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Original Article

The effect of small-sided games with different dimensions as warm-up on muscle power, agility, and repeated sprint performance in young soccer players

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Abstract
Objective: Warm-up protocols play an important role in enhancing athletic performance, minimizing injury risk, and preparing athletes for higher training intensities. In soccer, an effective warm-up is particularly important for optimizing players' performance. Despite this, there is limited research on the use of small-sided games as a warm-up strategy for young soccer players. This study aimed to investigate the effects of warm-up using small-sided games with different dimensions on muscle power, agility, and repeated sprint ability. Approach: Twelve male soccer players under 15 years of age (mean age: 13.0±1.2 years; body mass: 50.3±13.2kg; height: 158.7±11.2cm) participated in this study. The players completed three different warm-up protocols: a traditional soccer warm-up, a warm-up involving small-sided games on a 15 m×15 m field, and a warm-up with small-sided games on a 30 m×15 m field. Eight minutes after each warm-up condition, performance assessments were performed, including the standing long jump, the agility T-test, and the repeated sprint test (12.5 m×12.5 m). The rate of perceived exertion (RPE) was also recorded eight minutes after warm-up. On a separate day, a body composition analysis was performed. Results: The RPE differed significantly between the conditions (traditional: 12.1±1.1; 15×15: 13.9±0.8; 30×15: 15.9±0.7; p=0.001). The standing long jump performance was significantly improved after the 30 m × 15 m small-sided game compared to the traditional warm-up (1.90±0.6 m vs. 1.83±0.5 m; p=0.001), while no significant differences were observed for the agility T-test or repeated sprint ability time trials. Significant correlations were identified between the percentage of body fat and agility T-test performance ($r>0.769$, $p<0.05$) as well as the best time trial in the repeated sprint ability test ($r>0.686$, $p<0.05$). Additionally, significant correlations were observed between long-jump performance and agility T-test results ($r>-0.654$, $p<0.05$), as well as the best time trial in the repeated sprint ability test ($r>-0.667$, $p<0.05$) across all three conditions. Conclusions: These findings suggest that a warm-up using 30 m × 15 m small-sided games can significantly enhance lower body power but also induces higher RPE exertion compared to traditional warm-ups and 15 m×15 m small-sided games. Moreover, body fat appears to be a limiting factor for power and sprint performance in young soccer players, highlighting the importance of careful attention to training and daily nutrition. Additionally, the standing long jump is a useful predictor of agility and repeated sprint performance in young soccer players.
Key Words: Long-jump, body fat, young players, lower-body power

Introduction

Soccer is an intermittent team sport characterized by several high and low intensity muscle actions including running, sprinting and jumping as well as by numerous technical skills like kicking the ball, dribbling the ball and passing the ball. Soccer is also a tactical game, where players perform specific movements inside the pitch in an attempt to enhance both the offensive and defensive positions of the whole team. During soccer game players cover approximately 10-13km from which the 185-190m may be covered with maximum sprinting velocity (Modric et al., 2022). Moreover, players cover approximately 418-568m with high intensity running and perform approximately 100-150 accelerations and decelerations (Nobari et al., 2022; Rey et al., 2023; Varley & Aughey, 2013). Consequently, performance in soccer depends on the physical condition of players as well as on their technical skills and tactical plan. However, these gaming demands require a good preparation of players before training and competition in order to enhance in field soccer performance.

One common strategy to prepare players for training and competition is the warm-up. Warm-up is an integral part of the training process which may enhance player's performance (Fradkin et al., 2010). Several physiological changes may occur during warm-up such as an increase in muscle temperature, an increase in blood flow at the periphery, and consequently an increase in neuromuscular performance (Bishop, 2003). On the basis of the latter, the presence of the post-activation performance enhancement (PAPE) phenomenon seems to acutely increase athletic performance mainly by increasing the phosphorylation of myosin light chains in the

