Validity and reliability of a 6-a-side small-sided game as an indicator of match-related physical performance in elite youth Brazilian soccer players

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ABSTRACT
The aims of this study were: (i) to compare the external and internal load during a 6-a-side small-sided game (6v6-SSG) according to age-group; (ii) to relate these parameters between the 6v6-SSG and official matches; and (iii) to test the reliability of the 6v6-SSG. A total of 51 Brazilian youth soccer players participated in this study (U11 [n = 16]; U13 [n = 10]; U15 [n = 9]; U17 [n = 8]; U20 [n = 8]). Three experiments were conducted. Experiment A: fifty-one U11 to U20 players were submitted to 6v6-SSGs (n = 10 games; two for each age-group). Experiment B: thirty-two players were randomized to also play official matches (n = 6 matches). Experiment C: thirty-five youth players played the 6v6-SSG twice for test and retest reliability analysis. External load was obtained using Global Positioning Systems and the internal load parameter was calculated through mean heart rate. Statistical approaches showed progressive increases in all parameters according to categories (U11< U13< U15< U17< U20; $p < 0.05$; ES = 0.42–23.68). Even controlling for chronological age, all parameters showed likely to almost certain correlations between 6v6-SSG and official matches ($r = 0.25$–0.92). Collectively, the proposed protocol indicates good reliability (CV % = 2.0-12.6; TE% = 2.3-2.7%; ICC = 0.78-0.90). This research suggests that the 6v6-SSG is an alternative tool to indicate match-related physical performance in youth soccer players.

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Association football; time-motion analysis; construct validity; GPS; sports sciences

Introduction

A variety of methods exist to assess soccer player physical performance, both outside the match context (Stølen, Chamari, Castagna, & Wisløff, 2005), as well as during actual competitions (Carling, Bloomfield, Nelsen, & Reilly, 2008). Traditionally, assessments of the former have mainly been conducted in laboratory settings, e.g., incremental treadmill tests (Cerda-Kohler et al., 2016), the Wingate Anaerobic Test (Meckel, Machnai, & Eliakim, 2009), and the maximal anaerobic oxygen deficit test (Andrade et al., 2015). However, to improve ecological estimations of physical performance, there has been an emergent trend of using field tests to assess physical fitness, e.g., Yo-Yo Intermittent Recovery Test (Yo-Yo IR) (Krustrup et al., 2003), repeated sprint ability test (Impellizzeri et al., 2008), Hoff Test (Chamari et al., 2005), and Footeval (Manouvrier, Cassirame, & Ahmaidi, 2016). In general, these physical fitness tests have various purposes, notably to identify player individual strengths and weaknesses, investigate the effects of training interventions, aid in rehabilitation programs following injury, and profile and monitor youth player development (Svensson & Drust, 2005).

In order to ensure that the protocol and subsequent information gathered from a given physical test have practical meaning, large relationships between the player's physical fitness (derived from laboratory and field tests) and match running performance assessments using time-motion analyses are required, to gain insights into construct validity (Aquino, Palucci Vieira, de Paula Oliveira, Cruz Gonçalves, & Pereira Santiago, 2018). In the 1990s, Bangsbo and Lindquist (1992) were the first to address this issue in professional soccer players. Subsequently, there was a rapid increase in similar research (Buchheit, Mendez-Villanueva, Simpson, & Bourdon, 2010; Castagna, Manzi, Impellizzeri, Weston, & Barbero Alvarez, 2010), mainly related to the growth and availability of a range of portable match-play tracking equipment, e.g., accelerometers, local position measurement, global positioning systems (GPS) (Carling et al., 2008). However, Drust, Atkinson, and Reilly (2007) reported that the match-play running profile is not-continuous; therefore its patterns defy precise modeling and are difficult to replicate or predict, hindering the creation of specific and valid tests outside the match context to evaluate soccer players.

Small-sided games (SSGs) have been widely used as a training methodology in team sports (e.g. soccer)(Hill-Haas, Dawson, Impellizzeri, & Coutts, 2011). Therefore, since SSGs are highly specific and frequently used during the season, an additional practical application could be their use as a fitness indicator, mainly since: (i) more players can be evaluated at the same time; (ii) SSGs involve technical and tactical

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demands; and (iii) players are performing soccer training during the test. Stevens, De Ruiter, Beek, and Savelsbergh (2016) tested this hypothesis and found that SSGs alone cannot be used as a valid and reliable fitness indicator. However, the authors used a field test as the criterion measure (Yo-Yo IR) to relate the external (e.g., GPS measures) and internal (e.g., heart rate) load obtained during the SSGs. With substantial methodological alterations, the aims of the present study, therefore, were: (i) to test the sensitivity of the 6v6-SSG to discriminate external and internal load according to age (U11 to U20); (ii) to evaluate construct validity by relating these parameters between the 6v6-SSG and official matches; and (iii) to test the reliability of the 6v6-SSG.

Methods

Participants

A total of 51 Brazilian youth soccer players participated in this study (U11 [n = 16]; U13 [n = 10]; U15 [n = 9]; U17 [n = 8]; U20 [n = 8]). The sample size was calculated using the correlation coefficients between the Yo-Yo IR2 and running demands reported in a previous study (Stevens et al., 2016) (statistical power = 0.85; alpha = 5%; software G*Power, Dusseldorf, Germany). All measurements were performed in-season as part of the regular testing program of the teams analyzed. The players were members of a professional soccer club that plays in the 1st division of the São Paulo State Championship, Brazil – the leading state-level tournament in the country (Aquino et al., 2016). This study was approved by the Research Ethics Committee of the School of Physical Education and Sport of Ribeirão Preto/USP (CAAE: 61884716.9.0000.5659) and was conducted in accordance with the Declaration of Helsinki. All participants and their legal guardians signed an Assent and Consent Term, respectively.

Experimental design

Three experiments were conducted. First, all 51 players were submitted to 6-a-side small-sided games (6v6-SSG) to investigate the sensitivity of the protocol (n = 10 games; two for each age-group). In this step, we compared external and internal load parameters between U11 to U20 age-groups (Experiment A). Second, thirty-two players were randomized to play official matches according to the official rules of their category (U11: n = 16 players, n = 2 matches; U15: n = 8 players, n = 2 matches; U17: n = 8 players, n = 2 matches). This experiment was performed to test the construct validity of the 6v6-SSG as an indicator of match-related physical performance (Experiment B). Finally, thirty-five youth players (U11: n = 16; U13: n = 10; U15: n = 9) played the 6v6-SSG twice to test and retest (i.e., after seven days) the reliability analysis (Experiment C). During all study phases, each test (6vs6-SSG or official matches) was followed by at least 48-hours of recovery. In addition, all tests were performed on artificial grass (~105 x 68 m) between 09:00 AM and 12:00 AM. Prior to the tests, the players performed a habitual warm-up, consisting of 5-minutes of low-intensity running and 10-minutes of coordinative running (i.e., skipping, dribbling, anfersen, hopserlauf, and kick-out).

Measures

6v6-SSG: the protocol was played including goalkeepers, in 6 × 6 min with 90 s of active rest between periods (playing time: 36 minutes; pitch size = 49 x 25 m). Field size and playing time were adapted from previous studies (Rebelo, Silva, Rago, Barreira, & Krustrup, 2016; Stevens et al., 2016). Consistent coach encouragement was given at all times during the 6v6-SSGs. We recommended the players use the 1–2–2–1 team formation (i.e., goalkeeper – central + external defender – central + external midfielder – forward). All official match rules were applied with the exception of “offside” and yellow/red cards. The coaches organized the players in evenly balanced teams to maintain the competitiveness of the playing teams. The players were familiar with the 6v6-SSG structure from their training routines. Goalkeepers could be involved with the play, but restricted to a maximum of 3 ball possessions (Stevens et al., 2016). For the reliability analysis, the teams were composed of the same players (e.g., test: team A vs. team B; re-test: team A vs. team B).

Official matches: all matches were performed during the in-competitive season. Two matches (i.e., one at home – against top-ranking opponent team [draw]; and one away – against worst-ranking opponent team [won]) were monitored for each age-group (U11: 20′ x 20′ with 10 minutes of passive rest; U15: 30′ x 30′ with 15 minutes of passive rest; U17: 40′ x 40′ with 15 minutes of passive rest), to prevent the possible confounding factor of situational variables (Aquino, Carling, et al., 2018). External and internal measures were obtained (see below). The team formation in all categories was 1–4–4–2 with occasional minor variations. In the U11 category, the corner kick was performed at the intersection between the lateral line and penalty area (Palucci Vieira, Carling, Barbieiri, Aquino, & Santiago, 2019). The players were allowed to drink water and isotonic beverage (6% tangerine-flavored carbohydrate-electrolyte) freely before, during, and after the matches.

External and internal load: external load was measured using GPS technology (Sports®, QSTARZ, BT-Q1300ST, 5 Hz, Taipei, Taiwan). Previous studies have reported good coefficients of variation and error rate, i.e., <5% in all running outputs (Aquino et al., 2018, 2017). In this study, a complementary quality-control assessment was conducted. The players wearing the GPS devices covered a known distance (calculated by tape measure) at different intensities (6, 13, and 15km·h^{-1}). The error rate was <5% for all running categories. The GPS units were attached to the players' shorts. All players used the same unit throughout the study. The 2D reconstruction of the geographical coordinates (latitude and longitude) of each player at each time point were exported to a CSV format file using QSports software (Taipei, Taiwan) for later analysis in Matlab environment (The MathWorks Inc., Natick, USA). The geographic coordinates were converted to Cartesian coordinates (*xy*) and smoothed by a third order Butterworth digital filter (cutoff frequency = 0.4 Hz) for further calculation of the total distance covered (m), high-intensity running (speed thresholds individualized according to distance covered > 60% of peak game speed; U11 [mean≥14 km.h^{-1}], U13 [mean≥15km.h^{-1}], U15 [mean≥16 km.h^{-1}], U17 [mean≥17 km.h^{-1}], U20 [mean≥18 km.h^{-1}]), acceleration (≥ 2 m·s^{2}), and deceleration (≥ −2 m·s^{2})(Castagna, Varley, Póvoas, & D'Ottavio, 2017). The mean heart rate (HR_{MEAN}) was calculated after beat-to-beat monitoring using the Polar Team System (Polar Electro OY, Kempele, Finland) (Hill-Haas, Rowsell, Coutts, & Dawson, 2008).

Statistical analysis

Data normality and homogeneity of variance were checked using the Shapiro-Wilk and Levene tests, respectively. The p-value threshold was pre-fixed at 5% ($p < 0.05$). Comparisons between internal and external load according to age-groups were performed by ANOVA one-way (Experiment A). When necessary, we used the Bonferroni post-hoc and log-transformed data. Partial correlations (to control for the possible effect of chronological age) of Pearson (parametric) and Spearman (nonparametric) were used to assess the relationships between 6v6-SSGs and official matches (Experiment B) according to each age-group. This was performed while controlling for the possible casual relationships between 6v6- SSGs and official matches. The test and retest reliability of the internal and external load parameters was tested using the t-test for dependent samples, coefficients of variation (CV%), absolute and typical percentage error (TE), and intraclass correlation coefficient (ICC). The typical percentage error was obtained by dividing the resulting estimate of the typical error by the mean for the participants in all trials, then multiplying by 100 (Hopkins, 2000). In addition, the smallest detectable difference (SDD) was calculated using the following equation: SDD = [1.96 · √2 · (SD of the test and retest differences · √1 − ICC)](Haley & Fragala-Pinkham, 2006) (Experiment C). The analyses were performed using the software IBM SPSS Statistics for Windows, version 22.0 (Armonk, NY: IBM Corporation®). A magnitude-based inferential (MBI) statistical approach was also used (confidence level = 90%, number of independent inferences = 1; maximum risk of harm = 0.5%; minimum chance of benefit = 25%; benefit/harm odds ratio = 66). Raw data outcomes in standardized Cohen units were used (Effect Size [ES]). Quantitative chances of higher or lower differences were assessed qualitatively as follows: < 1%, almost certainly not; 1 − 5 %, very unlikely; 5 − 25%, unlikely; 25 − 75%, possibly; 75 − 95%, likely; 95 − 99%, very likely; > 99%, almost certain. If the chance of higher or lower differences was > 5%, the true difference was assumed as unclear. Otherwise the effect was deemed clear (Hopkins, Marshall, Batterham, & Hanin, 2009). For greater impact of the results, only likely chances (> 75%) of differences were considered true (Lacome, Simpson, Cholley, Lambert, & Buchheit, 2018).

