Assessment of VO2max of Soccer Players in Different Competition Levels

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ABSTRACT

The purpose of the study was to assess the VO2max of soccer players in different competition levels. For this study, forty-five (N=45), fifteen (15) each for I-league, state league and inter-universities participant players. The ages of the subjects ranged between 18 to 25 years and were randomly selected. Yo-Yo Intermittent Recovery Test Level-1 (YYIRTL-1) was administered to collect the pertaining data for VO2max and distance covered. To calculate VO2max value was determined in ml/kg/min unit by the formula of Bangsbo et al. (2008): VO2max (ml/kg/min) = YYIRT1 distance (m)×0.0084+36.4 and distance covered expressed in the unit of meters (m). Descriptive and analysis of variance (ANOVA) statistical techniques were employed to find out the characteristic of data and significant differences of VO2max and distance covered of soccer players in different competition levels.Further post hoc test was applied by using the Scheffe's method to determine the paired mean differences of soccer players in different competition levels. The level of significance was set at P<0.05. A significant mean difference in VO2max and distance covered was found between the Inter-university and I-league players. There were insignificant differences of VO2max and distance covered was found between the I-league and state-league players; and state-league and inter-university players respectively. So, the results of the findings show that VO2max and distance covered of soccer players are significantly different according to their competition levels. Higher competition levels have high VO2max levels compared to the lower competition levels.

Keywords: *VO2max, Distance Cover, YYIRTL-1 and Soccer*

DOI Number: 10.14704/nq.2022.20.9. NQ44782 **Neuro Quantology 2022; 20(9):6680-6685**

1. Introduction

Soccer is an intermittent, team-based sport, where repeated high-intensity actions are required, interspersed with periods of lower intensity or submaximal work (Reilly et al., 2000). A soccer match demands highly physical and physiological fitness efficiency. Studies (Bangsbo, 1994; Bangsbo et al., 1991; Mohr et al., 2003), to found out, by means of time – spatial analysis, that adult professional players run 9 – 12 km at different paces during a match. During a match, there are frequently repeated sprints, high intensity running and load work activities are performed. VO2max as a highlighter for aerobic capacity is an important variable for this sport because increases physiological performance indicators and physical fitness markers during the match, increasing players' recovery capacity (Tonnessen et al., 2013; Di Salvo et al., 2007; Reilly et al., 2000; Mohr et al., 2003). Consequently, it is the aerobic performance of soccer players that can determine whether they operate at the elite, sub-elite or non-elite level (Vaeyens et al., 2006). Higher levels of VO2max have been shown to result in increased match performance, including distance covered, the number of sprints and the number of

involvements with the ball (Helgerud et al., 2001 & McMillan et al., 2005).

Aerobic capacity of the organism, i.e. the functional capacities of cardiovascular and respiratory systems, as well as the capacity of tissues to utilize oxygen; at the same time, it is the best indicator of the athlete's physical capacity (Rankovic et al., 2010). Cardiovascular fitness is one of the most important aspects of physical fitness in soccer (Da Silva et al., 2008; Nikolaidis, 2011; Stølen et al., 2005). Maximal oxygen uptake (VO2 max) refers to the intensity of aerobic processes and represents the capacity of the organism to utilize at a certain moment the maximum amount of oxygen (Živanić et al., 1999).Maximal oxygen uptake as a measure of aerobic capacity has been determined as the international standard of physical capacity (Fleg et al., 2000; Fletcher et al., 1995). The basic unit for measuring the maximal oxygen uptake is its absolute value expressed in liters or millilitres of oxygen per minute (Rankovic et al., 2010). Therefore, well-developed aerobic fitness helps soccer players to maintain repetitive high-intensity actions within a soccer match, to accelerate the recovery process, and to maintain their physical condition at an optimum level during the entire game and season (Stølen et al., 2005). The performance of intermittent and repeated activities during soccer game depends on aerobic endurance and recovery capacity of players (Bayrakdaroğluet al., 2020).

VO2max is the most important factor in a Soccer match. So, players should be required maximum aerobic capacity for a long duration to exhibit better performance. Higher VO2max allows the players to run longer and faster and to be more involved in various actions of the game (Stølen et al., 2005). High aerobic capacity also helps the players to recover better from high-intensity actions and intermittent exercise, typically observed in a football match (Reilly, 1997). During the match, players are involved in many physical activities and require continuous adaptation to maintain or change the situation's direction by individual players and team players. The activities involved in soccer are intermittent nature, with changes every 3–5 s, resulting in repeated high-intensity spells of play (Krustrup et al., 2006). These are reflected in the physical and physiological fitness of soccer players (Reeves et al., 1999).Maximum aerobic endurance person can be maintained the game situation and physical fitness level fora long duration of time. $VO2_{MAX}$ is considered to be the most essential component of endurance performance **(**Åstrand P Ø et al., 1986; Hoff J et al., 2004).Stolen et al., (2005) reported test results have varied widely with VO2max values between 50 and 75 mL · kg–1 · min–1 among outfield athletes.