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sarcomeres, thus increasing the recruitment of higher threshold motor units and possibly the modification of the fascicle angle of the recruited muscles (Tillin et al., 2009; Boulosa, 2021; Wilson et al., 2007). From a practical perspective, the warm-up in soccer is separated into the general and the specific warm-up. The general warm-up includes low-intensity exercises such as running and static stretching, aiming to increase muscle temperature, general flexibility and the readiness of the player. On the contrary, the specific warm-up aims to progressively increase the intensity of exercises by adding dynamic stretching and high-intensity sport-specific exercises (Ioannides et al., 2023). In soccer, several teams follow the warm-up guidelines from FIFA 11+ (Bizzini et al., 2013; Nuhu et al., 2021) or the sports metrics warm-up for injury prevention and performance (Grandstrand et al., 2006). These warm-up protocols include sub-maximum aerobic actions, static and dynamic stretching exercises as well as strength, plyometric and balance exercises for injury prevention (Soligard et al., 2010). In addition, high intensity exercises like sprints, change of directions and plyometrics are often used while soccer game specific exercises such as the small-sided games (SSGs) may included. However, the implementation of SSG as a warm-up strategy in soccer has not been adequately investigated.

During the past decades, SSGs have become a useful training tool to enhance training variety in several team sports and especially in soccer (Clemente et al., 2012; Hill-Haas et al., 2011). SSGs are characterized as game-based training aiming to simultaneously enhance several technical, tactical and physical fitness attributes of the players (Clemente and Sarmento, 2020; Bujalance-Moreno et al., 2018). Indeed, a systematic review on SSGs in soccer players showed that SSGs may lead to a significant enhancement of sprint, repeated sprint ability (RSA) and change of direction accompanied by muscular and physiological adaptations (Bujalance-Moreno et al., 2018). Although SSGs are well known for their benefits on player's performance, the evidences are scarce regarding the use of SSGs as a tool for warm-up young players. A study on 10 male, amateur soccer players investigated the effects of warm-up with a team-sport warm-up protocol or with two high intensity warm-up protocols including 5-RM in leg press and a SSG. The study showed that both high intensity warm-up protocols induced greater increases in power and repeated sprint tasks compared to the team-sport warm-up condition (Zois et al., 2011). More recently, a study on 20 male, amateur soccer players examined the effects of warm-up with SSGs and a traditional soccer warm-up protocol on physical fitness qualities in soccer. The results of the study showed that SSGs were more effective at improving change of direction and countermovement jump performance whilst, the traditional warm-up induced significant increases only in linear speed (Thapa et al., 2023). These studies suggest that SSGs may have a beneficial role in warm-up, although it remains uncertain whether SSGs with different dimensions may enhance power, agility and RSA in young soccer players.

Body composition is a crucial physiological variable that affects the physical fitness performance of soccer players. Although fat-free mass is a strong factor for performance, excess percentage of body fat has been shown to decrease sprinting, jumping, throwing and agility tasks in individual and team sports (Whittington et al., 2009; Kyriacou-Rossi et al., 2024). Similarly, percentage body fat seems to be a limiting factor for performance in soccer. Specifically, a study on 136 young soccer players investigated the effects of percentage body fat on physical fitness. The study showed that percentage body fat was negatively correlated with aerobic capacity ($r = -0.44$), with maximal anaerobic power ($r = -0.47$) and with local muscle endurance ($r = -0.67$) (Nikolaidis, 2012). These negative correlations suggest that percentage body fat may be a limiting factor for soccer performance especially in youth. Whether these relationships may regulate lower body power, agility and RSA in young soccer players needs further investigation.

The purpose of the study was to investigate the effects of SSGs with different dimensions on power, agility and RSA in young soccer players as well as to explore the relationship between percentage body fat and physical fitness. The hypothesis of the study was that warm-up with SSGs will induce significantly greater increases in power, agility and RSA compared to the traditional soccer warm-up, while percentage body fat would be a limiting factor for physical fitness in young soccer players.

