*Journal of Physical Education and Sport* ® (JPES), Vol. 23 (issue 6), Art 177, pp. 1449 - 1455, June 2023
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

**Original Article**

# The effect of a four-week mesocycle with small side games on the agility and sprinting ability of professional soccer players during in-season

KOMSIS THEOCHARIS[1], KOMSIS STERGIOS[1], KOMSIS GEORGE[1], PAPADOPOULOU ZACHAROULA[1,2], METAXAS THOMAS[2], GISSIS IOANNIS[1], VRABAS S. IOANNIS[1]
[1]Department of Physical Education and Sport Sciences at Serres, Aristotle University of Thessaloniki, GREECE
[2]Department of Physical Education and Sport Sciences, Aristotle University of Thessaloniki, GREECE

Published online: June 30, 2023
(Accepted for publication June 15, 2023)
**DOI:10.7752/jpes.2023.06177**

**Abstract**
Despite the extensive use of SSGs training in soccer, our knowledge about their effectiveness as a training tool for developing physical, technical and tactical skills in soccer players is not complete (Hill-Haas et al., 2011). The aim of the present study is to examine the effects of a 4-week SSGs training intervention on the agility and sprinting ability of professional soccer players in season. Twenty-four male professional soccer players (3 Central Defender, 4 Full Backs,4 Central Midfielders, 4 Attack Midfielders, 6 Wingers, 3 Strikers) with age (26±3,45y), height (1,81± 3,78m), body weight (75,23±5,62 kg), BMI (24,17 ±1,59kg/m$^2$) of second professional Greek league participated in this study. They were randomly assigned to small side games training group (SSG, n=12) or a control group (CG, n=12). This study was conducted in season, when participants attended soccer training sessions five times per week and played competitive matches at least once a week. In order to examine the changes in agility and sprinting ability after the 4-week meso-cycle periodized small side games training, all players were tested two times, pre and post of the intervention. Body mass was measured the same days of testing but in the morning before breakfast. All the test sessions were carried out on a grass soccer field after a typical 15min soccer warm up. The order of the tests was 30m linear sprint and illinoise agility test. Statistical analysis was conducted using SPSS 18.0 for Windows and the significance level was set at $P \leq 0.05$. Data were tested with two-way analysis (2x2 ANOVA) with repeated measure (groups x measurement). In variables that were significant interaction we continue with paired t test. Results showed that there was statistically significant interaction in Agility with p=0,000, t= 4,458 and there was no statistically significant interaction in 30m Sprint with p=0,770, t= 0,298, in Bodyweight with p=0,245, t= 0,809 and in BMI with p=0,994, t= 0,809.
**Key words:Soccer, Agility, Sprint, SSG, Performance, In-season, Meso-cycle**

## Introduction

Soccer performance is highly dependent on the combination of technical, physical and tactical abilities (Bangsbo, 1994; Di Salvo et al et al., 2010). The physiological demands of sport relate to high aerobic and anaerobic endurance, muscular strength, speed, power, dexterity, agility and flexibility to improve performance and prevent injuries (Reilly, Howe & Hanchard, 2003). The most critical moments of a soccer game (e.g., ball regaining, goal scoring or saving) are depending on player's ability to perform at high-intensity actions (Ferrete et al., 2014; Relly et al., 2000).

In research by Turgut et al., 2009 it was shown that there are differences in speed and agility in professional and amateur soccer players. It also has been found, that first-division soccer players perform more high-intensity runs and more sprints over the same distance than second-division soccer players (Ekblom, 1986). The ability to perform multiple sprints in a match is a determining factor for a soccer player to play at a high level (Bangsbo, 1992). This is also supported by (Kaplan et al., 2009) who compared speed and agility in professional and amateur soccer players.

One of the most important factors is agility. Agility is characterized by very quick and sharp change of direction, quick and sharp deceleration and acceleration (Thomas et al., 2009). In an attempt to define agility, (Sheppard et al., 2006) refer to agility as the ability to quickly move the whole body, changing direction or speed, in response to a stimulus.

A soccer player makes 1,200-1,400 changes of direction during a match, as reported in related research by (Sporis et al., 2010). