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Relationships Between The Yo-Yo Intermittent Recovery Test Level 2 And Match-Running Performance Vary Between Playing Positions In Elite Under-14 Soccer Players

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Abstract

The aim of the present study was to examine the relationships between the Yo-Yo intermittent recovery test level 2 (YYIR2) and match-running performance across playing position in elite young soccer players. Participants were 142 players from 14 professional soccer academy under-14 teams. Twenty-six 11-a-side matches were analyzed using a Global Positioning System. Total distance, distance covered by sprinting (> 5.3 $m \cdot s^{-1}$), distance covered at very high-intensity activity (VHIA, ≥ 4.5 $m \cdot s^{-1}$), distance covered above maximal power (MaxP, > 55 $W \cdot kg^{-1}$) and metabolic power greater than or equal to 35 $W \cdot kg^{-1}$ (MP≥35), and acceleration (> 2 $m \cdot s^{-2}$, NA>2) and deceleration (< 2 $m \cdot s^{-2}$, ND<2) frequencies were computed. The YYIR2 test was conducted within three weeks of the matches. When all players were included, the YYIR2 distance was positively related to all match-running performance variables (r = 0.31-0.49, all P < 0.01). When the analysis was conducted on individual playing positions, the YYIR2 distance demonstrated: positive relationships with total distance in defenders and central midfielders (r = 0.42-0.63, all P < 0.05); positive relationships with sprinting, VHIA, MaxP and MP≥35 distance and NA>2 in all playing positions (r = 0.41-0.71, all P < 0.05); and positive relationships with ND<2 in central midfielders (r = 0.55, P = 0.005). The present results indicate that the YYIR2 is a valid test for the assessment of match-related physical fitness in elite young soccer players across playing position. However, the relationships between the YYIR2 and match-running performance variables are playing position-dependent except for match-running distance at high-speeds and high-metabolic powers and NA>2.

Keywords: Association football; endurance fitness; field test; match analysis; and young players

Abbreviations

The Yo-Yo intermittent recovery test level 1 and 2 (YYIR1 and YYIR2).
Central defenders (CD).
Central midfielders (CM).
Wide defenders (WD).
Wide midfielders (WM) sprinted.
Strikers (ST).

Introduction

Aerobic fitness has been suggested as a key component in elite level young soccer players [7, 35] and several field tests have been created to monitor aerobic fitness of soccer players [3, 4, 6, 13, 21] including the Yo-Yo intermittent recovery test level 1 and 2 (YYIR1 and YYIR2) [3]. The YYIR1 and YYIR2 have been widely employed to assess the intermittent endurance ability of players in field conditions. The YYIR1 was designed to evaluate an ability to repeat intermittent activities with a high aerobic component towards the end of the test [3]. An improvement in the YYIR1 performance as a result of a training intervention was associated with a greater match-running distance [24] and significant relationships between the YYIR1 distance and match-running performance has been reported in under-14 (U14) to U17 soccer players [7, 8, 15, 32]. While the YYIR1 focuses primarily on the aerobic energy system, the YYIR2 intensely stresses both aerobic and anaerobic energy systems and examines an ability to repeat high-intensity running with an almost maximum aerobic energy production [25]. It has been reported that the YYIR2 possesses high reproducibility and can be used to detect changes in the ability to perform intense intermittent activities both between and within seasons [25], and has been suggested as a more effective test than the YYIR1 [29]. However, the construct validity of the YYIR2 has not been evaluated in young soccer players and an identification of valid field tests would support coaching staff and sport scientists to develop talent selection procedures and to control training processes [21].

Several studies have examined match-running performance of elite young soccer players by measuring distance covered by players within certain speed categories (speed zone based approach) [5, 16, 17, 20, 34, 37] and match-running distance has been reported to vary across playing position [5, 27, 34, 37]. For example, wide defenders (WD) and wide midfielders (WM) sprinted (> 5.3 $m{\cdot}s^{-1}$) a greater distance than central defenders (CD) and central midfielders (CM) [5]. As match-running distance appears to be playing position-dependent in elite youth soccer players, relationships between field test performance and match-running distance may differ across playing position.