Results

Experiment A

Table 1 presents the values of the external and internal load obtained during the 6v6-SSGs protocol in the analyzed age-groups (U11 to U20). We observed progressive increases in all parameters according to categories (U11 < U13 < U15 < U17 < U20; $p < 0.05$; ES = 0.42–23.68; *likely-almost certain*).

Experiment B

Figure 1 show the correlation coefficients (r) observed in the relationships between 6v6-SSGs and official matches controlled by chronological age. All parameters showed *likely* to *almost certain* correlations (r = 0.25–0.92). The distance covered in HIR was the best predictor in the relationship between 6v6- SSGs and official matches (r = 0.92; *almost certain*). Within age-groups (Table 2), U11 and U17 players demonstrated *likely* to *almost certain* relations in all variables (r = 0.46–0.98), with the exception of HR_{MEAN} (r = 0.29–0.54; *unclear*). The U15 category showed *likely* to *very likely* relations for TD, DAcHI, and HIR (r = 0.42–0.90), and *unclear* for DDecHI and HR_{MEAN} (r = 0.004–0.05).

Experiment C

In general, Table 3 indicates good reliability of the 6v6-SSG. In relation to CV%, the DAcHI, DDecHI, and HIR demonstrated greater values (CV% = 8.1–12.6); however, TD and HR_{MEAN} presented good reproducibility (CV < 5%). All parameters of external and internal load demonstrated low values of typical percentage error (TE = 2.3–2.7%) and high ICC (0.78–0.89). The test and retest measures did not differ substantially according to statistical analysis ($p > 0.05$; ES = −0.19–0.25; *possibly*).

Discussion

The present investigation was conducted in youth soccer players with the aim of verifying the sensitivity, validity, and reliability of a 6v6-SSG as an indicator of match-related physical performance. The main findings were: (i) the protocol presented sensitivity in discriminating age-related performance (U11 to U20, see Table 1); (ii) even controlling for chronological age, all external and internal measures showed *likely* to *almost certain* correlations (see Figure 1); iii) the

Table 1. Mean (standard deviation) of external and internal load obtained during the 6-a-side small-sided games (n = 10 games; playing time: 36 minutes per game) according to age-groups analyzed (U11 [n = 16 players], U13 [n = 10 players], U15 [n = 9 players], U17 [n = 8 players], U20 [n = 8 players].

Variables	U11	U13	U15	U17	U20
TD (m)	2786.3 (304.6)	3421.6 (382.2)	5699.1 (770.2)	6086.0 (214.9)	6416.3 (149.4)
DAcHI (m)	42.1 (15.1)	75.9 (14.6)	191.4 (51.8)	243.9 (40.9)	298.8 (12.4)
DDecHI (m)	24.7 (10.6)	79.3 (17.7)	160.9 (47.4)	258.4 (34)	298.6 (22)
HIR (m)	179 (57.7)	413.8 (137.7)	447 (40.5)	629.3 (68.7)	757.8 (55.5)
HR_{MEAN} (bpm)	160.8 (5.1)	174.5 (4.1)	188.2 (2.4)	189.4 (2.1)	188.4 (3.3)

Note: TD = Total Distance covered; DAcHI = Distance covered at High-Intensity Accelerations (≥ 2 m.s^{2}); DDecHI = Distance covered at High-Intensity Deceleration (≥ −2 m.s^{2}); HIR = Distance covered at High-Intensity Running (60.1 to 100% of maximum running speed); HR_{MEAN} = Mean Heart Rate.

