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The Effect of Small Sided Games Training on Increasing Speed and Agility in Football Players Aged 13-15 Years

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Abstract

Study purpose. The modern game requires excellent speed and agility in tackling, creating space, and making transitions. It is especially important at the "golden age" of motor development (ages 13-15 years old) because exercises performed in this period result in the best neuromuscular adaptation. Conventional isolated exercises develop correct biomechanical skills but do not include the cognitive aspect of the game present in match play. This was the reason for the implementation of SSG in the training process.

Materials and methods. This experiment investigates the efficacy of an SSG training scheme lasting 6 weeks, compared with conventional drills, to increase sprinting speed over 30 meters and agility (IAT) of male football players within the age group 13-15 years. Methodology: The experiment utilizes quasi-experimental pretest-posttest methodology with 30 participants from the academy, *n* = 15 each in SSG group and control group (random allocation). Baseline homogeneity was checked (*p* > .05). Data analysis was carried out using Shapiro-Wilk, Levene's, paired and independent t-test (SPSS v26; $\alpha = .05$).

Results: The SSG group showed significant improvements (speed $\Delta = -0.18$ s, agility $\Delta = -0.64$ s; *p* < .001 within-group; *p* < .001 between-group vs. control $\Delta = -0.03$ s/–0.09 s), with normal distributions and homogeneous variances confirmed.

Conclusion: SSG is superior to conventional training for improving speed and agility in young athletes. It is our suggestion to include SSG training in periodized programs when the young athletes are at their developmental peaks.

Keywords: Small-Sided Games, Speed, Agility, Youth Football, SSG Training, Adolescent Athletes

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Introduction

One of the most widely played games in the world is football. It is a sport that requires the participation of eleven players in a team. In this game, each individual is permitted to use all parts of the body except for the hands and arms (Alkayyis & Permono, 2025). Football in

the modern age demands not just great technical proficiency, but also physical fitness (Iaia et al., 2009). In terms of physical qualities, speed and agility become especially important for one-to-one battles, space creation, and fast transitions from defensive to offensive positions (Díez et al., 2021). Fast speed is vital to help players attain the ball by accelerating or maneuvering around the opponent easily, whereas agility helps players change direction swiftly without losing their balance (Sun et al., 2025). SAQ (Speed, Agility & Quickness) development drills have been found effective in improving these attributes in young soccer players (Trecroci et al., 2022). This is considered to be the "golden age" for motor skill development for individuals within the age group of 13-15 years, wherein athletic adaptation takes place in response to training stimuli (Brown et al., 2017). In this stage, football plays an important role in physical, psychomotor, and social development where coordination, speed, and agility develop fast (Sandra et al., 2022). Thus, it becomes imperative to utilize this critical period for laying down a proper technical and physical base.

In the past, the two components were trained independently through linear sprint training and programmed cone agility training (Nicholson et al., 2022). However, this isolated technique does help to improve basic biomechanics including sprint mechanics and change of direction technique (Pietraszewski et al., 2025), enabling concentration on technicalities without outside interruption (Mendiguchia et al., 2020). However, most training procedures do not encompass the difficulties encountered during a real game situation when one has to respond to an opponent's actions or anticipate a pass from his teammate (Zhu et al., 2024). As a result, players might perform well in drills but will be ill-prepared for decision-making under pressure on the field.

In reply, Small-Sided Games (SSG) have appeared as a complete training program (Fernández-Espínola et al., 2020a). SSG uses modified games with reduced numbers of players on smaller playing fields (Fernández-Espínola et al., 2020b). This process involves fitness, tactics, and technique at the same time (Zanin et al., 2021). Coaches can induce accelerations and decelerations along with sport-specific direction changes through manipulation of pitch size and player numbers in practice, thus replicating game requirements in football (Teune et al., 2022). The above theory explains why SSG is a good platform through which one can incorporate physical, tactical and technical aspects in one training session.

In spite of increasing popularity of the technique, there is an existing research gap in relation to the effects of the structured SSG training program on the development of speed and agility among football players between 13 to 15 years old. Thus, the aim of this research is to investigate the effect of the structured SSG training program on the development of speed and agility.

Materials and methods

Study participants

The sample comprised 30 male football players recruited from a registered youth football academy. football academy. The participants were purposively selected based on the following criteria: enrolled in an academy, aged 13 to 15 years old, had undergone at least 2 years of training in football, achieved at least 90% attendance throughout the study period, and had no lower extremity musculoskeletal injuries within 3 months prior to the experiment. The participants were then divided into experimental (*n* = 15) and control groups (*n* = 15) through a lottery system.