In recent years, metabolic power has been suggested as an alternative estimate of the physical demands during match-play (metabolic power zone based approach) as metabolic power allows a quantification of energy expenditure of very high-intensity and short duration running phases such as accelerations and decelerations [30]. Previous studies have employed a metabolic power zone based approach to analyze match-running distance in 12-18 year old soccer players [15, 34]. However, such studies failed to report match-running distance in relation to individual playing positions and detailed information derived from such an approach regarding match-running performance may be useful to guide coaches and sports scientists to create playing position-specific training programs for young soccer players.

Some studies reported that acceleration and deceleration profiles during match-play are playing position-dependent [10, 22, 38] and are more sensitive to fatigue than the running distance analyzed using speed approach [2, 22, 33, 38]. However, the profile of accelerations and decelerations across playing position has not been reported in young soccer players. Furthermore, an examination of relationships between the YYIR2 performance and accelerations/ decelerations during match play may extend the knowledge regarding construct validity of the YYIR2 as an indicator of a player's ability to complete more distance, at higher speeds and metabolic powers during match play. measure of match-running performance.

Therefore, the aims of the present study were to examine: 1) match-running performance across playing position using the metabolic power approach in elite young soccer players; 2) acceleration and deceleration related match-running performance across playing position; and 3) the relationships between the YYIR2 and match-running performance across playing position. We hypothesized that: 1) match-running performance analyzed using metabolic power approach, and acceleration and deceleration related match performance are playing position-dependent; and 2) the relationships between YYIR2 and match-running performance are playing position-dependent.

Materials and Methods

Experimental approach to the problem

The current study recruited U14 outfield players from 14 professional soccer club academy teams which represents the highest standard of youth soccer development in Japan. The study assessed the construct validity of the YYIR2 as an indicator of match-running performance across playing position in elite U14 soccer players by examining the relationships between the YYIR2 and match-running performance in individual playing positions. The match analysis was conducted with a Global Positioning System (GPS) technology (15Hz, SPI HPU, GPSports, Canberra, Australia) and the data was analyzed using the speed and metabolic power approaches. In addition, the number of accelerations and decelerations completed during match-play were included in the analysis.

Participants & ethical approval

The participants were 142 elite outfield players from 14 Japanese professional soccer club academy teams, of which two were Japanese international players (N = 142; age = 13.7 ± 0.6 years; height = 161.4 ±5.8 cm; body mass = 49.9 ± 7.2 kg [mean ± SD]). The players generally participated in four 2-hour training sessions and a match (Saturday or Sunday) in each week during the season. All players generally participated in all training sessions and matches, and the players who missed more than two training sessions and/or matches within three months from the data collection were excluded from the study. The players were provided with a written and verbal explanation of the study including all measurements to be taken. Each player signed an informed assent form and completed a health screen questionnaire prior to participation in the study. Each player's parent or guardian signed a consent form prior to the start of the study. Players were free to withdraw from the study without giving any reasons and without any penalty regarding their position within the soccer club and this was explained to them verbally and in writing. Participants were withdrawn from the study if they did not have a satisfactory health status. The study was approved by a University Ethics Committee (ethics number: 2017-19).

Match sample

A total of 26 11-a-side official league matches were analyzed and the players were categorized as central defenders (CD, N = 37), wide defenders (WD, N = 32), central midfielders (CM, N = 31), wide midfielders (WM, N = 17) and strikers (ST, N = 25). All matches were played on international match size (length = 100-110 m, width = 64-75 m, Fédération Internationale de Football Association (FIFA)) flat artificial grass pitches (third generation astroturf). Match duration was 2 x 30 min or 2 x 35 min and data were expressed in relative terms (per 60 min). Playing formation was consistent throughout the match and the players were required to play a full match in the same playing position for the whole match to be included in the analysis. All matches started and finished with 22 players.