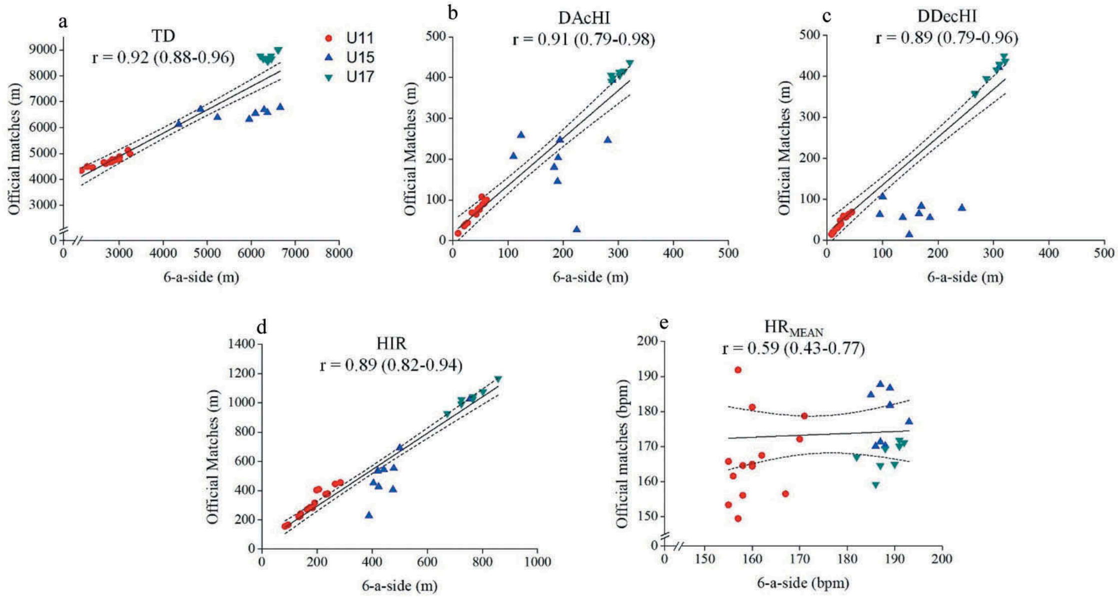

Figure 1. Correlation coefficients (± 90% confidence interval and quantitative chances) of external and internal loads between 6-a-side small-sided games (n = 6 games) and official matches (n = 6 matches) controlled by chronological age. Note: TD = Total Distance covered; DAcHI = Distance covered at High-Intensity Accelerations (≥ 2 m.s^2); DDecHI = Distance covered at High-Intensity Deceleration (≥ −2 m.s^2); HIR = Distance covered at High-Intensity Running (60.1 to 100% of maximum running speed); HR_{MEAN} = Mean Heart Rate.

Table 2. Correlation coefficients (± 90% confidence interval and quantitative chances) of external and internal load measures of the 6-a-side small-sided games (n = 6 games) with official matches (n = 6 matches) per age-group.

	U11			U15			U17		
Variables	r	±90% CI	QC	R	±90% CI	QC	r	±90% CI	QC
TD (m)	0.94	0.06	*almost certain*	0.62	0.45	*likely*	0.71	0.39	*very likely*
DAcHI (m)	0.97	0.03	*almost certain*	0.42	0.21	*likely*	0.92	0.14	*almost certain*
DDecHI (m)	0.98	0.02	*almost certain*	0.05	0.63	*unclear*	0.98	0.04	*almost certain*
HIR (m)	0.96	0.04	*almost certain*	0.71	0.39	*very likely*	0.97	0.06	*almost certain*
HR_{MEAN} (bpm)	0.29	0.40	*unclear*	0.004	0.63	*unclear*	0.54	0.50	*unclear*

Note: TD = Total Distance covered; DAcHI = Distance covered at High-Intensity Accelerations (≥ 2 m.s^2); DDecHI = Distance covered at High-Intensity Deceleration (≥ −2 m.s^2); HIR = Distance covered at High-Intensity Running (60.1 to 100% of maximum running speed); HR_{MEAN} = Mean Heart Rate; 90% CI = Confidence Interval; QC = Quantitative Chance.

distance covered in HIR during the 6v6-SSG explained 84% of the variance in the distance covered in HIR during the official matches; and (iv) the proposed protocol demonstrated good reliability (see Table 3).