Materials and Methods

Participants

Twelve young male soccer players (age: 13.0 ± 1.2 years; body mass: 50.3 ± 13.2kg; body height: 158.7 ± 11.2cm; body mass index = 19.7 ± 3.1kg·m^{-2}; body fat: 19.7 ± 4.7%) with 4.3 ± 2.8 years of training experience, participated in the study. Players were recruited from the same soccer club competing in the U15 local division. From the total of 12 players, three were forwards, four were midfields and five were defenders. For being eligible to participate in the study, players should meet the following criteria: absence of any nutritional supplements, regular participation in soccer training and official games during the two previous years, and free from any cardiovascular diseases and musculoskeletal injuries. Athletes and their legal guardians were fully informed about the experimental procedures and signed an informed consent while a parental consent form was also obtained. All procedures were in accordance with the 1975 Declaration of Helsinki as revised in 2000 and were approved by the University ethics committee of the Democritus University of Thrace (project number Α.Π.Δ.Π.Θ./Ε.Η.Δ.Ε./48168/351).

Experimental Design

This study focused on the investigation of warm-up with different SSG dimensions on power, agility and RSA in young soccer players. All players followed the three different warm-up conditions including the traditional warm-up (Control), the SSG15x15 which was the small side dimension condition and the SSG30x15 which was the large side dimension condition. All warm-up conditions were randomly performed during a 10 day experimental period with at least 72 h of rest between interventions (Figure 1). Players visited the training facilities on four different occasions. During the first day, anthropometric characteristics and a familiarization training session including the long-jump, the T-Test agility time trial and the RSA time trial measurements was performed, in that exact order. Then, during the next three experimental days, players were randomly assigned into the three different warm-up conditions and performed the C, SSG15x15 and SSG30x15 warm-up interventions. Following the warm-up interventions, players performed the long-jump, the T-Test agility and the RSA time trials. At the end of the experimental procedures, all players had completed the three different warm-up conditions. Changes in long-jump, T-Test agility and RSA time trials were compared between C, SSG15x15 and SSG30x15.

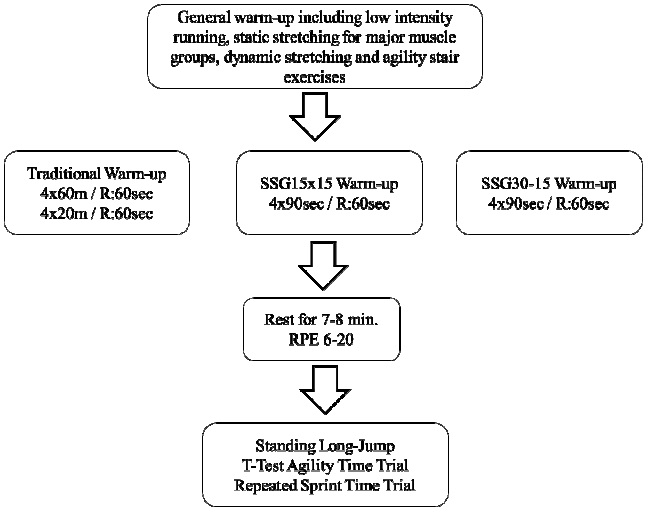

Fig. 1 Experimental design of the study. All warm-up conditions were randomly performed.

Warm-up strategies

All warm-up conditions were performed during the competition training period. When the study was conducted, players performed approximately 3-4 training sessions per week, which included soccer drill training, cardiovascular endurance exercise, body mass resistance training and plyometrics. In addition, players participated at least in one official soccer game every weekend. In order to minimize circadian influences, all warm-up conditions and tests were performed at the same time of the day. During the day of measurement all players followed the same general warm-up before applying the specific warm-up condition. The general warm-up consisted of low intensity running, static and dynamic stretching and agility-stair exercises. Then, players followed one of the three different warm-up strategies including the C, the SSG15x15 and the SSG30x15 as presented in Figure 1. During the C warm-up players were instructed to progressively increase their sprint velocity during the 60 m sprints and to perform maximal sprint during the 20m distances. In addition, the two different SSGs were design to be either 225m^2 (15m x 15m) or double the area covered by 450m^2 (30m x 15m). During both SSGs conditions a 3x3 player's scheme was designed and the aim was the ball possession. Players were verbally encouraged to keep moving and running inside the sided area. Extra balls were used in order to minimize the rest period when the ball falls out of the field. At the end of each warm-up condition, 7-8 min of rest was allowed for players since previous studies have shown that this is a sufficient period of rest to enhance performance following a sport-specific dynamic warm-up (Tillin et al., 2009; Ioannides et al., 2024). At the end of the 8 min rest period, the players provided their personal rate of perceived exertion (RPE) on a scale of 6-20. During all warm-up conditions, a certified strength and conditioning researcher was present to vocally encourage players to perform their maximum efforts.

