Submitted: 27 March, 2023 Accepted: 25 April, 2023 Published: 30 August, 2023 DOI:10.22514/jomh.2023.074

JOMH
Journal of Men's Health

ORIGINAL RESEARCH

Small-sided game-related physical performance is not influenced by the sprint and power performance of youth male soccer players

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Abstract

The aim of this study was to analyse the effects of sprint and power performance on physical fitness and small-sided game-related physical performance in youth male soccer players, using a median split analysis to separate faster and slower players, and powerful and weaker ones. Thirty youth male soccer players (age = 16.9 ± 1.4 years; height = 174.1 ± 7.1 cm; body mass = 63.1 ± 7.9 kg; % body fat = 15.5 ± 3.2) completed the following physical tests: 40 m linear sprint test, repeated sprint ability (RSA) test, countermovement jump (CMJ), horizontal jump (HJ) and a half-squat (HS) power test. In addition, players completed a 4 *vs.* 4 with goalkeepers small-sided game while external loads were recorded. According to their sprint and HS power performance, players were divided into fast and slow, and powerful and weak. Faster players performed better in 5 m sprint (p = 0.004, Effect Size (ES) = −1.158), 10 m sprint ($p < 0.001$, ES = −1.722), 40 m sprint ($p < 0.001$, ES = −3.268), RSAbest ($p < 0.001$, ES = −2.415), RSAtotal ($p < 0.001$, ES = −2.785), CMJ height (p = 0.032, ES = 0.823) and HJ distance ($p < 0.001$, ES = 1.589), but no significant differences ($p > 0.05$) were found in external loads during small-side games (SSG). In addition, no significant differences ($p > 0.05$) were observed between powerful and weaker players in the fitness tests and SSG-related physical performance. These results highlight the importance of grouping youth soccer players by their sprinting capacity to design specific and individualized training strategies and suggest that SSG-related physical performance is not influenced by their sprint or power performance.

Keywords

Demands; Football; Strength; Velocity; Youth

1. Introduction

Soccer players must cover great distances at different velocities and perform many high-intensity efforts, such as sprints or jumps [1]. Considering that most soccer high-intensity efforts are performed over short distances, the ability to accelerate and decelerate is quite important during soccer match-play [2]. The capacity of soccer players to satisfactorily perform high-intensity activities seems to be related with success in matches [2–4]. However, it could be interesting to know the relationship between isolated physical capacities (*i.e.*, fitness test) and the players' performance during matches to improve and individualize the soccer training process.

Traditionally, the physical performance analysis attending to different capacities has been developed for the whole team [5, 6] or based on the age category [7] or competitive level [8]. Unfortunately, there is no consensus about the influence of physical fitness in physical performance during soccer matches and small-sided games (SSGs) [9, 10]. On the one hand, some studies reported significant associations between sprinting, repeated sprint ability (RSA) and cardiovascular capacity with match-play and SSG external loads in youth and adult players [11–13]. On the other hand, some authors did not report significant relationships between physical performance during test sessions and during matches or SSGs in youth and adult players [13, 14]. Due to this controversy observed in the literature, future studies on this topic are necessary.

Comparisons between faster and slower players have been previously carried out to establish the influence of the strength and power on sprinting capacity [15]. However, it should also be advisable to analyse the impact of players' levels in sprint and power performance on their external loads during SSGs. This could help soccer practitioners to design individualized training strategies towards the specific players' profile, applying the most suitable individual stimulus for each player [16]. In this scenario, the median split analysis could be a key strategy in order to group players with a similar level for a certain physical capacity and then to compare their performance in specific games [3, 17]. Using this approach, a recent study indicates that jumping and sprinting capacity did not influence bout-related variation in running demands for U14 and U16 age categories, although a better jumping performance may let U18 players to cover higher distance at high intensity and perform a great number of accelerations [18].