Sports scientists continuously address physical tests that are closely linked to match physical demands. Krustrup et al. (2003) reported that high-intensity running (> 18.0 km·h^{-1}) covered by the players during matches was correlated to Yo-Yo test performance (r = 0.71) but not to $\dot{V}O2_{MAX}$ or an incremental treadmill test in professional soccer players. In addition, two previous recent systematic reviews indicated trends of associations between several physical fitness tests (e.g., Yo-Yo IR-1, IR-2; multistage fitness test, Carminatti test, 20-m shuttle run test, Zig-Zag test, Hoff test) and match running performance (e.g., total distance covered, sprinting, high-intensity running) in youth soccer players (Palucci Vieira et al., 2019; Paul & Nassis, 2015). However, one can argue that laboratory and field tests *per se* are not sensitive enough to profile in-match performance (Stølen et al., 2005). This statement is supported by the apparent lack of laboratory/field tests which reproduce construct validity with respect to the motion types, directions, and intensities corresponding to match running demands. Therefore, the representativeness of these tests to predict official match physical demands remains questionable (Drust et al., 2007). Thus, soccer practitioners should use laboratory and field tests to prescribe training sessions (e.g., maximal aerobic speed during incremental tests) and not to predict/associate match-related physical performance.

In contrast, the integrated approach of the SSGs (i.e., including physical and tactical/technical aspects compared to traditional strength and endurance exercises) has been deemed high enough to promote soccer-specific adaptations (Hill-Haas, Coutts, Rowsell, & Dawson, 2009; Hill-Haas et al., 2011), supporting recent criticisms. Recently, Stevens et al. (2016) observed that running demands during small-sided games cannot serve as a valid and reliable fitness indicator for professional and amateur soccer players. Nonetheless, in this study, the 6v6-SSG presented good sensitivity, validity, and reliability to indicate match-related physical performance in youth soccer players. First, as expected, we observed progressive increments in running demands during the 6v6-SSGs across the age-groups analyzed (U11 to U20). Second, we verified positive *likely* to *almost certain* correlations between

Table 3. Reliability analysis for external and internal load obtained during the 6-a-side small-sided games (n = 6 games; playing time: 36 minutes per game).

Variables	Test	Retest	CV%	TE	ICC	SDD	ES	QC
TD (m)	3716.8 (1300.9)	3522.6 (1354.4)	4.4 (2.8)	86.9 (2.4%)	0.89	339.9	−.019	*possibly*
DAcHI (m)	90.2 (68.2)	98.7 (62.4)	10.0 (8.0)	2.2 (2.3%)	0.79	7.7	0.19	*possibly*
DDecHI (m)	75.3 (61.7)	84.1 (66.7)	12.6 (13.2)	1.8 (2.3%)	0.80	6.4	0.22	*possibly*
HIR (m)	315.0 (151.9)	345.2 (163.2)	8.1 (4.7)	8.8 (2.7%)	0.78	33.5	0.21	*possibly*
HR_{MEAN} (bpm)	171.7 (12.2)	175.0 (14.8)	2.0 (1.7)	4.1 (2.4%)	0.87	15.4	0.25	*possibly*

Note: TD = Total Distance covered; DAcHI = Distance covered at High-Intensity Accelerations (≥ 2 $m.s^2$); DDecHI = Distance covered at High-Intensity Deceleration (≥ −2 $m.s^2$); HIR = Distance covered at High-Intensity Running (60.1 to 100% of maximum running speed); HR_{MEAN} = Mean Heart Rate; CV% = Coefficient of Variation; TE = Typical Error Absolute (relative); ICC = Intraclass Coefficient Correlation (all values were *almost certain*); SDD = Smallest Detectable Difference; ES = Effect Size; QC = Quantitative Chance.

