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## Physiological responses of Yo-Yo Intermittent Recovery Test 2 (YYIRT2) among Indian collegiate level soccer players

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### Abstract

Soccer is the most popular sports played worldwide. Apart from technical efficiency and tactical skills, the most important features of successful soccer players are their physical components of motor fitness which affects their performance. The assessment of physical capacities of soccer players is one of the most important issues in modern gameplay. The objective of present study was to assess the selected physical and physiological parameters among Indian collegiate soccer players. For the purpose of this study, a total of 20 male soccer players (age:  $19 \pm 0.47$  years; height:  $170 \pm 4.5$  cm; body weight:  $67 \pm 2.04$  kg) were recruited from the soccer match practice group at LNIPE Gwalior. YYIRT2 was administered to measure aerobic endurance, VO<sub>2max</sub> was assessed using an equation and HR, and BR were recorded by palpation method. The major finding of this study is that collegiate level soccer players exhibited fairly excellent results which shows that they had a sound physical base. They may be lacking tactical and technical skills to excel the game of soccer at higher competitive levels. The coaching staff may utilize these field-based tests to track the improvements made by different training methods.

**Keywords:** Yo-Yo Intermittent Recovery Test 2, sports played worldwide, training methods

### Introduction

Soccer is the most popular sports played worldwide. Apart from technical efficiency and tactical skills, the most important features of successful soccer players are their physical components of motor fitness which affects their performance (Little and Williams, 2007)<sup>[10]</sup>. A soccer player is required to run short sprints of 20-30 meters every now and then, along with slow jog throughout the match (Krustrup *et al.*, 2006; Little and Williams, 2007)<sup>[6, 10]</sup>. A soccer game involves jumping, shooting, challenges, turns, dribbles, sprints, controlling the ball under pressure, running at different speeds, and sliding tackles; both aerobic and anaerobic energetic pathways are used during games (Açıkada *et al.*, 1998; Stolen *et al.*, 2005)<sup>[1, 13]</sup>. Since high-intensity bursts of short distance require considerable time to recover, a player with greater anaerobic and aerobic capacity can outplay his opponents (Tomlin and Wenger, 2001; Castagna *et al.*, 2008; Bangsbo *et al.*, 2008)<sup>[15, 5, 3]</sup>.

The assessment of physical capacities of soccer players is one of the most important issues in modern gameplay. Coaches and sport scientists use field and laboratory tests for screening candidates, in selection procedures, or to monitor the efficacy of training regimes (Norkowski, 2002)<sup>[11]</sup>. Recently, Yo-Yo tests have become one of the most extensively studied shuttle run tests in soccer players and referees (Krustrup *et al.*, 2003; Bangsbo *et al.*, 2008; Aziz *et al.*, 2005)<sup>[8, 3, 2]</sup>. The relationship between Yo-Yo tests performance and VO<sub>2max</sub>, heart rate, and breathing rate is well studied among soccer players with conflicting evidence (Bangsbo *et al.*, 2008; Aziz *et al.*, 2005; Castagna *et al.*, 2006; Krustrup *et al.*, 2003; Thomas *et al.*, 2006)<sup>[3, 2, 6, 8, 14]</sup>. However, there are very limited studies conducted on assessing physical and physiological responses of Yo-Yo intermittent recovery test 2 (YYIRT2) among Indian soccer players at collegiate level. Since, yo-yo test does not require much apparatus and is a field-based test, it may serve the purpose of testing soccer players in testing, training and talent identification (Krustrup *et al.*, 2006; Bangsbo, 1994)<sup>[7, 4]</sup>. Therefore, the objective of present study was to assess the selected physical and physiological parameters among Indian collegiate soccer players.

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## Material and Methods

### Participants

For the purpose of this study, a total of 20 male soccer players (age:  $19 \pm 0.47$  years; height:  $170 \pm 4.5$  cm; body weight:  $67 \pm 2.04$  kg) were recruited from the soccer match practice group at LNIPE Gwalior. All the participants had a mean playing experience of  $4 \pm 2.3$  years. The participants were explained about the objectives of the study and they provided their informed-consent. The study was conducted in accordance with the tenets of Declaration of Helsinki 2013. The study was conducted at the soccer field and the set up for yo-yo intermittent recovery test 2 was marked. Players were familiarized with the tests' protocols and underwent a trial before actual test performance.