Unfortunately, there is a lack of evidence analysing whether the SSG-related physical performance of youth players of a similar age with greater sprinting or jumping capacity are different from players with worse performance in these capacities. Therefore, the aim of this study was to analyse the effects of sprint and power performance on physical fitness and SSG-related physical performance in youth male soccer players, using a median split analysis to separate faster and slower players, and powerful and weaker ones. In accordance with previous research [7, 18–20], it was hypothesized that faster and powerful players of a similar age would exhibit better physical performances and higher external loads during the SSG than their counterparts.

2. Materials and methods

2.1 Study design

A cross-sectional comparative study design was used to compare the external loads encountered during the SSG by faster and slower players as well as powerful and weaker ones. The level of physical performance was evaluated using the following physical tests: 40 m linear sprint test (40-LST), RSA test, countermovement jump (CMJ), maximal bilateral horizontal jumps (HJs) and a half-squat (HS) power test. Moreover, participants performed 4 bouts of 4 min with 3 min passive rest between bouts in a 4-a-side SSG with goalkeepers. External loads during SSG were measured using a global positioning system (GPS). Before performing the physical tests and SSG, all participants performed a standardized 20 min warm-up (5 min of low-intensity running, 4 min of high-intensity running, 4 min of jump exercises, 7 min of accelerations and sprints). Participants were asked to avoid any strenuous exercise 48 h prior to physical testing and the SSG. These measurements were carried out in two sessions across two separate days. Jumping and power performance were measured in laboratory conditions (17–22 °C, 60–70% relative humidity) during the first testing day. Players performed the sprinting test and SSG on an outdoor soccer pitch (12–15 °C, 60–70% relative humidity) during the second day. All procedures were carried out in the afternoon (6–8 PM) during November. Once the data were collected, the median split analysis was used to separate players into two groups depending on their sprint-profile (faster and slower) and HS-profile (powerful and weaker) [3, 17, 21].

2.2 Participants

Thirty youth male soccer players (age = 16.9 ± 1.4 years; height = 174.1 ± 7.1 cm; body mass = 63.1 ± 7.9 kg; % body fat = 15.5 ± 3.2) participated in this study. Participants trained 4 times a week and played an official match every weekend. Goalkeepers played the SSG, but they were excluded from the statistical analysis due to their specific tactical role.

2.3 Physical performance tests

Players performed two bilateral CMJs on a platform with infrared rays (Optojump Next, Microgate®, Bolzano, Italy). The passive recovery time between each jump was 45 s. Players were instructed to perform a quickly executed squat to a self-selected depth and then jump as high as possible, maintaining their hands on the hip [22]. CMJ performance was measured using jump height. The best measurements were included in the statistical analysis [23]. The CMJ test showed a between-trial intraclass correlation coefficient (ICC) of 0.741.

Players performed two maximal bilateral HJs with arm swing. Players placed their toes on the starting line, then bent their knees to ~120° as quickly as possible and rapidly jumped as far as possible. A metric tape was used to determine the jump distance (m) [24]. The longest HJs were used for data analysis. The between-trial ICC for the HJ test was 0.919.

The power of the lower limb was measured using the HS power test and following the protocol described by Suarez-Arrones *et al*. [25]. The lower-limb power was the highest mean power obtained during the propulsive phase of a bilateral HS exercise completed with two different loads (30 and 40 kg). Players were asked to perform the concentric phase as fast as possible and to maintain the trunk as straight as possible. Participants firstly performed the HS exercise with 30 kg, and afterwards the same was done with 40 kg. The passive recovery time between each repetition was 2 min. A warm-up with 10 repetitions at loads of 10–15 kg was performed prior to measurements. A Smith Machine (Multipower, Technogym, Cesena, Italy) and a dynamic measurement system were used for the HS power test (SmartCoach Power Encoder SPE-35, SmartCoach Europe AB, Stockholm, Sweden). Then, data were registered with the SmartCoach V5.0.0.20 software (SmartCoach Europe AB, Stockholm, Sweden) to calculate the mean propulsive power for each repetition derived from bar velocity during the HS test. The lower-limb power was expressed in relative terms (HS power = power/body mass).