running outputs in the 6v6-SSG and official matches (even when controlling for chronological age), especially for distance covered in HIR (explained 84% of the common variance between 6v6-SSGs and official matches). A previous study demonstrated that HIR is one of the best variables to discriminate won vs. lost matches (Aquino et al., 2018); therefore, the current results demonstrated the construct validity of the 6v6-SSG. Third, collectively the protocol demonstrated good reliability. Only the external load related to high-intensity efforts (i.e., DAcHI, DDecHI, and HIR) presented greater values of CV% (CV% = 8.1-12.6), in agreement with previous studies (Hill-Haas et al., 2008; Stevens et al., 2016). These results promote novel insights for coaches and practitioners, primarily by providing scientific evidence that the 6v6-SSG can be useful to indicate match-related physical performance in youth soccer players.

Furthermore, SSGs are frequently used in training routines during the soccer season. Thus, soccer coaches in youth academy should implement the 6v6-SSG utilized in this study during the training session to indicate match-related physical performance, without wasting time with extended periods of physical evaluation. Stevens et al. (2016) complement that SSGs can be used to signal possible limitations in physical endurance fitness of individual players and in case of doubt, additional maximum endurance tests (e.g., Yo-Yo IR) can be performed for the selected player, without having to test all players. However, the external load parameters of the 6v6-SSG are lower (~30–40% depending on the age-group) compared to official matches. Therefore, coaches and practitioners should not use the 6v6-SSG structure to simulate an official game.

We consider two main limitations of this study. First, we used a cross-sectional design. Further studies should adopt repeated assessment during the season and analyze the consistency of the relationships reported in this study. Second, in this study it was not possible to separate the players according to their positional role. In contrast, this study also has some novel aspects: (i) to the best of our knowledge, this is the first study to demonstrate the possible use of SSGs to indicate match-related physical performance in youth soccer players; (ii) external and internal parameters were considered to define physical performance; and (iii) the results proved to be efficient in supporting conditioning coaches during evaluation periods. In addition, we highlighted five crucial points for when clubs opt to use SSGs as a match-fitness indicator: (i) consistent coach encouragement should be given at all times during the 6v6-SSG, as this can improve the reliability analysis; (ii) although the SSGs are better standardized than official matches (e.g., less position-dependent; Stevens et al., 2016), we recommend players use the 1–2-2–1 team formation, and the same teams in the comparisons between two or more moments (e.g., test: team A vs. team B; re-test: team A vs. team B); (iii) all official rules should be applied with the exception of “offside” and yellow/red cards – increasing the representativeness of SSGs with official matches; (iv) in practice, the players often like competitive playing teams, therefore, the coaches and sports scientists should use evenly balanced teams (Hill-Haas et al., 2011); and (v) youth players should be familiar with the 6v6-SSG structure.

Practical application

Physical fitness evaluated outside the match context may well guide training and research, but does not seem to have the best potential to predict match running demands in youth soccer players (Aquino, Palucci Vieira, et al., 2018). Our research suggests that the 6v6-SSG could be an alternative tool to indicate match-related physical performance in youth soccer players, with greater specificity and representativeness (i.e., technical-tactical aspects) than traditional approaches; therefore, coaches and practitioners should include the 6v6-SSGs in physical assessment routines.

Conclusion

The overall aim of our study was to determine whether the use of the 6v6-SSG internal and external load can serve as an indicator of match-related physical performance for youth soccer players. We performed three experiments to test this hypothesis: (i) we compared running demands and HR_{MEAN} according to age-groups (U11 to U20); (ii) we checked the relationships between the 6v6-SSG and official matches; and (iii) we verified the reliability analysis of the protocol used. Collectively, we demonstrated that the 6v6-SSG presented sensitivity, validity, and reliability to indicate match-related physical performance in elite youth Brazilian soccer players.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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