### Test administration

The tests were carried out with the help of 2 trained testing personnel who were the coaches of LNIPE soccer team. All the players were trained about taking heart rate through palpation method and breathing rate through self-reporting. They were motivated to exert maximal efforts and were verbally encouraged to run for as long as possible. The standard warm up was performed with lower limb muscle stretching for 3 minutes on instructor's command.

### Maximal Oxygen consumption (VO<sub>2max</sub>)

The maximum oxygen consumption (VO<sub>2max</sub>) is vital to

soccer performance. VO<sub>2max</sub> can be estimated using a formula:

$$\text{VO}^2 \text{ max } (\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}) = \text{total distance (m)} \times 0.0136 + 45.3$$

### Yo-Yo intermittent recovery test 2 (YYIRT2)

YYIRT2 consists of repeated 20-m runs back and forth between the starting, turning, and finishing lines at a progressively increased speed, which is controlled by audio beeps from a tape recorder. When the subjects failed twice to reach the finishing line in time, the distance covered was recorded as the test result (Krustrup *et al.*, 2003; Bangsbo, 1994)<sup>[8, 4]</sup>. YYIRT 2 test started at a speed of 13 km·h<sup>-1</sup>, which increased by 2 km·h<sup>-1</sup> after the first stage and by 1 km·h<sup>-1</sup> after the second stage, afterwards it continued with stepwise 0.5 km·h<sup>-1</sup> speed increments after every stage until exhaustion (Krustrup *et al.*, 2003)<sup>[8]</sup>.

### Statistical Analysis

The data are reported as means and standard deviations. The VO<sub>2max</sub> was calculated using the above formula. Since, it was descriptive analysis, no comparison was performed.

### Results

Table 1 shows the descriptive results of age, height, weight, and BMI of soccer players.

**Table 1:** Descriptive characteristics of collegiate level soccer players

Participants	Age (years)	Height (cm)	Weight (kg)	BMI	Training years
Mean	19	170	67	23.18	4.32
Standard Deviation	0.47	4.5	2.04	2.08	2.1

Since it was a descriptive study, normality assessment was not carried out. Table 2 shows YYIRT2, VO<sub>2max</sub>, heart rate, and breathing rate among soccer players.

**Table 2:** Physiological profile of collegiate level soccer players

Participants	HR <sub>max</sub> (Beat/min)	BR <sub>peak</sub> (count/min)	YYIRT2 (meters)	VO <sub>2max</sub> (ml/kg/min)
Mean	190	54	1240	62.89
Standard Deviation	7.5	6.9	60	2.45

HR<sub>max</sub>: maximum Heart rate at maximum effort, BR<sub>peak</sub>: Peak Breathing rate at maximum effort

### Discussion

The estimation of physical and physiological parameters during competitions has greater implication on training and further improvement of player performance. During high intensities, the measurement of physiological parameters such as VO<sub>2max</sub>, HR, BR etc using equipment such as gas and ventilation analysers becomes tricky as it requires expertise, is expensive, and trained personnel are required (Leibetseder *et al.*, 2002; Stickland *et al.*, 2003)<sup>[9, 12]</sup>, so it may not be appropriate for team sports where testing every player will take time away from training (Stickland *et al.*, 2003; Aziz *et al.*, 2005)<sup>[12, 2]</sup>. For these reasons, there is increased interest in predictive tests (Aziz *et al.*, 2005)<sup>[2]</sup> and sports scientists have focused on comparing these tests with each other. The major finding of this study is that collegiate level soccer players exhibited fairly excellent results which shows that they had a sound physical base. They may be lacking tactical and technical skills to excel the game of soccer at higher competitive levels.

The coaching staff may utilize these field-based tests to track the improvements made by different training methods. Few studies have previously examined the relationship between YYIRT2 performance and VO<sub>2max</sub>. While Rampini *et al.*

(2010) found a weak correlation between YIRT2 performance with VO<sub>2max</sub>, Krustrup *et al.* (2006)<sup>[7]</sup> reported a moderate correlation between YIRT2 performance and measured VO<sub>2max</sub> values ( $r = .56$ ).

### Recommendations

1. The coaching staff for soccer players at collegiate level should emphasize on training sessions dedicated to technical and tactical skills.
2. A profile of soccer players must be maintained at collegiate level to follow up the improvement and avoid the chances of burn-outs or injuries to soccer athletes.

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