Participants were assessed over a 40-LST with split times on 5 m (SPR5), 10 m (SPR10) and 40 m (SPR40). Photocell gates (Microgate Polifemo, Microgate®, Bolzano, Italy) were used to record the time. They were placed 0.4 m above the ground. Players started at 0.5 m from the first photocell gate and ran as fast as possible until the 40 m crossing the last photocell. The timer was activated automatically as the players passed through the first gate and split times were recorded at 5, 10 and 40-m. Two sprints with a 90 s passive recovery period between them were completed, and the fastest time was included in the subsequent statistical analysis [23]. 40-LST reported a between-trial ICC of 0.982.

The RSA test consisted of 5 × 30 m repeated sprints interspersed with 30 s of active recovery [26]. The sprint time was measured using photocell gates (Microgate Polifemo, Microgate®, Bolzano, Italy) located at the start and at 30 m. They were placed 0.4 m above the ground. Players were asked to perform the 5 × 30 m repeated sprint as fast as possible. The best sprint time (RSAbest) and the sum of sprint times (RSAtotal) were considered as measurements of RSA performance [27]. The fatigue index associated with change in RSA performance (RSAchange) was calculated using the equation: RSAchange = ((RSA latest – RSA first)/(RSA first)) × 100 [28].

2.4 Small-sided game (SSG)

The SSG was played as a 4 *vs.* 4 with goalkeepers. The SSG was divided into four bouts of 4 min separated by 3 min of passive recovery. According to previous research on skill proficiency in youth soccer [29], the pitch size was 30 × 20 m, resulting in an individual space of 60 m^2 per player. Players were distributed in four teams depending on their role as goalkeeper, defensive and offensive soccer players [30]. Players were asked to win each bout of the SSG as a normal competitive match. Only the following rule modifications were applied: no offside rule; goalkeeper to restart the game after a goal has been scored; and award kick-ins to the opposing side of the player who last touched the ball [31].

2.5 External load monitoring

Data related to external load measures were obtained using 10 Hz GPS devices (WIMU PROTM, RealTrack Systems, Almería, Spain) [30]. The validity and reliability of these devices were reported previously [32]. GPS devices were inserted in a pocket located at the back of a fitted body vest and were activated approximately 15 min before the start of the SGG in accordance with manufacturer's recommendations. Consistent with previous research with youth soccer players [30], distances covered at different speed thresholds were recorded: high-intensity running (HIR; 14.1–21.0 km·h^{-1}) and sprinting (>21.0 km·h^{-1}). The number of total accelerations (Acc) and decelerations (Dec) and distances at different intensity thresholds were monitored as in a previous study [33]: low-intensity accelerations (LAcc; 1–2.5 m·s^{-2}), medium-intensity accelerations (MAcc; 2.5–4 m·s^{-2}), high-intensity accelerations (HAcc; >4 m·s^{-2}), low-intensity decelerations (LDec; −1/−2.5 m·s^{-2}), medium-intensity decelerations (MDec; −2.5/−4 m·s^{-2}), and high-intensity decelerations (HDec; <−4 m·s^{-2}).

2.6 Statistical analysis

Results are reported as means ± standard deviations (SD). The ICC was used to assess the variability within the trials of each physical test [34]. The Shapiro-Wilk test was applied to determine data normality, and the Levene test evaluated homogeneity of variance. A *t*-test for independent samples was used to analyse the differences in fitness and external loads during an SSG between the powerful and weaker players, and between the faster and slower ones. Mean differences for reporting paired comparisons were calculated using the following formula: mean difference (%) = ((mean 1–mean 2)/mean 2) × 100. The Cohen's effect size (ES) was also obtained [35]. The following thresholds were considered to interpret the ES: trivial (<0.2); small (0.2–0.5); moderate (0.5–0.8); and large (>0.8). Data analysis was carried out using the Statistical Package for the Social Sciences (SPSS^{TM} 25.0, Chicago, IL, USA). Statistical significance was established at $p < 0.05$.

