009; Oliveira et al., 2013).

In addition to aerobic Capacity, anaerobic Capacity is also the most important component that futsal players must possess, and this is evident from research that has been conducted by (Astagna, 2010; Barbero-Alvarez et al., 2008), which revealed that around 75% of the physical abilities of futsal players last between 1 to 18 seconds, this shows that Anaerobic strength is more dominant so that if it can be increased, it can help athletes

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to achieve success in competing. Several previous research stated that speed training carried out systematically for 6-10 weeks had a significant impact on improving the performance of athletes in several sports, such as football, volleyball, and Pencak silat (Eryılmaz & Kaynak, 2019; Majid, 2021; Mathisen, 2016; Mathisen & Pettersen, 2018; Sloth et al., 2013). The speed training carried out in this research was an implementation of a form of speed training conducted in previous research (Haugen, 2011).

The rapid development of futsal has become a momentum for coaches to find good athletes and encourage researchers to develop research on futsal. The achievements of the Indonesian futsal national team still need to be improved at the international level, however, in terms of ranking, it is better when compared to football. The ranking of Indonesian futsal national team is in 50th place in the world, while the national football team is 173rd. Athlete development must be pursued in various regions, one of which is West Java, which has many talented players. Research on the effects of sprint training on physical performance still needs to be done, increasing the physical ability to support matches is needed by a team. Besides that, this research is also expected to provide a reference for trainers in making a training program. Thus, this study aimed to determine how significant the changes in the physical ability of futsal athletes are after speed training.

METHOD

This research used the experimental method with a pretest-posttest approach without a control group. Participants in this study were selected based on inclusion criteria, namely futsal players from Bandung City and Tasikmalaya City, had no history of asthma and heart disease, were in good health, did not smoke, practiced at least 3-5 times per week for the last 6 months, and came from clubs. Futsal senior who has participated in the West Java Porprov event.

The research subjects were 30 people and consisted of several playing positions, including goalkeeper, *flank*, *anchor*, and *pivot*. The players have experience in playing futsal for three years. The research

subjects were 30 senior male athletes from 3 futsal clubs (2 futsal clubs from Bandung city and 1 futsal club from Tasikmalaya city) with an average age of 18 years consisting of several playing positions including goalkeeper, flank, anchor, and pivots. The average player has experience competing for 3-4 years. The research has been approved by the Research Ethics Commission of POLTEKKES Bandung, number 03/KEPK/EC/IX/2022. All research subjects received verbal and written explanations regarding the research's procedures, objectives, risks, and benefits. Furthermore, the research subjects were directed to fill out an informed consent form.

Measurement and Research Procedures

Anthropometric

Variables taken in this research were the calculation of body weight and percentage of fat using the OMRON Karada Body Fat Scan tool (HBF-375). Meanwhile, a stadiometer was used to measure height. In collecting data on body weight and percentage of fat using the OMRON Karada Body Fat Scan tool (HBF-375), the research subjects were instructed to stand straight on the OMRON Karada Body Fat Scan tool (HBF-375) without using footwear, either shoes or shirts legs with both hands straight forward forming an angle of 900 and holding the control of the OMRON Karada Body Fat Scan tool (HBF-375). Furthermore, data on the body weight, fat percentage, and body mass index (BMI) of the research subjects would appear on the OMRON Karada Body Fat Scan tool (HBF-375) screen.

Aerobic Capacity (VO2max)

The bleep test field method was used in this research to determine the aerobic Capacity of the research subjects. The aerobic capacity test using the bleep test was carried out in an indoor field with a flat surface. Then, on the flat field surface, a marker was made using a funnel between A and B with a distance of 20 meters. The research subjects were familiar with this series of bleep tests because they frequently did it. However, the researchers reminded the research subjects of the technical testing of aerobic Capacity to use the bleep test to avoid technical errors when testing aerobic Capacity using the bleep test.

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Vertical Jump

The Vertec tool (SPRI Commercial SKU: 07-70250) was used to measure the jumping height of research subjects. Subjects were instructed to jump as high as possible. Then, when at the top of the jump, research subjects were required to touch the propeller of the Vertec tool.

20-meter sprint

The 20-meter sprint test in this research was carried out on an indoor field with a flat surface, which was then marked on the flat surface using a funnel between A and B with a distance of 20 meters. Research subjects were instructed to run from points A to B as fast as possible.

Agility

The agility test in this research employed the Illinois agility run test and was performed on an indoor field with a flat surface. Subjects were instructed to read the agility test protocol, demonstrated by the researcher, who then conducted an agility test using the Illinois agility run test.