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2. Objective

The main objectives of the study are

i. To find out the status of VO2max and distance coveredof soccer players in different competition levels.
ii. Further, to investigate the significant differences ofVO2max and distance covered of soccer players in different competition levels.

3. Hypothesis

It was hypothesized that there would not be significant differences in VO2max and distance covered of soccer playersin different competition levels.

4. Methodology

For this study, forty-five (N=45), fifteen (15) each for I-league, state league and inter-universities participant players. The ages of the subjects ranged between 18 to 25 yearsand were randomly selected. Yo-Yo Intermittent Recovery Test Level-1 (YYIRTL-1) was administered to collect the pertaining data for VO2max and distance covered.To calculateVO2maxvalue was determined in ml/kg/min unit bythe formula ofBangsbo et al., (2008):VO2max(ml/kg/min)=YYIRT1 distance (m)×0.0084+36.4 and distance covered is expressed in the unit of meters (m). Descriptive and analysis of variance (ANOVA) statistical techniques were employed to find out the characteristic of data and significant differences of VO2max and distance covered of soccer

playersin different competition levels. If significant differences would be found, further post hoc test was applied by using the Scheffe's method to determine the degree and direction between paired mean differences of soccer players indifferent competition levels. The level of significance was set at P<0.05.

5. Result

The pertaining data of VO2max and distance covered were treated by using the descriptive analysis to find out the range (R), minimum (min), maximum (max), mean (M), standard deviation (SD) and standard errors (SE) shows in table 1.

Table 1: Descriptive Analysis of VO2max and Distance Covered of Soccer Players inDifferent Competition Levels.

Variable	Parameter	R	Min	Max	M	SD	SE
I-League (n = 15)	**VO2max** (ml/kg/min)	11.42	49.17	60.59	55.44	3.62	0.94
	Distance (m)	1360.00	1520.00	2880.00	2266.67	431.52	111.42
State-League (n = 15)	**VO2max** (ml/kg/min)	11.43	48.83	60.26	54.14	3.60	0.93
	Distance (m)	1360.00	1480.00	2840.00	2112.00	428.21	110.56
Inter-University (n = 15)	**VO2max** (ml/kg/min)	10.42	48.16	58.58	52.01	3.56	0.92
	Distance (m)	1240.00	1400.00	2640.00	1858.67	423.82	109.43

Table 1 shows that the mean (M) and standard deviation (SD) of the VO2max of I-league, state-league and inter-university players were 55.44±3.62, 54.14± 3.60 and 52.01±3.56 respectively; the range were 11.42, 11.43 and 10.42 respectively and standard errors were 0.94, 0.93 and 0.92 respectively.

And the mean (M) and standard deviation (SD) of the distance covered for I-league, state-league and inter-university players were 2266.67±431.52, 2112.00±428.21 and 1858.67±423.82 respectively; the range were 1360.00, 1360.00 and 1240.00 respectively and standard errors were 111.42, 110.56 and 109.43 respectively.

The result of the analysis of variance (ANOVA) used to find out the significant mean differences of VO2max and distance covered of soccer players in different competition levels is shown in table 2.

Table 2: Significant Mean Differences of VO2max and Distance Coveredof Soccer Players in Different Competition Levels.

Parameter	Variable	Mean	SD	F	Sig. (P-value)
VO2max	I-League	55.44	3.62	3.474	0.04
	State-League	54.14	3.60		
	Inter-University	52.01	3.56		
Distance Covered	I-League	2266.67	431.52	3.476	0.04
	State-League	2112.00	428.21		
	Inter-University	1858.67	423.82		

**Significant at 0.05 level of confidence, where, F(0.05)(2,42) = 3.22*

Table 2 reveals that there were significant mean differences in VO2max of soccer players in different competition levels as the calculated F- ratio = 3.474 is greater than the tabulated F-value = 3.22 at 0.05 level of confidence (P<0.05).

And significant mean differences werealso found in distance covered of soccer players in different competition levels as the calculated F-ratio = 3.476 is greater than the tabulated F-values = 3.22 at 0.05 levels of confidence (P<0.05). Hence, further post hoc test was applied by using the Scheffe's method to determine the degree and direction between paired mean differences of the soccer players in different competition levels and the results have been presented in table 3.