3. Results

Table 1 shows the differences in physical fitness and external loads between faster and slower players. Faster players performed better in all fitness tests: 5 m sprint performance (p = 0.004, ES = −1.158, large); 10 m sprint performance (p < 0.001, ES = −1.722, large); 40 m sprint performance (p < 0.001, ES = −3.268, large); RSAbest (p < 0.001, ES = −2.415, large); RSAtotal (p < 0.001, ES = −2.785, large); CMJ height (p = 0.032, ES = 0.823, large); and HJ distance (p < 0.001, ES = 1.589, large). However, no differences were obtained for HS power and RSAchange. Otherwise, no significant differences (p > 0.05) were obtained between powerful and weaker players in the fitness tests (Table 2). In addition, no significant differences (p > 0.05) were obtained between faster and slower players, and between powerful and weaker ones in external loads during the SSG (Tables 1 and 2).

4. Discussion

The aim of this study was to analyse the effects of sprint and power performance on physical fitness and SSG-related physical performance in youth male soccer players, using a median split analysis to separate faster and slower players, and powerful and weaker ones. There is a lack of evidence analysing whether the SSGs' external loads encountered by similarly aged youth players with better sprinting or jumping performance are different from players showing worse values in these capacities. The current results show that faster players performed better in the most of fitness tests, but no significant differences were found in external loads during a 4 *vs.* 4 SSG with goalkeepers. Moreover, no significant differences were observed between powerful and weaker players in the fitness tests and external loads during the SSG. These results highlight the importance of grouping youth soccer players by their sprinting capacity to design specific and individualized training strategies and suggest that SSG-related physical performance is not influenced by their sprint or power performance.

The current results show that faster players obtained better results in fitness tests, confirming that those players able to accelerate faster over short distances (*e.g.*, 5 m) performed better in jumping and sprinting in comparison to slower players [3]. As expected, better performances in both 40 m LST and RSA test were obtained by faster players in comparison to slower ones. Since acceleration and maximal sprint velocity are two relevant components of sprint performance [36], it is not surprising that faster players showed a better acceleration capacity (*e.g.*, 5 m) and sprint performances on short distances (*e.g.*, 10 m), due to the necessity to effectively accelerate over short distances to achieve greater performances in the 40 m LST [3]. In addition, better performance of faster players during the RSA test can be explained by better sprinting skills [28, 37]. With regard to the jump capacity, faster players showed greater performance in both tests (*e.g.*, CMJ and HJ) in comparison to their slower counterparts. This may be explained by the relationship among tests in which the rapid

TABLE 1. Differences in physical performance tests and external loads during SSG between faster and slower players.

	Faster players (n = 15)		Slower players (n = 15)		Pairwise comparisons (faster *vs.* slower players)		
	Mean	SD	Mean	SD	*p*	Mean Difference (%)	ES
Physical performance test							
SPR5 (s)	1.017	0.049	1.089	0.073	0.004*	−0.072	−1.158
SPR10 (s)	1.694	0.053	1.820	0.089	<0.001*	−0.126	−1.722
SPR40 (s)	5.177	0.099	5.615	0.162	<0.001*	−0.438	−3.268
RSAbest (s)	4.307	0.141	4.637	0.133	<0.001*	−0.331	−2.415
RSAtotal (s)	22.330	0.513	23.918	0.622	<0.001*	−1.588	−2.785
RSAchange (%)	3.848	2.933	2.979	3.586	0.474	0.869	0.265
CMJ height (cm)	37.000	4.594	32.280	6.685	0.032*	4.720	0.823
HJ distance (cm)	2.179	0.155	1.967	0.106	<0.001*	0.211	1.589
HS power (w/kg)	3.903	0.506	3.709	0.689	0.389	0.193	0.320
External load SSG							
HIR (m)	209.877	85.228	216.499	92.128	0.849	−3.059	−0.075
Sprinting (m)	10.202	10.287	7.818	6.371	0.740	30.494	0.076
Acc (n)	256.333	43.036	264.333	33.297	0.574	−3.026	−0.208
Dec (n)	253.533	47.251	260.000	35.705	0.676	−2.487	−0.154
LAcc (m)	367.353	74.476	385.437	78.457	0.595	−4.692	−0.120
MAcc (m)	248.023	74.296	228.281	60.243	0.431	8.648	0.292
HAcc (m)	62.064	29.629	52.797	18.578	0.314	17.552	0.375
LDec (m)	254.807	58.754	247.047	47.450	0.595	3.141	0.120
MDec (m)	140.120	38.152	128.460	35.363	0.135	16.083	0.562
HDec (m)	45.688	25.128	52.249	20.586	0.441	−12.557	−0.286