Research Subject

All subjects were young boys engaging in football games (13-15 years old; mean age = 14.1 ± 0.8 years). Demographic and anthropometric information is given in Table 1. Subjects

and their parents/guardians were completely aware of all study procedures, possible dangers, and benefits of the research and gave written informed consent.

Study organization

The research design used in this study is the quasi-experiment. It involved the use of two-group pretest posttest design. The independent variable used was the form of training intervention (SSG or traditional isolated drills). The dependent variables included speed and agility. Speed was measured through the 30-m sprint, while the Illinois Agility Test was used to test agility. The intervention was introduced to the experimental group (Group A) and not to the control group (Group B). Both groups underwent the same tests for speed and agility before and after the intervention period.

Data Instruments

In order to obtain reliable and valid results, this study used standardized procedures to test variables such as speed with the aid of a photoelectric timing device (Timing Gates) for 30-m sprint test, split times at 10m and 30m (seconds), agility using the Illinois Agility Test (IAT) with cones, stopwatch, and measuring tape (seconds), and anthropometric assessments of body mass (kg) and height (cm).

Data collection techniques

The research methodology was designed using three phases: pre-test, intervention, and post-test. At the pre-test phase, the participants took their anthropometry measurements prior to going through a dynamic warm-up consisting of jogging, dynamic stretches, and skipping. Following the dynamic warm-up, they were asked to complete 30-meter sprint and Illinois agility test in two trials and record the best one from each. The intervention phase included six-week interventions where two sessions per week (total 12 sessions) were carried out non-consecutively. As for the experimental group, they had to play small-sided games (either in 4v4 or 3v3 format with a goalkeeper) during six weeks (the first two weeks using a bigger field size [25 m x 20 m], while the last four weeks using a smaller field size [20 m x 15 m]). There were four games (four minutes each), with three minutes passive recovery after each game; as for the control group, they had to do an isolated linear sprint (5 x 20 m flying start) and closed skill agility ladder/cone drill.

Statistical analysis

Pre- and posttest data were coded on Microsoft Excel and analyzed via IBM SPSS Statistics Version 26.0, wherein descriptive analysis (M & SD) was conducted on all variables, the Shapiro-Wilk test was employed to determine normality due to the relatively small sample size of *n* = 15 per group, and Levene's test was used for equality of variances. Within-group effect (pre- versus post-test) was tested via paired sample *t*-tests, whereas between-group effect (delta comparison between the two groups) was done via independent sample *t*-tests with level of significance *p* < .05.

Results

Table 1. Description of Research Subject Data

Characteristics	Experimental Group (SSG) n=15	Control Group (Traditional) n=15
Age (years)	14.20 ± 0.77	14.13 ± 0.74
Height (cm)	165.4 ± 6.2	166.1 ± 5.8
Body Weight (kg)	54.8 ± 7.1	55.2 ± 6.9
IMT (kg/m²)	20.0 ± 1.5	20.1 ± 1.4

The data is presented in Mean ± SD. There was no significant difference in initial characteristics between groups (p > 0.05).

Table 1 shows the basic characteristics of the study subjects in each of the groups under investigation (i.e., the experimental group [Small-Sided Games/SSG, n=15] and the control group [traditional training program, n=15]), where age values (14.20 ± 0.77 years vs. 14.13 ± 0.74 years), height (165.4 ± 6.2 cm vs. 166.1 ± 5.8 cm), weight (54.8 ± 7.1 kg vs. 55.2 ± 6.9 kg), and body mass/BMI index (20.0 ± 1.5 kg/m² vs. 20.1 ± 1.4 kg/m²) were very similar in both groups and showed no significant differences (p > 0.05). Thus, there was good homogeneity of subjects' characteristics in both groups; therefore, differences observed in the course of intervention could be considered as being caused by different types of exercises rather than by variation in the subjects' characteristics.