Anthropometric characteristics and body fat

During the morning hours of the first day, soccer players visited the laboratory for the anthropometric characteristics and the percentage body fat evaluations. Evaluations begun with the body mass on a portable scale and then body height measurement followed. All measurements performed twice. Following the anthropometric measurements the percentage body fat was evaluated via a bioelectrical impedance analysis scale (MC-780A; TANITA, Tokyo, Japan). Players were instructed to fasten for 8 hours before the body fat measurement. Thereafter, a familiarization session followed for all performance measurements. The intra-class correlation coefficient (ICC) for percentage body fat was 0.988 (95% confident intervals (CI): Lower = 0.94, Upper = 0.99).

Standing long-jump

Seven to eight minutes following each warm-up condition, players performed the standing long-jump test. All players were familiar with this test since they frequently performed standing long-jumps during their training sessions. Specifically, all players placed their feet in parallel position behind the measuring tape. From this position players were instructed to push with their lower body and jump with arm swing as long as possible (Zaras et al., 2019). Three maximum standing long-jump trails were performed with one minute of rest between each trial. The distance of the best jump was measured to the nearest cm from the take-off point to the mark where the heels landed on the field. Marks were placed on the side of the measuring tape as a goal-reaching feedback. The longest jump was recorded and included into the statistical analysis. The ICC for the standing long-jump was 0.96 (95% CI: Lower = 0.88, Upper = 0.99).

Agility T-Test time trial

Immediately after the standing long-jump, players performed the T-Test agility time trial. Players were instructed to start from a standing position approximately 50cm behind the photocell. For the evaluation of time performance, a photocell gate system was used (Microgate, Race-time2, kit-system, Italy). Players performed 2 attempts with maximum velocity with 3 min of rest between each trial (Panteli et al., 2023). The best time-trial was used for the statistical analysis. The ICC for the T-Test was 0.94 (95% CI Lower = 0.82, Upper = 0.96).

Repeated sprint time trial

Following the T-Test agility time trial, players rested for 3 minutes and then, they performed the RSA test. Players performed six repetitions of maximal 25m sprints including a 180º change of direction in each 12.5m (Buchheit et al., 2010) departing every 25sec. Similar to the agility T-Test a photocell gate system was used (Microgate, Race-time2, kit-system, Italy). Players performed 6 sets of maximum sprints with a 20-sec rest between sprints. Between each sprint, players rested passively while 5 seconds prior to the commencement of each sprint, players were instructed to get their position and listen to the signal of the researcher. Players were instructed to complete all sprints as fast as possible, while strong verbal encouragement was provided during all sprints. From the RSA time trial the best time trial, the total time of sprints, the mean time of all sprints and the percentage sprint decrement were used for the statistical analysis. The ICC for the RSA test was 0.93 (95% CI Lower = 0.72, Upper = 0.98).

Statistical Analysis

All variables are presented as mean ± SD. Following the Shapiro–Wilk test, all data were normally distributed. A 3-way analysis of variance for repeated measures was used to examine differences between control, SSG15x15 and SSG30x15 warm-up strategies. Effect size eta squared (η^2) was also calculated. Correlations between variables were performed with Pearson-r correlation coefficient. The reliability of all measurements was determined with a 2-way random effect intra-class correlation coefficient and confidence intervals. Significance was set at $p \leq 0.05$.