Match-running performance

The match-running distance was analyzed using speed zone based approach and metabolic power zone based approach. The speed zones were as follows: high-intensity running (HIR, 3.6 to 4.4 $m \cdot s^{-1}$); very high-intensity running (VHIR, 4.5 to 5.3 $m \cdot s^{-1}$); and sprinting (> 5.3 $m \cdot s^{-1}$); very high-intensity activity (VHIA, calculated by VHIR plus sprinting) [5]. Metabolic power was analyzed according to a method which was proposed previously [30]. Metabolic power zones were as follows: high power (HP, 20-35 $W \cdot kg^{-1}$); elevated power (EP, 35-55 $W \cdot kg^{-1}$); maximal power (MaxP, > 55 $W \cdot kg^{-1}$); and MP≥35 (calculated by EP plus MaxP) [17, 26, 30]. Moreover, the number of accelerations (> 2 $m \cdot s^{-2}$ (NA>2) and > 3 $m \cdot s^{-2}$ (NA>3)) and decelerations (< 2 $m \cdot s^{-2}$ (ND<2) and < 3 $m \cdot s^{-2}$ (ND<3)) completed by each player were counted. Acceleration had to exceed and remain above the limit for at least 0.8 s to be included and the same applied for decelerations but with negative signs [28, 38].

Match-running performance was analyzed with 15 Hz (5 Hz interpolated to 15 Hz) GPS technology (SPI HPU, GPSports, Canberra, Australia) which was positioned on the upper back in a custom-made vest. This device has been reported to possess a sufficient validity and reliability to analyze distance covered at various speeds, metabolic powers, accelerations and decelerations in a team sport set up [23, 31, 36]. At least 8 satellites (mean ± SD = 9.8 ± 0.7 satellites) were connected during data collection which is the minimum number of satellites required to allow an accurate measurement [31, 39]. The match-running performance were calculated using Team AMS software version R1.2019.1 (GPSports, Canberra, Australia).

The Yo-Yo intermittent recovery test level 2

The YYIR2 was conducted within 3 weeks from the matches during the season. All players were familiarized to the YYIR2 test and the tests took place on outdoor artificial grass pitches where the matches were played. The test involved repeated 20 m shuttle runs and the running speed was increased progressively with audio sound signals from a laptop computer. The players were given 10 s between each run to jog around a cone which was placed 5 m behind the finish line and get back to the start line. The test was terminated when a player failed to complete the shuttle run in time on two occasions. The distance covered in the last complete successful shuttle was recorded as the test score [25].

Statistical analyses

Normality of the data was examined by Kolmogorov-Smirnov test and homogeneity of variance was assessed with Levene's test. One-way analysis of variance (ANOVA) with Bonferroni's post hoc test was employed to examine between-playing position differences in the YYIR2 and match-running performance. Log transformation was conducted whenever normality of the data was violated [14]. If normality of the data was still violated after the log transformations, Kruskal-Wallis tests were conducted to examine the between-playing position differences and pairwise comparisons with adjusted P-values were performed to assess differences [14]. When the data was normally distributed but variances were unequal, ANOVA with Games-Howell post hoc test was employed [14]. Partial eta-squared (η^2) was determined as measures of effect size when ANOVA was employed and the values were considered as small (0.01), medium (0.06) and large (0.15) [9].

Pearson's product-moment correlations (r_p) were calculated to examine the relationships between the YYIR2 distance and match-running performance variables. When the data was not normally distributed, Spearman's rank correlation (r_s) was employed to examine the relationships. The magnitude of correlation coefficients was considered as trivial (< 0.1), small (0.1-0.3) moderate (0.3-0.5), large (0.5-0.7), very large (0.7-0.9) and nearly perfect (> 0.9) [19]. The level of statistical significance was set at $p < 0.05$ and 95% confidence intervals (CI) were determined wherever appropriate. Results are presented as mean ± SD and all the statistical analyses were performed using SPSS version 22.0 (IBM SPSS statistics for Windows, IBM, Armonk, New York, USA).