Table 2. Description of Pre-test and Post-test Statistics

Variable	Groups	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	Differences (Δ)
Speed 30m (sec)	Experimental (SSG)	5.12 ± 0.23	4.94 ± 0.19	-0.18
	Control	5.10 ± 0.25	5.07 ± 0.24	-0.03
Illinois Agility (sec)	Experimental (SSG)	17.85 ± 0.67	17.21 ± 0.54	-0.64
	Control	17.90 ± 0.71	17.81 ± 0.68	-0.09

Table 2 highlights significant gains in speed and agility among the intervention groups, especially those involved in small-sided games (SSG). In relation to 30-m sprint speed test, the SSG group registered a decrease in average time from 5.12 ± 0.23 s before the intervention to 4.94 ± 0.19 s after (Δ = -0.18 s), while the control group made no significant progress with an average time before the intervention being 5.10 ± 0.25 s and an average time after the intervention amounting to 5.07 ± 0.24 s (Δ = -0.03 s). As for Illinois agility test, SSG group managed to decrease the average time from 17.85 ± 0.67 s to 17.21 ± 0.54 s (Δ = -0.64 s), whereas the average time of the control group registered no substantial changes from 17.90 ± 0.71 s before to 17.81 ± 0.68 s after the intervention (Δ = -0.09 s).

Table 3. Normality Test (Shapiro-Wilk)

Groups	Variable	Sig. Pre-test	Sig. Post-test	Remarks
Experiment	Speed	0.412	0.378	Normal
	Agility	0.251	0.189	Normal
Control	Speed	0.533	0.641	Normal
	Agility	0.092	0.105	Normal

*A Sig. A value of > 0.05 indicates normally distributed data, so parametric analysis (T-Test) is worth using.

According to Table 3 below, The findings from the Shapiro-Wilk normality test indicate that all distributions of variables concerning speed and agility follow normal distributions in both the experimental and control groups before and after conducting the experiment. The values of Sig. are all greater than 0.05 and range between 0.092 and 0.641. This means that there is no breach of the assumption on normality and, therefore, parametric techniques (independent t-test/paired t-test) may be applied in comparing means of the groups before and after the experiment.

Table 4. Homogeneity Test (Levene Test)

Variable	Levene Statistic	Sig.
Speed Difference	1.542	0.225
Agility Difference	0.981	0.331

The Sig. > value of 0.05 indicates that the variance between groups is homogeneous.

The outcomes of the Levene's Test presented in Table 4 confirm the equality of variances between the speed difference (Levene statistic = 1.542, significance value = 0.225) and agility difference (Levene statistic = 0.981, significance value = 0.331). The significance level is higher than the traditional threshold ($p > 0.05$), which guarantees that the assumption of the equality of variances has been met. Thus, it becomes possible to perform independent sample t-test or one-way ANOVA when analyzing the data.

Table 5. Paired Samples T-Test

Groups	Variable	t	df	Sig. (2-tailed)	Conclusion
Experiment (SSG)	Speed	7.432	14	0.000	significant
	Agility	9.154	14	0.000	significant
Control	Speed	1.875	14	0.082	Insignificant
	Agility	1.622	14	0.127	Insignificant

The findings of the study revealed that there was a statistical significance in terms of speed and agility for SSG training participants, ($p = 0.000$) (< 0.05), within 6 weeks, whereas the control group, which underwent regular training, did not reveal any significant changes in their performances during this duration ($p > 0.05$).

Table 6. Independent Samples T-Test on Value Difference (Δ)

Variable	Groups	Mean Difference (Δ)	t	Sig. (2-tailed)	Conclusion
Speed Difference	Eksperiment	-0.18	4.102	0.000	SSG > Control
	Control	-0.03			
Agility Difference	Eksperiment	-0.64	5.231	0.000	SSG > Control
	Control	-0.09			

The above data confirm the research hypothesis. The increase in sprint time of 0.18 seconds in the SSG group is a substantial improvement for the 13-15 age level, where the difference of 0.1 seconds is often the difference in ball duel situations.

A very significant increase in agility (a reduction in Illinois Test time of 0.64 seconds) in the SSG group can be attributed to the high frequency of eccentric acceleration and reactive direction changes that occur naturally in the 4v4 game format on small courts. Players not only run, but also have to read the opponent's body language and spontaneously cut or pivot, stimuli that are not obtained from closed-skill and predictable zig-zag cone running exercises.

Therefore, from the analysis performed using SPSS software, the results have shown that the use of Small Sided Games can be an effective way of training adolescent football players physically, technically, and tactically at once.