*SD: standard deviation; ES: effect size; SPR5: time to cover a distance of 5 m; SPR10: time to cover a distance of 10 m; SPR40: time to cover a distance of 40 m; RSAbest: best sprint time during the Repeated Sprint Ability test; RSAtotal: total time during the Repeated Sprint Ability test; RSAChange: change in the fatigue index, which relates the first and last sprint; CMJ: countermovement jump; HJ: horizontal jump; HS power: lower limb relative power during half-squat; HIR: distance covered at 14.1–21.0 km·h^{-1}; Sprinting: distance covered at >21.0 km·h^{-1}; LAcc: low-intensity accelerations (1–2.5 m·s^{-2}); MAcc: medium-intensity accelerations (2.5–4 m·s^{-2}); HAcc: high-intensity accelerations (>4 m·s^{-2}); LDec: low-intensity decelerations (−1/−2.5 m·s^{-2}); MDec: medium-intensity decelerations (−2.5/−4 m·s^{-2}); HDec: high-intensity decelerations (<−4 m·s^{-2}); *: Significant level set at $p < 0.05$.*

TABLE 2. Differences in physical performance tests and external loads during SSG between powerful and weaker players.

	Powerful players (n = 15)		Weaker players (n = 15)		Pairwise comparisons (powerful *vs.* weaker players)		
	Mean	SD	Mean	SD	*p*	Mean Difference (%)	ES
Physical performance test							
SPR5 (s)	1.054	0.065	1.051	0.079	0.920	0.003	0.037
SPR10 (s)	1.763	0.096	1.751	0.100	0.725	0.013	0.130
SPR40 (s)	5.429	0.271	5.362	0.251	0.486	0.067	0.258
RSAbest (s)	4.515	0.220	4.429	0.209	0.286	0.085	0.398
RSAtotal (s)	23.203	1.044	23.045	0.947	0.669	0.157	0.158
RSAchange (%)	2.889	2.637	3.939	3.784	0.385	−1.050	−0.322
CMJ height (cm)	34.553	5.544	34.727	6.854	0.940	−0.173	−0.028
HJ distance (cm)	2.082	0.169	2.064	0.175	0.776	0.018	0.105
HS power (w/kg)	4.279	0.299	3.333	0.427	0.001*	0.945	2.563
External load SSG							
HIR (m)	231.577	85.684	194.799	87.798	0.255	18.880	0.424
Sprinting (m)	8.305	8.911	9.715	8.306	0.633	−14.514	−0.107
Acc (n)	262.667	25.424	258.000	48.343	0.743	1.809	0.121
Dec (n)	261.733	15.782	251.800	56.816	0.519	3.945	0.238
LAcc (m)	396.595	55.659	356.195	88.911	0.653	11.342	0.102
MAcc (m)	258.382	57.735	217.921	71.746	0.100	18.567	0.621
HAcc (m)	55.731	24.835	59.129	25.417	0.714	−5.747	−0.135
LDec (m)	268.443	33.977	233.411	62.642	0.161	15.009	0.307
MDec (m)	150.434	29.353	127.146	42.221	0.090	18.316	0.640
HDec (m)	50.411	29.914	47.526	21.287	0.736	6.070	0.124