Results and Discussion

Results

The YYIR2 distance and match-running performance of all players and across playing position are presented in Table 1. An ANOVA revealed that the YYIR2 distance was not different between playing positions (P = 0.649, η^2=0.02). When match-running performance was analyzed using the speed zone based approach, CD covered less total and VHIR distance than other playing positions (all P < 0.05, η^2 = 0.22-0.27). Moreover, CD and CM covered 25-56% less sprinting and VHIA distance than WD, WM and ST (all P < 0.05, η^2 = 0.33-0.35). In addition, a Kruskal-Wallis test showed that CM covered 25-49% greater HIR distance than CD, WD and ST (all P < 0.05). When match-running distances were analyzed using the metabolic power zone based approach, a Kruskal-Wallis test demonstrated that CD covered 18-26% less HP distance than WD, CM and WM, and ST covered 18% less HP distance than CM (all P < 0.01). Whereas, an ANOVA showed that CD and CM covered 23-33% less EP and MP≥35 distance than WD, WM and ST (all P < 0.01, η^2 = 0.32-0.33). Moreover, CD displayed 31-37% less MaxP distance than WD and ST, and CM showed 44-54% less MaxP distance than WD, WM and

ST (all P < 0.01, η^2 = 0.25). In addition, central defenders completed 26-33% fewer accelerations at 2m.s^{-2} NA>2 was 26-33% less in CD compared to WD, WM and ST (all P < 0.01, η^2 = 0.21) and ND<2 was 22-33% less in CD than all the other playing positions (all P < 0.01, η^2 = 0.28). Furthermore, ND<3 was 35-38% less in CD than WD and WM, and was 29% less in CM than WD (all P < 0.01, η^2 = 0.22) (Table 1). There were no other between-playing position differences in match-running performance.

		All players	***CD***	***WD***	***CM***	***WM***	***ST***	***η^2***
N		142	37	32	31	17	25	
YYIR2 (m)	Mean	763	739	803	773	694	789	0.02
	SD	249	257	231	277	201	269	
Total distance (m)	Mean	7180	6726[abc*d]	7239	7506	7222	7310	0.22
	SD	584	608	484	475	485	527	
HIR (m)	Mean	981	813[b*]	947[b*]	1214[d]	987	973	N/A
	SD	236	173	178	237	160	219	KW test
VHIR (m)	Mean	488	376[a*b*c*d*]	526	487	591	510	0.27
	SD	137	85	118	125	158	116	
Sprinting (m)	Mean	318	244[a*cd]	422[b*]	186[c*d*]	389	384	0.35
	SD	161	109	114	107	148	185	
VHIA (m)	Mean	805	620[a*c*d*]	948[b*]	673[c*d*]	981	894	0.33
	SD	267	181	194	210	284	270	
HP (m)	Mean	1348	1144[a*b*c*]	1395	1546[d*]	1433	1265	N/A
	SD	275	225	256	231	210	254	KW test
EP (m)	Mean	437	349[a*c*d*]	507[b*]	370[c*d*]	521	480	0.33
	SD	128	84	93	97	128	141	
MaxP (m)	Mean	100	84[ad]	122[b*]	61[c*d*]	109	133	0.25
	SD	56	35	51	27	51	78	
MP≥35 (m)	Mean	537	433[a*c*d*]	630[b*]	430[c*d*]	631	613	0.32
	SD	170	110	113	118	168	207	
NA>2 (counts)	Mean	50	40[a*c*d*]	54	47	55	60	0.21
	SD	16	10	13	10	18	21	
NA>3 (counts)	Mean	5	4	5	4	5	6	N/A
	SD	3	2	3	2	4	5	KW test
ND<2 (counts)	Mean	69	54[a*b*c*d*]	74	69	81	72	0.28
	SD	18	12	12	14	20	19	
ND<3 (counts)	Mean	17	13[a*c*]	21[b*]	15	20	19	0.22
	SD	7	4	5	5	8	10	