Results

All players completed all warm-up conditions and measurements without injuries. A significant main effect was found for RPE (Wilks' Lambda = 0.023, $F_{(2,10)} = 213.2$, $\eta^2 = 0.977$, $p = 0.001$). More specific, significant difference was found between C with SSG15x15 (12.1 ± 1.1 vs. 13.9 ± 0.8, p = 0.001), and with SSG30x15 (12.1 ± 1.1 vs. 15.9 ± 0.7, p = 0.001). In addition, RPE following warm-up with SSG30x15 was significantly higher compared to SSG15x15 (p = 0.001). Significant main effect was found for standing long-jump (Wilks's Lambda = 0.256, $F_{(2,10)} = 14.6$, $\eta^2 = 0.744$, p = 0.001). More specific warm-up with SSG30x15 induced greater increases in standing long-jump compared to C (SSG30x15: 1.91 ± 0.21m vs. C: 1.83 ± 0.18m, p = 0.015) (Figure 2). No significant difference was found between SSG15x15 (SSG15x15:1.86 ± 0.18m) with C or with SSG30x15 (p > 0.05).

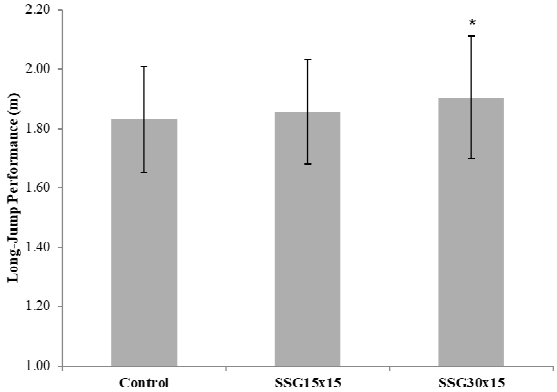

Fig. 2 Changes in standing long-jump performance following control, SSG15x5 and SSG30x15 warm-up conditions. *P < 0.05. Indicates significant difference between SSG30x15 and Control.

Table 1 presents the results from the agility T-Test and from the RSA time trials. No significant change was observed in agility T-Test time trial between the three different warm-up conditions (Wilks' Lambda = 0.638, $F_{(2,10)} = 2.841$, $\eta^2 = 0.362$, $p = 0.105$). In addition, no differences were observed for the variables of RSA time trial. More specific, no significant difference was found for the best time trial (Wilks' Lambda = 0.812, $F_{(2,10)} = 1.160$, $\eta^2 = 0.188$, $p = 0.352$), for the total RSA time (Wilks' Lambda = 0.663, $F_{(2,10)} = 2.546$, $\eta^2 = 0.337$, $p = 0.128$), for the average RSA time (Wilk's Lambda = 0.712, $F_{(2,10)} = 2.256$, $\eta^2 = 0.312$, $p = 0.130$) and for the percentage RSA decrement (Wilks' Lambda = 0.958, $F_{(2,10)} = 0.216$, $\eta^2 = 0.042$, $p = 0.809$).

Table 1. Results in agility T-Test and repeated sprint ability time trials following the three different warm-up strategies.

	Control	SSG15x15	SSG30x15	p
T-Test (sec)	11.35 ± 0.79	11.66 ± 0.76	11.61 ± 0.72	0.105
RSAbest (sec)	5.72 ± 0.38	5.64 ± 0.33	5.68 ± 0.32	0.352
RSAtotal (sec)	35.17 ± 2.3	34.68 ±2.09	34.81 ± 1.95	0.128
RSAaverage (sec)	5.86 ± 0.38	5.78 ± 0.34	5.80 ± 0.32	0.130
%RSA	2.48 ±0.81	2.39 ± 1.1	2.19 ± 0.9	0.809

SSG = small-sided game, RSA = repeated sprint ability

Correlational analysis revealed significant relationships between variables during all three conditions. More specific, significant correlations were found between percentage body fat with agility T-Test and RSA time trials following all three conditions (Table 2). In addition, standing long-jump was significantly correlated with agility T-Test and RSA time trials (Table 2). Correlations between percentage body fat and standing long-jump were not significant (C: $r = -0.336$ $p = 0.286$; SSG15x15: $r = -0.379$, $p = 0.201$; SSG30x15: $r = -0.473$, $p = 0.121$). Moreover, the correlations between the percentage body fat and standing long-jump with the percentage RSA decrement were not significant ($p < 0.05$).