*SD: standard deviation; ES: effect size; SPR5: time to cover a distance of 5 m; SPR10: time to cover a distance of 10 m; SPR40: time to cover a distance of 40 m; RSAbest: best sprint time during the Repeated Sprint Ability test; RSAtotal: total time during the Repeated Sprint Ability test; RSAChange: change in the fatigue index, which relates the first and last sprint; CMJ: countermovement jump; HJ: horizontal jump; HS power: lower limb relative power during half-squat; HIR: distance covered at 14.1–21.0 $km{\cdot}h^{-1}$; Sprinting: distance covered at >21.0 $km{\cdot}h^{-1}$; LAcc: low-intensity accelerations (1–2.5 $m{\cdot}s^{-2}$); MAcc: medium-intensity accelerations (2.5–4 $m{\cdot}s^{-2}$); HAcc: high-intensity accelerations (>4 $m{\cdot}s^{-2}$); LDec: low-intensity decelerations (−1/−2.5 $m{\cdot}s^{-2}$); MDec: medium-intensity decelerations (−2.5/−4 $m{\cdot}s^{-2}$); HDec: high-intensity decelerations (<−4 $m{\cdot}s^{-2}$); *: Significant level set at $p < 0.05$.*

force application against low loads, such as body weight, is a key factor [38]. For instance, moderate correlations between 15 m and 30 m LST performance and CMJ height were reported when assessing soccer players [38, 39], while correlations between HJ may be higher when related to the 15 m sprint compared with the 5 and 10 m sprints [38]. These results highlight the importance of grouping soccer players by their sprinting capacity to design specific and individualized training strategies, so that strength and conditioning coaches can individualize training using different training principles (*e.g.*, progression, specificity, variation/periodization), load components (*e.g.*, volume, duration, frequency, intensity and density) or training methods (*e.g.*, running-based exercises, technical training, strength/power, plyometric training) based on sprint performance profiles.

With regard to HS power, the current results contrast with those obtained with semi-professional soccer players [20]. These authors found that maximal power attained with 75% and 100% of the body weight in HS was significantly different between the faster and slower players [20]. Considering that different resistance training interventions beyond one maximum repetition (1RM) values may induce different adaptations on the load-velocity relationship [40], the age and competitive level of participants, the previous resistance training and the loads used during HS testing could explain these differences between both studies.

Attending to SSG-related physical performance, the current findings reported no significant differences between faster players and slower ones in external loads during a 4 *vs.* 4 SSG with goalkeepers. These findings are in contrast with those obtained in a previous study, in which a better sprint performance allowed youth players to cover greater distance at cruising and sprinting intensities, a greater distance at HAcc and HDec, a greater number of sprints, and a higher maximum velocity during different SSGs [13]. It is possible that the individual interaction space had influenced these results. These authors used spaces of 100 and 200 m^2 while in this study the players played the SSG reduced to 60 m^2. Thus, further research would be advisable to understand the impact of physical fitness on SSG-related physical performance. This could help practitioners to improve the physical conditioning process in the early stages, which may determine the specific competence of top soccer players [41, 42].

This is the first study in which youth soccer players were divided into powerful and weaker groups according to their HS-profile. Requena *et al.* [20] suggested that relative power obtained in the HS test is a relevant variable related to the 15 m sprint performance in senior soccer players. This may be explained by the similarity of movement patterns between the HS and the jumps, so a smaller difference between HS and jump performance than between HS, sprint and RSA might be expected in powerful players. However, the current findings do not support this idea, since no significant differences between powerful and weaker players in the fitness tests were observed. HS, jump and LST are multi-joint exercises in which plantar flexors and knee and hip extensor muscle groups are the principal agonist muscles [43]. Nevertheless, biomechanical variances (*i.e.*, time to apply force, range of movement) exist between them and may be the underlying factors that explain the absence of differences between powerful and weaker players. In addition, high-intensity actions (*e.g.*, sprint, jump) depends on fast twitch motor units' activation from lower-limb extensor muscles [43, 44], so it may be speculated that neural drive required during the HS test was meaningfully altered with respect to other fitness tests. This could also explain the absence of significant differences between powerful and weaker players in the fitness tests.