Significantly different at p < 0.05 vs. a: WD, b: CM, c: WM, d: ST. *P < 0.01. CD = central defenders, WD = wide defenders, CM = central midfielders, WD = wide midfielders, ST = strikers, YYIR2 = Yo-Yo intermittent recovery test level 2, HIR = high-intensity running, VHIR = very high-intensity running, VHIA = very high-intensity activity, HP = high power, EP = elevated power, MaxP = maximal power, MP≥35 = metabolic power greater than or equal to 35 W·kg^{-1}, NA>2 = number of accelerations (> 2 m·s^{-2}), NA>3 = number of accelerations (> 3 m·s^{-2}), ND<2 = number of decelerations (< 2 m·s^{-2}), ND<3 = number of decelerations (< 3 m·s^{-2}).

Table 1: The YYIR2 distance and match-running performance of all players and across playing position.

When all players were included in the analysis, there were small to moderate significant positive relationships between the YYIR2 distance and all match-running performance variables (r_p = 0.26-0.49, all P < 0.01). When each playing position was analyzed separately, the YYIR2 distance showed: moderate to large significant positive relationships with total distance in CD, WD and CM (r_p = 0.42-0.63, all P < 0.05); moderate to large significant positive relationships with HIR distance in CD and CM (r_p = 0.49-0.55, all P < 0.05); large significant positive relationships with VHIR distance in CD, CM and ST (r_p = 0.52-0.57, all P < 0.05); large to very large significant positive relationships with sprinting and VHIA distance in all playing positions (r_p = 0.51-0.71, all P < 0.05) (Figure 1).

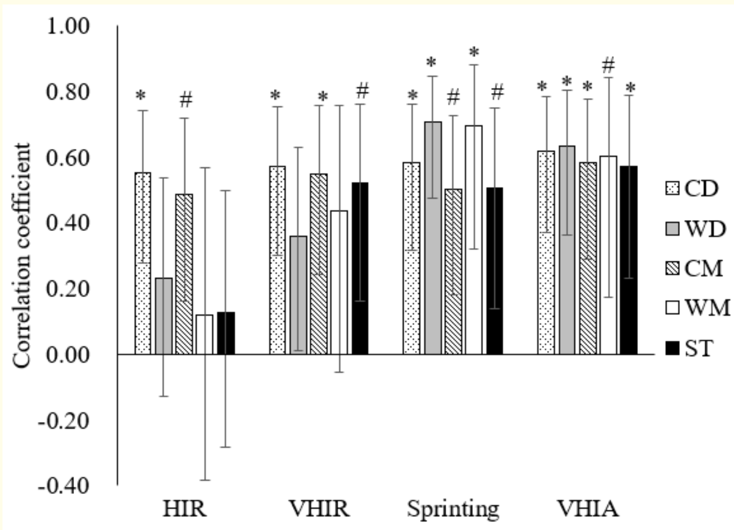

Figure 1: Correlation coefficients (95% CI) between the YYIR2 distance and HIR, VHIR, sprinting and VHIA distance. Significantly correlated to YYIR2 distance at #P < 0.05 and *P < 0.01. CD = central defenders, WD = wide defenders, CM = central midfielders, WD = wide midfielders, ST = strikers, YYIR2 = Yo-Yo intermittent recovery test level 2, HIR = high-intensity running, VHIR = very high-intensity running, VHIA = very high-intensity activity.

Moreover, the YYIR2 distance illustrated moderate to large significant positive relationships with: HP distance in CD (r_p = 0.57, P =0.001) and CM (r_s = 0.44, P = 0.029); and EP, MaxP and MP≥35 distance in all playing positions (r_p = 0.41-0.69, all P < 0.05) (Figure 2).

In addition, the YYIR2 distance revealed: moderate to large significant positive relationships with NA>2 in all playing positions (r_p = 0.46-0.54, all P < 0.05); moderate significant positive relationships with NA>3 in CD (r_s = 0.45, P = 0.014); large significant positive relationships with ND<2 in CM (r_p = 0.55, P = 0.005); and moderate to large significant positive relationships with ND<3 midfielders (r_p = 0.41-0.59, all P < 0.05) (Figure 3). There were no other significant relationships between the YYIR2 distance and match running performance variables.