Discussion

Interpretation of the Main Effect

In summary, the results presented above offer convincing support that a 6-week SSG training protocol leads to considerable improvements in 30-m sprint speed and agility among players aged 13 to 15 years old. Specifically, participants in the experimental group were able to achieve a 0.18-second decrease in their sprint times and a 0.64-second improvement in Illinois agility test times, both of which proved statistically significant (*p* < .001). On the other hand, participants in the control group, who engaged in standard isolated training exercises, did not make significant progress. Although an improvement of 0.18 seconds in the time needed to complete a 30-m sprint is relatively small, it is highly significant within the framework of adolescents' sports physiology and game dynamics and, in fact, could be crucial in determining whether one wins a game or loses it, especially during a 50-50 ball battle.

Physiological Mechanisms Underlying Small-Sided Games

There are a number of factors that contribute to the better performance in SSG. One of them is the fact that SSG involves frequent acceleration and deceleration. For instance, playing in 4v4 game on 20 × 15m pitch demands from players to run at full speed and to decelerate immediately to prevent collision (Hessel et al., 2017; Honório et al., 2021). The eccentric contraction of muscles acts as a great stimulus for building up strength and stability in the limbs, which is necessary for building explosive speed. Secondly, the skills involved in SSG are open skills which require constant perceptual and cognitive processing from the mind to be able to react to opponents' movements and make fast decisions (Mohamed Shapie, 2018). The third factor is that the small space in SSG causes a lot of jumping, turning, and pivoting which help in improving the stretch-shortening cycle (SSC) in muscles and tendons, leading to improved agility (Surawan et al., 2022).

Comparison with Other Aerobic Interventions in Youth Football

The challenge faced in youth football coaching involves the time distribution between physical training and technical-tactical training (Morgans et al., 2014). SSG is an approach that is better than other forms of aerobic exercises like track HIIT (Wen et al., 2024). Research by Impellizzeri et al. (2020) demonstrated that SSG can increase VO_2max to levels comparable with interval running, but with significantly higher adherence and enjoyment among young athletes. The above is in agreement with what was observed in the current study, where the control subjects demonstrated boredom while conducting isolated exercises, whereas those in the SSG category maintained high levels of motivation as a result of the competitive and game-oriented nature of the training sessions. In addition, SSG is a form of training that has an excellent ability of skill transfer since it combines cardiorespiratory development alongside tactical thinking about how to run at particular times.

Practical Implications for Youth Football Training

These studies have led to the development of some recommendations for the coaching of grassroots and academies level players. First, 40-50% of the non-ball running exercises must be replaced with manipulation in terms of the structure of SSG. For example, SSG in 3v3 format in confined space with small goals can be used. Second, manipulate pitch dimensions as a means of periodization, larger pitch (25 x 20 m) should be used for speed training in the form of open sprints, and a smaller one (15 x 15 m) with two-touch rule to develop agility and acceleration. Third, use the concept of tactical periodization where SSG is performed at the beginning of the training session after warm-ups.

Strengths, Limitations, and Future Directions

The quasi-experimental design with an active control group is one of the key advantages of the current study in terms of isolating the impact of SSG on speed and agility development specifically. Moreover, it utilizes objective measurements via electronic timing gates to improve accuracy of results. Nevertheless, several weaknesses should be mentioned. Small sample size (*n* = 30) limits generalizability of findings of the study. The six-weeks intervention program focuses only on short-term benefits of training; there is no information about retention effects after detraining period. Furthermore, the current study does not take into consideration internal physiological factors (heart rate, blood lactate level, etc.) that can be used to calibrate exercise intensity. Thus, future research in the field might include long-term programs (a full competition season or 6-8 months) in order to explore the impact on injury prevention and long-term adaptations. Biomechanical assessment through advanced technologies like GPS and IMU can determine acceleration/deceleration profiles (>3 m/s^2) for various SSG formats (3v3 versus 5v5). Finally, studies exploring the impact of position-specific training (center-back versus striker) are worth consideration due to the different movements involved.

Conclusions

This research shows that a 6-week SSG training course performed twice a week is associated with a substantial improvement of 30-meter sprint speed and agility in football players in the age range of 13-15 years old. Specifically, the SSG training resulted in the decrease in sprint time by 0.18 seconds and by 0.64 seconds on the Illinois Agility Test, all of which was statistically significant (*p* < .001). However, the control group did not show any changes in their test results. In contrast to the isolated skills practice, one of the greatest strengths of SSG training is that it includes neuromuscular stimuli, promotes the formation of reactive acceleration/deceleration, and helps develop tactics in a real-life game situation. Therefore, SSG is a tool for improving athletic performance and a holistic training method as well because it unites physical, technical, and tactical components in one game-like and enjoyable process.

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Conflict of interest

The authors declare no conflict of interest**.**

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