No significant differences were observed between powerful and weaker players in the external loads during the SSG. A previous study divided players into powerful and weaker groups depending on their CMJ profile [18], indicating that sprinting and jumping capacity did not influence bout-related variation in running demands for U14 and U16 age categories, although a better jumping performance may let U18 players to cover higher distance at high intensity and perform a great number of accelerations. However, differences in the mode of exercise (*i.e.*, CMJ *vs.* HS), in protocols used (*i.e.*, methods for calculating power, procedures for monitoring external loads) and in SSGs played make it difficult to compare between studies. It could be hypothesized that the previous resistance training and the low loads using during HS testing (30 and 40 kg) influenced the determination of the powerful and weaker players [40], which are not related to the demands of the SSGs. The players cover distances at different velocities and perform a great number of high-intensity actions during the SGG by applying force against their body weight, and not against an external load as in the HS test. Therefore, the CMJ seems to be more appropriate to differentiate between powerful and weaker players when the objective is to compare the SSG-related physical measures between both groups [18]. Further research should confirm this hypothesis.

One limitation of the current study was the sample characteristics and the SGG format, so it remains questionable whether these results may extend to senior or female players playing in similar or different SSG formats. Another limitation was the number of players measured in the current study. It would be interesting to include more participants and different SSG formats in order to obtain more generalizable results. A further limitation was the absence of internal loads measurements (*e.g.*, heart rate derived-metrics, rating of perceived exertion and well-being metrics). Considering the relevance of change of direction and RSA in soccer, further studies are also required to analyse whether players with better change of direction and RSA performance exhibit similar or different SSG external loads. Additionally, it may be useful to use different machine-learning algorithms, such as random forest clustering, to group players according to their fitness level and based on the interaction of different physical capacities.

5. Conclusions

The findings of the current study indicate that faster players performed better in most of the fitness tests, but no significant differences were found in external loads during a 4 *vs.* 4 SSG with goalkeepers. In addition, no significant differences were observed between powerful and weaker players in the fitness tests and SSG-related physical performance. These results highlight the importance of grouping youth soccer players by their sprinting capacity to design specific and individualized training strategies and suggest that SSG-related physical performance is not influenced by their sprint or power performance.

AVAILABILITY OF DATA AND MATERIALS

Due to privacy and ethical concerns, authors do not have permission to share data.

AUTHOR CONTRIBUTIONS

DC and JRG—study design/planning. DC, SSD and JRG—data collection/entry. DC, DMJ and JRG—data analysis/statistics, data interpretation, literature analysis/search, preparation of manuscript. SSD—review of manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was conducted in accordance with the Declaration of Helsinki (2013) and was approved by the Ethics Committee of University Isabel I before recruitment (FUI1-PI002). Prior to the start, parental or tutors written informed consent was obtained, and all participants volunteered to participate in the study.

ACKNOWLEDGMENT

Authors would like to thank the Burgos Promesas Football Club for their participation and cooperation in this study.

FUNDING

The project leading to these results has received funding from “La Caixa” Foundation (ID 100010434) and Caja de Burgos, under agreement LCF/PR/PR18/51130008. Javier Raya-González was supported by a Ramoń y Cajal postdoctoral fellowship (RYC2021-031072-I) given by the Spanish Ministry of Science and Innovation, the State Research Agency (AEI) and the European Union (NextGenerationEU/PRTR).

CONFLICT OF INTEREST

The authors declare no conflict of interest. Daniel Castillo is serving as one of the Editorial Board members of this journal. We declare that Daniel Castillo had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to DAM.

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How to cite this article: Daniel Castillo, Diego Marqués-Jiménez, Silvia Sánchez-Díaz, Javier Raya-González. Small-sided game-related physical performance is not influenced by the sprint and power performance of youth male soccer players. Journal of Men's Health. 2023; 19(8): 76-83. doi: 10.22514/jomh.2023.074.