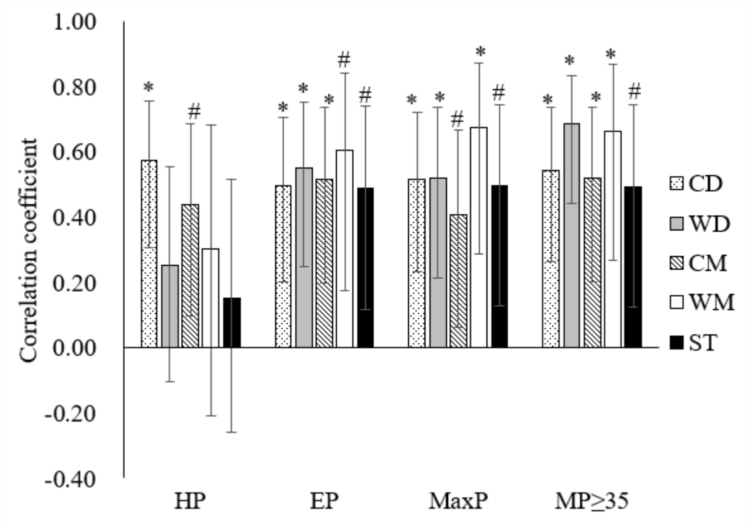

Figure 2: Correlation coefficients (95% CI) between the YYIR2 distance and distance covered during EP, MP and MP≥35. Significantly correlated to YYIR2 distance at #P < 0.05 and *P < 0.01. CD = central defenders, WD = wide defenders, CM = central midfielders, WD = wide midfielders, ST = strikers, YYIR2 = Yo-Yo intermittent recovery test level 2, HP = high power, EP = elevated power, MaxP = maximal power, MP≥35 = metabolic power greater than or equal to 35 W·kg^{-1}.

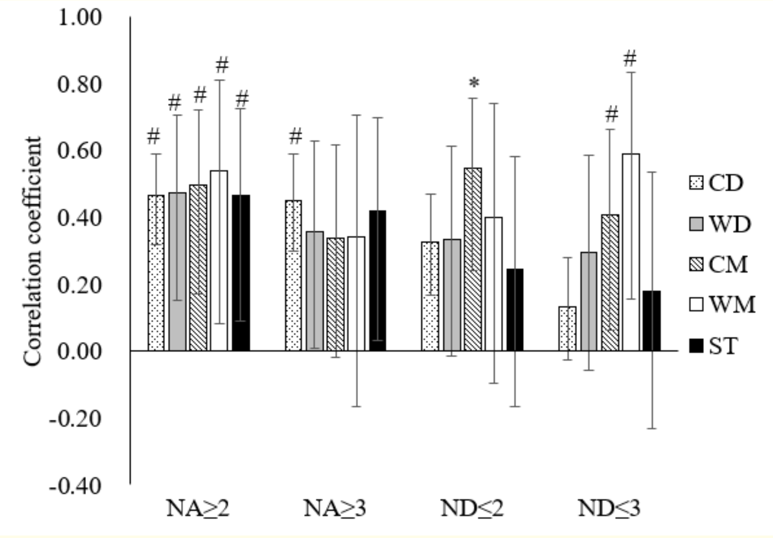

Figure 3: Correlation coefficients (95% CI) between the YYIR2 distance and number of accelerations and decelerations. Significantly correlated to YYIR2 distance at #P < 0.05 and *P < 0.01. CD = central defenders, WD = wide defenders, CM = central midfielders, WD = wide midfielders, ST = strikers, YYIR2 = Yo-Yo intermittent recovery test level 2, NA>2 = number of accelerations (> 2 m·s^{-2}), NA>3 = number of accelerations (> 3 m·s^{-2}), ND<2 = number of decelerations (< 2 m·s^{-2}) and ND<3 = number of decelerations (< 3 m·s^{-2}).