Research Procedures

The research pretest was conducted in the 0th week; all research subjects were instructed to test their aerobic Capacity using the bleep test, vertical jump, 20-m sprint, and agility. In addition, anthropometric measurements were carried out during the pretest. From the 1st-10th weeks, all research subjects did additional exercises in the form of speed exercises without eliminating the exercise the coaching team of each team had designed. Each subject in this study involved 3 futsal clubs (2 futsal clubs from Bandung city and 1 futsal club from Tasikmalaya city), and each club was taken as many as 10 participants. All participants did a pretest before being given the sprint training treatment.

The speed training carried out in this research was an implementation of a form of speed training conducted in previous research (Haugen, 2011). However, the speed exercises carried out are supervised by experts in sports science and coaching. The speed training program of this research is described in Table 1. Meanwhile, the research posttest was

conducted at week 11; all research subjects were instructed to re-test aerobic Capacity using the bleep test, vertical jump, 20-m sprint, and agility.

Table 1. 10-Week exercise program

Week (Training Load)	Exercise Form
0	Pretest
1st (medium)	3 x 4 x 40 m, R = 1:30 min, SR= 10 min, / = 95-100%
2nd (high)	4 x 4 x 40 m, R = 1:30 min, SR= 10 min, / = 95-100%
3rd (high)	5 x 4 x 40 m, R = 1:30 min, SR= 10 min, / = 95-100%
4th (low)	2 x 5 x 40 m, R = 1:30 min, SR= 10 min, / = 95-100%
5th (medium)	3 x 5 x 40 m, R = 1:30 min, SR= 10 min, / = 95-100%
6th (high)	4 x 5 x 40 m, R = 1:30-2 min, SR= 10 min, / = 98-100%
7th (low)	2 x 5 x 40 m, R = 1:30-2 min, SR = 10 min, / = 98-100%
8th (medium)	3 x 5 x 40 m, R = 1:30-2 min, SR = 10 min, / = 98-100%
9th (high)	4 x 5 x 40 m, R = 1:30-2 min, SR = 10 min, / = 98-100%
10th (low)	2 x 4 x 40 m, R = 1:30-2 min, SR = 10 min, / = 98-100%
11^{th}	Posttest

R=recovery; SR= set recovery; I= Intensity

Before speed training each week, the research subjects completed general and special warm-ups. A general warm-up consisted of 15 minutes of jogging at a low intensity. During a special warm-up, the athletes run 5-7 accelerations for 40-50 m, with 2-3 minutes of recovery between each run. Subjects must complete at least 90% of the training period. Subjects are also required to be able to complete all series of tests; thus, the results can be included in further analysis.

Data Analysis

In this research, the results of the data that have been collected are displayed in the mean and standard deviation. Homogeneity and normality tests were carried out using the Shapiro-Wilk test. Furthermore, after testing homogeneity and normality, a significance analysis was carried out using a one-way test or one-way ANOVA. Parameters of aerobic Capacity, vertical jump, 20-m sprint, and agility before and after sprint training using paired T-test analysis. SPSS application version 22 was used in this research. All statistical analyses used a significance level of $p<0.05$.

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RESULTS

Table 1 shows that the results of the research subject data were analyzed in a quantitative descriptive manner, the data included age, height, weight, FAT, BMI, and FAT. The findings in this study did not show any significant differences in the standard deviation between individuals.

Table 2. Anthropometric data

Variabel	Experiment (N=30)		
	Mean (SD)	Min	Max
Age (years)	19.40 ± 1.18	18.00	21.00
Height (cm)	170.04 ± 3.54	162.50	173.2hasil 0
Weight (kg)	62.89 ± 5.44	52.50	71.50
BMI (kg/m^{-2})	21.74 ± 1.71	18.94	25.79
FAT (%)	12.17 ± 1.71	10.40	15.20

BMI= body mass index

Table 3. Data on aerobic Capacity, vertical jump, 20-m sprint, and agility

Variabel	Experiment (N=30)		
	Pretest	*Posttest*	*p-value*
Aerobic Capacity (ml/kg/min)	45.38 ± 3.21	49.33 ± 2.88	0.005*
Vertical Jump (cm)	50.46 ± 4.65	51.17 ± 3.35	0.145
Sprint 20-m (s)	3.23 ± 0.23	3.09 ± 0.15	0.192
Agility (s)	18.60 ± 1.28	16.60 ± 1.66	0.008*

*significant p<0.05

The results showed a significant difference in the average posttest scores for aerobic and agility (aerobic capacity p=0.005 and agility p=0.008). Meanwhile, the average value of the vertical jump and 20-meter sprint increased but was not statistically significant (VJ p=0.145, 20M sprint p=0.192).