Table 2. Correlation coefficients between body fat and standing long-jump with agility T-Test and repeated sprint ability time trials.

		T-Test	RSAbest	RSAaverage	RSAtotal
Percentage Body Fat	Control	0.775**	0.702*	0.725**	0.725**
	SSG15x15	0.819**	0.686*	0.773**	0.773**
	SSG30x15	0.769**	0.819**	0.825**	0.825**
Long-Jump	Control	-0.718**	-0.667*	-0.727**	-0.727**
	SSG15x15	-0.654*	-0.755**	-0.735**	-0.735**
	SSG30x15	-0.761**	-0.799**	-0.799**	-0.799**

**. Correlation is significant at the 0.01 level (2-tailed), *. Correlation is significant at the 0.05 level (2-tailed). RSA = repeated sprint ability, SSG = small sided game.

Discussion

The purpose of the study was to investigate the effects of SSGs with different dimensions as warm-up on power, agility and RSA in young soccer players. The hypothesis was that SSGs would induce greater increases in physical fitness. The main finding of the study was that SSG30x15 increased significantly standing long-jump performance compared to C, but induced higher RPE scores compared to both C and SSG15x15. Moreover, agility T-Test and RSA time trials remained unchanged following the SSGs warm-up protocols. Therefore, a SSG warm-up in young soccer players may induce positive adaptations in lower body power but not in more complicated mechanical movements like agility and RSA. In addition to these results, the study also found that percentage body fat is a limiting factor for performance while standing long-jump may be a useful test for predicting agility and RSA performance in young soccer players. Interestingly, these correlations had repeatability following all three warm-up conditions, which underpins the importance of reducing percentage body fat in an attempt to enhance physical fitness and as a consequence soccer performance in youth.

During a soccer game, players perform a combination of powerful movements including sprinting, kicking, jumping and changing of directions as well as accelerations and decelerations (Stølen et al., 2005). These powerful movements have a direct connection with lower body power production. In the current study, standing long-jump was significantly increased following the SSG30x15. Standing long-jump considered being a lower body powerful movement frequently used by several individual and team sport athletes (Zaras et al., 2019; Katis and Kellis, 2009). Standing long-jump is an easy-to-use power test which may be utilize either as a lower body test or as a training tool to enhance lower body muscle power. According to the author's knowledge, this is the first study to investigate the effects of SSGs as warm-up strategy on standing long-jump performance in young soccer players. Previous study have used the countermovement jump as a lower body power test, and found that SSGs with increasing field dimensions may lead to an increase vertical jump height by 6% (Zois et al., 2011). In line with the above results, warm-up with a SSG (15m x 15m) may increase vertical jump by 6.8% in a group of male soccer players (Thapa et al., 2023). In the current study the enhancement in standing long-

jump following the SSG15x15 condition was not significant (percentage increase 1.5 ± 3.6%), however, SSG15x15 maintain performance and did not induce any negative effects on lower body power production. Consequently, coaches may use the SSGs as useful tool during warm-up in an attempt to enhance lower body power in young soccer players.

SSG30x15 induced significantly higher RPE compared to SSG15x15 and C. RPE is a valuable index for monitoring training loads and understanding the intensity level of an exercise (Mcguigan & Foster, 2004). Previous studies have showed that when the ratio between the number of players and the SSG covered area is increased then, RPE is also increased (Kelly & Drust, 2009; Köklü et al., 2013). More specific, a study on 16 young male soccer players showed that as the dimensions of the SSGs were increased RPE values were also increased (Köklü et al., 2013). These results are in agreement with the findings of the current study since the higher RPE value was found for the SSG30x15. SSGs with larger dimensions may increase the physiological demands and movements of players (with and without the ball) leading to the conclusion that energy expenditure might be significantly higher (Köklü et al., 2011). In warm-up, coaches and athletes should preserve their energy for the upcoming training or competition (Bishop, 2003). Consequently, coaches should be aware when designing the warm-up with SSGs in terms of number of players and dimensions of the pitch.

