

# Effect of Plyometric and Sprint Training on VO<sub>2</sub>Max in Amateur Football Player

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## ABSTRACT

Background: Among the most important physiological performance indicators in football team are speed and velocity at maximal oxygen uptake. Plyometric training is considered essential techniques to enhance neuromuscular functioning in football players. Methods: The present study aims at investigating the changes in maximal oxygen uptake (VO<sub>2</sub>Max) among subjects in response to frequent training. The sample consists of 32 persons, ages 16-18. Subjects are required to perform on 45 minute training session every week for 6 weeks. The assessed variable of Vo<sub>2</sub>max, the assessment process is done pre-and post- training. Results show that there are significant differences in VO<sub>2</sub>Max improve after plyometric training and sprint training. The plyometric training (PT) group VO<sub>2</sub>Max improve 7,41 ml/kg/min and sprint training (PT) improve 1,9 ml/kg/min group with both of group significant differences ( $p \leq 0.05$ ). Conclusions: The study shows that plyometric training for 6 weeks better than sprint training for improving VO<sub>2</sub>Max.

**Keywords:** Football, Plyometric, Sprint, Vo<sub>2</sub>Max

## 1. INTRODUCTION

Maximum oxygen consumption (VO<sub>2</sub>max) have been reflects of cardiorespiratory fitness for a football player. During the football game, players perform aerobic and anaerobic activities together [1]. However, aerobic metabolism is mostly used in the football competition. Anaerobic metabolism involves almost all movements that affect the outcome of the competition [2]. Some of these movements; such as shooting, short sprinting, jumping, or double struggles Anaerobic metabolism is met by all movements that determine the outcome of the competition [3]. Physical fitness make important contributions to the endurance capacity and cardiorespiratory fitness of football player, each football player performs 1000 to 1400 short sprint stunts of 2 to 4 seconds recurrent every 90 seconds with an average regression time of 18 seconds in 90% of cases [4]. The importance of physical fitness in a football player so much study has focused on the development of sprints, and agility capacity using a variety of training methods, including speed, sprint, resistance, plyometric training (PT) and sprint training (ST) [5]. Plyometric training (PT) is type of exercise training that uses an explosive strength and explosive movements to improve muscular power. Plyometric training focuses on an explosive eccentric muscle contraction, followed by a brief amortization phase, which is then followed by an explosive concentric muscle contraction, allowing the synergistic muscles to participate in the myotatic stretch reflex during the stretch shortening cycle (SSC). This type of training has also been shown to improve cardiorespiratory capacity [6]

Sprint training (ST) is defined short duration sprints ( $\leq 10$ s) with recovery time that are long enough for near complete recovery (60 s-360 s) [7]. It is also an explosive type of training because it requires stretch shortening cycle movement. Because the mechanics of sprint training make beneficial to cardiorespiratory performance [8]. Therefore, this research aims to determine which training is better for improve VO<sub>2</sub>Max.

## 2. METHODS

### 2.1. Subject

Thirty-two amateur football players (ages:  $17.31 \pm 0.87$  years; height:  $166.62 \pm 5.66$  cm; body mass:  $55.75 \pm 7.16$  kg) were recruited to subject in this study. Prior to subject, all subjects were give information about requirements and risks associated with this study. All subject signed written informed consent prior in the initial testing session.

### 2.2 Procedure

This study used an experimental design with pre test-post test with control group. Subjects were randomly designed in which subjects were asked to complete pre test session in the form of a cooper test were conducted at an outdoor 400 m running track in 12 minute. Subsequently, subjects were randomly selected to join either the plyometric training group or the sprint training group. Both groups completed 6 weeks of training with twice weekly interventions. At the end of the intervention, all subjects repeated the same test as the pre-test in the form of a cooper test. All the implementation of the pre-test and the final test is carried out at IRDA FC Balaraja.

**2.2.1 Cooper Test (Pre -Test)**

After warm-up for 10 minutes, the cooper test was conducted with run 12 minutes on 400 meter running track to measure the initial VO2Max value.