Discussion

This is the first study to examine match-running performance with metabolic power approach and acceleration and deceleration frequencies across playing position in elite U14 soccer players. Moreover, the present study is the first to assess the relationships between the YYIR2 and match-running performance across playing position in elite U14 soccer players. The main findings of the current study were that: 1) match-running performance according to metabolic power zones and number of accelerations and decelerations were playing position-dependent in elite U14 soccer players; 2) the significant relationships between the YYIR2 distance and total match-running distance was revealed in defenders and CM; 3) the significant relationships existed between the YYIR2 distance and match-running distance at high-speeds and high-metabolic powers in all playing positions; and 4) the significant relationships between the YYIR2 distance and all acceleration and deceleration related variables except NA>2 were playing position-dependent.

In the current study, the mean YYIR2 distance was around 700-800 m in all playing positions. This is similar to or slightly better than Scandinavian 17-year-old academy players (680 m [3]). Moreover, the present results demonstrated no between-playing position differences in YYIR2 distance and this finding agrees with previous studies which reported a small difference in the YYIR2 distance across playing position in professional soccer players [25] and a small difference in physical capacity across playing position in elite youth soccer players [5].

Total match-running distance of roughly 7000 m·h-1 was displayed in the current study. This is similar to the U14 players from England [16, 34] and Qatar [5] and slightly greater than the players from New Zealand [1] and San Marino [7, 8]. Moreover, match-running distance observed in various speed zones in the current study was similar to that reported in the previous studies [5, 17]. Furthermore, as demonstrated previously in elite young soccer players, total distance and distance covered in various speed zones were playing position-dependent in the current study [5, 34, 37]. When match-running distance was analyzed using the metabolic power approach, distance covered was similar to that reported in the previous studies on elite young soccer players [17] and was playing position-dependent in similar trends to match-running distance analyzed using speed approach. For acceleration and deceleration frequencies, the current players accelerated 50 times·h^{-1} (NA>2) and 5 times·h^{-1} (NA>3) and decelerated 17 times·h^{-1} (ND<3) on average during a match. These values are lower than the accelerations and decelerations reported in the previous studies on elite (60 times (> 3 m·s^{-2}) [22]) and young (acceleration (> 3 m·s^{-2}): 26 times, deceleration (< 3 m·s^{-2}): 43 times [33]) professional soccer players. In the present study, CD tended to produce the lowest number of accelerations and decelerations compared to the other playing positions, and this is in line with previous research. The current findings may support coaches and sports scientists by extending understanding regarding match-running performance of elite young soccer players and potentially help them to create position-specific training programs.

The current study demonstrated statistically and practically significant positive relationships between the YYIR2 distance and all match-running performance variables when all players were included in the analysis. The current findings agree with previous studies on young soccer players which reported significant relationships between physical capacity (examined with the YYIR1) and match-running performance including total distance and match-running distance at high-speeds, high-metabolic powers and high-intensity accelerations and decelerations [7, 8, 15, 32]. Due to a lack of samples, the previous studies could not assess the relationships between physical capacity and match-running performance across playing positions [7, 8, 15, 32] and it has been argued that a large number of samples are required to detect real systematic differences in match-running performance in soccer as there is a high match-to-match variability [18]. Nevertheless, the current study managed to investigate the associations between physical capacity and match-running performance across playing position in elite young soccer players.

The present study established that the relationships between the YYIR2 and match-running performance can vary across playing position depending on match-running performance variables. The significant relationships between the YYIR2 distance and total distance were found in defenders and CM but not in WM and FW. Some previous studies have shown that YYIR1 distance is positively related to total distance covered during soccer match-play [7, 15], whereas other studies have not demonstrated this relationship [8] While YYIR1 is a more aerobic-based field test compared to YYIR2 [3], these previous studies did not report playing position distribution in detail and a rationale for the discrepancy in the findings may be caused by the differences in playing position distributions since the magnitude of relationships between physical capacity and total distance differs between playing positions [7, 8, 15].