Although standing long-jump increased following the SSG30x15 compared to C, no significant changes were found for agility T-Test and RSA time trials following the SSGs conditions. In contrast to the findings of the present study, results from previous studies have showed that agility was significantly enhanced following SSGs during warm-up (Zois et al., 2011; Thapa et al., 2023). We can only hypothesized that the absence of significant increases in these performance tests might be due to the combination of the rest period between warm-up and performance measurements as well as by the mechanical difficulty of these tests compared to the standing long-jump. Although players had 7 to 8 minutes of rest between the warm-up protocols and the performance measurements, this time of rest might not be sufficient for our young players so that the positive PAPE effects may appear (Wilson et al., 2012). In addition, both agility T-test and RSA have a significantly higher difficulty in mechanical execution and a greater metabolic demand compared to the standing long-jump. However, a negative effect was found for all time trials which did not reach the statistical significance. Consequently, in young soccer players perhaps a longer time of rest or a different dimension of SSG during warm-up might lead to a significant enhancement in agility and RSA. Nevertheless, future studies are needed to investigate these hypotheses.

Body composition and especially percentage body fat is a crucial variable that may negatively affect physical fitness and performance in both individual and team sport athletes (Whittington et al., 2009; Kyriacou-Rossi et al., 2024). Indeed, the results from the current study showed significant correlations between percentage body fat and performance with standing long-jump, agility T-Test and RSA time-trials. Interestingly, these correlations had repeatability following all three warm-up conditions (Kelekian et al., 2022). A study on 136 young soccer players showed significant negative correlations between percentage body fat and performance in aerobic capacity, maximal anaerobic power and local muscle endurance (Nikolaidis, 2012). From a practical perspective, excess percentage body fat may have a limiting role in physical fitness of young soccer players and as a consequence may deteriorate soccer performance. Coaches should regularly evaluate player's body composition and in communication with parents and nutritionists may adjust player's nutritional habits to reduce or maintain their body fat to the levels that it will not interfere with their soccer performance. Moreover, an interesting finding of the study was the positive correlations between standing long-jump and performance in agility T-Test and RSA time trials. Again, these correlations had repeatability following all warm-up conditions. As mention above, standing long-jump is an easy-to-use test and may easily depict changes in lower body muscle power. Similar to the current findings, studies on individual and team sport athletes have shown significant correlations between standing long-jump and physical fitness attributes (Zaras et al., 2019; Kyriacou-Rossi et al., 2024). Therefore, coaches may use the standing long-jump as a practical test to predict agility and RSA as well as to use it as a training tool in an attempt to enhance lower body muscle power.

This study has some limitations. The small sample size and the young age of the players may limit the generalization of the results in older and more experience players. In addition, it was not possible to measure muscle temperature or neural activation which might have provided a better insight into the nature of the results. Moreover, it is unknown how long these benefits from SSGs warm-up will last during the soccer game. In addition, locomotor activity data during the SSGs warm-up was not possible to measure due to the absence of a global positioning system. However, all experimental procedures were performed during the competition training period where players were expected to be at their best physical performance. More studies are needed in order to investigate the effects of SSGs with different dimension as a warm-up strategy on physical fitness of soccer players.

Conclusions

The results of the current study suggest that warm-up with SSG30x15 may enhance standing long-jump performance but will induce greater RPE compared to SSG15x15 and C. In addition, warm-up with SSGs may not significantly enhance agility T-Test and RSA time-trial although, a negative effect was found for all time

trials which did not reach the statistical significance. Moreover, percentage body fat is a limiting factor for physical fitness and soccer performance of young players. Regular monitoring of body composition and adjustment's in daily nutrition should be performed in an attempt to enhance soccer performance. Standing long-jump is a good predictor of agility and RSA. Consequently, coaches may use it effectively to predict time-trial performance or as a training tool to enhance lower body muscle power.

Conflicts of interest: The authors declare no conflict of interest.

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