Table 3: Paired Mean Differences for the VO2max and Distance Coveredof Soccer Players in Competition Levels.

Parameter	Mean			Mean Difference	SE	Sig. (p-value)
	I-League	State-League	Inter-University			
VO2max	55.44	54.14		1.30	1.31	0.62
		54.14	52.01	2.13	1.31	0.28
	55.44		52.01	-3.43*	1.31	0.04
Distance Covered	2266.67	2112.00		154.67	156.23	0.62
		2112.00	1858.67	253.33	156.23	0.28
	2266.67		1858.67	-408.00*	156.23	0.04

**Significant at 0.05 level of Confidence (P≤0.05).*

From table 3 shows that there was found significant mean difference of VO2max between inter-university and I-league as their mean difference was -3.43 respectively (P<0.05). However, there was found insignificant mean difference of VO2max between the I-league and State league; and State league and Inter-university as their mean difference of 0.62 and 0.28 respectively (P>0.05).

And the significant mean difference in distance covered was also found between the Inter-university and I-league players as their mean difference was -408.00 respectively (P<0.05). However, there was found insignificant mean difference of distance covered between the I-league and State league; and between State league and Inter-university players as their mean difference of 154.67 and 253.33 respectively (P>0.05).

The mean differences of VO2max and distance coveredof soccer players in different competition levels have been graphically presented in figure 1 and 2.

Figure 1: Mean Comparison of VO2max of Soccer Players in Different Competition Levels.

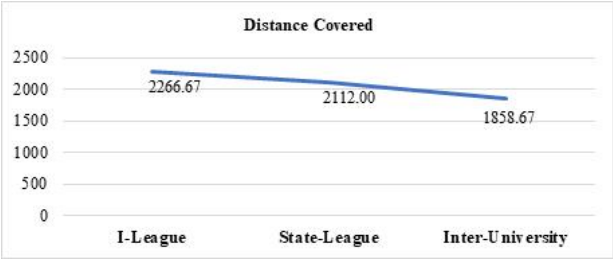

Figure 2: Mean Comparison of Distance Covered of Soccer Players in Different Competition Levels.

6. Discussion

The finding of statistical analysis of variance (ANOVA) revealed significant differences in VO2max and distance covered among the three different competition levels I-

league, State-League, and Inter-University. Further, the post hoc test was applied using Scheffe's method to determine the paired means differences of soccer players in different competition levels.

A significant mean difference in VO2max and distance covered was found between the Inter-university and I-league players. There were insignificant differences in VO2max and distance covered was found between the I-league and state-league players; and state-league and inter-university players respectively.

The mean differences in VO2max and distance covered between the inter-university and I-league players might be the reasons for the levels of playing and standard of the playing competition. I-league players are the high levels of physiological fitness efficiency compared to inter-university players. I-league players are professional players,they have a tight schedule of training, competition, and practice throughout the year. They are practiced from reputed professional football clubs with more qualified coaches. Inter-university players are the selected players from different colleges. They have lack of tight training schedule and practice. Teplan et al., (2012) reported thatthe performance reached in Yo-Yo IRT1 is significantly different in successful and less successful teams. Mohr et al., (2003) points out that demands on high intensity performance with short rest intervals put on the players during the match are the main and crucial difference between elite and average players.

There were insignificant differences in VO2max and distance covered was found between the I-league and state-league players; and state-league and inter-university players respectively. The results might be due to state league players are also highly trained, having tight schedules of practice and participating in many competitions. Players who have Good performance and high physical fitness person in the state league are selected for I-league players. Many inter-university participated players also played in the state league tournament.

Players at the international level (national teams, European cups) reach the greatest distance in Yo-Yo IRT1 (2420 m), elite players (the best teams in national competitions – 2190 m), average performance players in national competitions (2030 m) and semi-professional players (1810 m) (Castagna et al., 2006; Krustrup et al., 2003; Mohr, Krustrup, &Bangsbo, 2003). High parameters of aerobic capacity (distance, VO2max) may create better predispositions for achieving success (Teplan et al., 2012).

The finding of the result shows that the VO2max and distance covered by the players depend upon the training schedule, practice, levels of competition and standard of the playing levels, etc.

By the results of the study, the null hypothesis was rejected and alternate hypotheses was accepted.

7. Conclusion

From the above finding, significant differences were found in the mean comparison ofVO2max and distance covered of soccer players among the three different competition levels I-league, State-League, and Inter-University. Further, the paired mean comparisons showed the significant mean differences in VO2max between the inter-university and I-league players. There were insignificant differences of VO2max and distance covered was found between the I-league and state-league players; and state-league and inter-university players respectively.

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