DISCUSSION

The research conducted has focused on observing the effect of speed training (sprints) for 10 consecutive weeks on the values of aerobic Capacity, speed, agility, and vertical jump in futsal players of West Java. We observed that sprint training for 10 consecutive weeks positively impacted the values of aerobic Capacity, speed, agility, and vertical jump of the players.

This research found that the aerobic Capacity of the players increased after following the given protocol, significantly different. The research results have similarities with the results of previous research, which discovered that football and volleyball athletes increased aerobic Capacity after performing sprint training for 6-12 weeks (Eryılmaz & Kaynak, 2019; Majid, 2021; Mathisen, 2016; Mathisen & Pettersen, 2018; Sloth et al., 2013). Previous research concluded that this increase in aerobic Capacity was due to physiological adaptations to the body initiated by the large number of muscle fibers involved during the speed training process (Sloth et al., 2013). In general, type I muscle fibers are more dominant in speed training resulting in specific adaptations to type I fibers. In addition, the induction process of greater adaptation of oxidative enzymes in type II muscle fibers resulting from speed training interventions contributes to increased aerobic Capacity (Almeida et al., 2021; Sloth et al., 2013).

High aerobic and anaerobic abilities significantly contribute to meeting players' energy needs during intermittent maximal-intensity movements and assisting rapid recovery during short periods of rest during matches. The research showed that the aerobic Capacity of players after training intervention was at a value of 49 ml/kg/min. The aerobic capacity values produced in this study were no different from previous research involving futsal athletes from Bandung City, who had aerobic capacities in the range of 49-51 ml/kg/min (Juniarsyah et al., 2021). However, compared with the aerobic Capacity of professional futsal athletes competing in elite futsal competitions from various countries, the research subjects were still far behind, but differences in testing methods could be a factor in the difference in scores.

Several previous research stated that the aerobic Capacity of futsal players from Brazil was in the range of 55-59 ml/kg/min, while the aerobic Capacity of futsal players from Italy was in the range of 56-60 ml/kg/min, and the aerobic capacity of futsal players from Italy was in the range of 56-60 ml/kg/min. Then, Spain was in the range of 57-63 ml/kg/min (Ohmuro et

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al., 2020; Romero et al., 2020; Stubbs-Gutierrez & Medina-Porqueres, 2020).

In this research, we found that the sprint training protocol used had a positive effect on increasing agility for the players. Our research supports previous research, which concluded that 6-10 weeks of speed training had a positive effect on the performance of young athletes in various sports, such as taekwondo, Pencak silat, and football (Hidayat, 2018; Mathisen, 2016; Mathisen & Pettersen, 2018; Singh & Sathe, 2017). The increased agility of futsal athletes in this research is because the sprint training program involves many movements, such as changes in direction, and other movements, such as acceleration and deceleration; thus, with these movements, the body experiences neuromuscular adaptation. There is an increase in motor units that produces scientifically proven muscle coordination and increases the agility component (Hidayat, 2018; Mathisen, 2016; Mathisen & Pettersen, 2018; Singh & Sathe, 2017).

Sprint and vertical jump abilities did not find a significant difference in this research. However, it increases after participating in a sprint training program for 10 weeks. Our research has similarities with previous research which concluded that there is a positive effect on leg strength in volleyball and football athletes after completing a speed training program (Haugen, 2011; Majid, 2021; Perez-Gomez & Calbet, 2013). The increase in leg muscle performance is because most of the leg muscles, especially tendon muscles, after speed training adapt to increase power in the muscles around the legs (Ampillo & Ristian, 2014).

The research limitation was that during sprint training, all research subjects were not paired with aids such as heart rate monitors to measure heart rate and exercise intensity in real-time and objectively. Regular, disciplined, intensive, and continuous training programs can improve physical and mental performance so that movements performed during repetitive movements can have an impact on the development of better reflexes and movement patterns, which lead to better movement learning and automation (Ampillo & Ristian, 2014; Majid, 2021). Therefore, through

sprint training carried out for 10 consecutive weeks in this research, there was an increase in aerobic Capacity, speed, agility, and vertical jump aspects of West Java adolescent futsal players.

CONCLUSION

Based on the results and discussion in this research, the sprint training program for 10 weeks improved players' physical performance, more specifically, increases in aerobic Capacity, agility aspects, and vertical jumps on West Java adolescent futsal players. The research results can serve as a reference so that the 10-week sprint training program can become the preferred training program for futsal athletes in particular and athletes in other sports in general. Further research is needed using research samples, including athletes in various sports and heart rate monitors so that the characteristics of athletes when carrying out sprint training programs can be known objectively.

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