The significant relationships between the YYIR2 distance and HIR and VHIR distance were only demonstrated in a limited playing positions (CD, CM and/or FW). Whereas, significant relationships between the YYIR2 and match-running distance at higher speeds (sprinting and VHIA) were displayed regardless of playing positions. Previous studies which included all outfield playing positions showed significant relationships between the YYIR1 performance and match-running distance at speed zones similar to HIR, VHIR and sprinting in the current study [7, 8, 32]. However, the studies commonly demonstrated a greater magnitude of correlation coefficients when running speeds were greater [7, 8, 32]. This trend can be explained by the current findings. The current study showed that the significant relationships between physical capacity and match-running distance was playing position-dependent when running speeds were slower whereas significant relationships existed in all playing positions when running speeds were faster. Hence, it is understandable that the magnitude of relationships between the physical capacity and match-running distance increases as running speeds increase when all outfield playing positions are included in the analysis. In addition, the trends in the relationships between the YYIR2 distance and match-running distance across playing position was similar when speed approach and metabolic power approach were employed. Therefore, the current results suggest that the YYIR2 is useful for the assessment of match-running distance at high-speeds and high-metabolic powers in all playing positions in elite young soccer players.

There were significant relationships between the YYIR2 distance and number of accelerations (NA>2) in all playing positions. This is in line with a previous study which reported relationships between the YYIR1 distance and distance covered in acceleration and deceleration in young soccer players [15]. However, when the intensity of accelerations was increased (NA>3), the significant relationships were only observed in CD. Moreover, the significant relationships between the YYIR2 distance and deceleration frequency were only observed in midfielders. This result may partly be explained by the fact that accelerations and decelerations are a sensitive measure of fatigue during match-play [2, 22, 33, 38] and the decline in acceleration and deceleration frequencies was observed in CD [10] and CM [38]. On the other hand, it is interesting to see the significant relationships between the YYIR2 distance and deceleration frequency in CM and WM as they have different roles during match-play. CM has unique positional characteristics to link attack and defense within the team [11] whereas WM are often required to produce high-speed runs in order to create goal scoring opportunities [12]. Further studies are warranted to investigate the relationships between the YYIR2 distance and match-running performance related to acceleration and deceleration across playing position.

Acceleration and deceleration frequencies were included as match-running performance variables in the present study because they have previously been suggested as a sensitive indication of fatigue during soccer match-play [22, 33, 38]. Whereas, distance covered [2] and time spent [38] during accelerations and decelerations have been demonstrated to reflect match demands of soccer and distance covered during high-intensity accelerations and decelerations has been shown to relate to physical capacity in 12-16 year old soccer players [15]. Since the match analysis software employed in the current study was designed to only provide the acceleration and deceleration frequencies, future studies should consider an inclusion of other forms of acceleration and deceleration related match-running performance when examining relationships between field test and match-running performance.

Conclusion

The present study suggests that the YYIR2 is a valid field test for the assessment of match-related physical fitness in elite young soccer players regardless of playing positions. Moreover, the YYIR2 performance is a valid indicator of match-running distance at high-speeds and high-metabolic powers in elite young soccer players. However, the relationships between the YYIR2 and match-running performance can differ between playing positions. The YYIR2 distance was significantly associated with total distance in defenders and CM only and was significantly associated with distance covered during lower speeds and metabolic powers in just CD, CM and/or ST. Moreover, the YYIR2 distance was related to the number of accelerations at higher intensity (NA>3) in CD only and was associated with the number of decelerations in just midfielders. Therefore, the YYIR2 should be considered as a useful tool for coaches and sports scientists to monitor physical capacity of elite young soccer players and to guide the players to gain/maintain required fitness to cope with match demands. However, match-running performance variables may need to be selected with an attention when examining the relationships between the YYIR2 and match-running performance. Because they may limit the associations between physical capacity and match-running performance depending on playing positions.

Conflict of interest

Not applicable.

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