**2.2.2 Training**

All subject is compulsive to do PT or ST twice a week, for a total a period of 6 weeks according to their group Before to all training sessions, subjects completed 10 minute of warm-up, consisting of jogging, squats, lunges and plank. The principles of progressive and overloading was integrated into the training program for both training group. For PT group, the subjects is instructed to vertical jump to the maximum height they could afford for each repetition. For ST, instructed to run as fast as possible. Training done in 20 minutes and cold down. All subjects were instructed to continue as usual football drill and training.

**2.2.3 Cooper Test (Post-Test)**

All Subject returned to complete the cooper test with 10-minutes warm-up after 6 weeks training to measure the final VO2Max value

**2.3 Statistical Analysis**

The variables tested are expressed as mean ± SD. To determine whether there is a difference between groups on the measurement of VO2Max test before and after the training period using an independent t-test, while to determine the difference in the paired group from before and after the final test analysed using paired t-test.

**3. RESULTS**

Both of training groups showed significant improvement in VO2Max from pre-to post-test ( $p \leq 0.05$ ), but there was a difference in the increase in VO2Max in the PT group from the results before and after the test for the cooper test Occurred in the PT group VO2Max (7,41 ml/kg/min) and (1,9 ml/kg/min) in ST group Significant differences ( $p \leq 0.05$ ) were observed after training in the magnitude of the increase between the PT group and ST (Table 1).

**Table 1** VO2Max experimental results

Study variable [VO2Max]	Group	VO2Max		<i>p</i>	
		Pre-test (ml/kg/min)	Post-test (ml/kg/min)	<i>Pre</i>	<i>Post</i>
	PT	<b>40.82 ± 8.06</b>	<b>48.23± 8.32</b>	0.001	0.001
	ST	<b>35.79 ± 5.08</b>	<b>37.69 ± 5.69</b>	0.001	0.001

**4. DISCUSSIONS**

The aim of this study was to compare the effects of PT and ST to investigate the increase in VO2Max results of this 6 week intervention. These results support our hypothesis that both interventions will benefit VO2Max. However, our other hypotheses are supported as well because there is a significant change in VO2Max at PT group than the ST group. These results tend to support most of the previous published studies performed examining these types of training interventions with football players, several studies have shown the effectiveness of PT in improving VO2Max [9, 10, 11, 12]. Researchers have attributed that to modifications made by plyometric training running economy as the physiological indexes associated with aerobic efficiency (lactate and Vo2max response) were not modified in such studies. There are some possible mechanisms that may be responsible for improving running economy by plyometric training such as the neural adaptation and increase in the ability to use stored elastic energy [9]. The improvement in running capability after plyometric training has been attributed to improved musculotendinous stiffness [12]. Improved running economy, with marked

reduced oxygen consumption at a specific running speed due improve vertical stiffness (kvert) was associated with lower oxygen consumption during running. Therefore, it would be expected that PT improved running performance by improving RE via increase in the musculotendinous stiffness [13]. Muscle's ability is improved by plyometric training to generate power by exaggerating the stretch-shortening cycle. There is another additional change which is the potential to increase stiffness of muscle- tendon parts. The use of speed training and plyometric training to improve running economy in trained runners has been asserted by previous researches. The addition of lower-limb strength and /or plyometric training into endurance running for <10 weeks has been reflected in improvements in running economy of 4-8% [14][15], this may be attributed to neural adaptations that facilitate maximum exploitation of stretch shortening cycle and improved running mechanisms [16].

## 5. CONCLUSION

The current study shows that plyometric training (PT) and sprint training (ST) lead to increased VO<sub>2</sub>Max in amateur soccer players but increase in VO<sub>2</sub>Max in the plyometric training group higher than in the sprint training group. This suggests that the increase in running performance after the 6-week intervention is most likely due to the increase in muscle strength. Based on the findings in this study, practitioners and physiotherapists can include PT or ST twice a week in their training program.

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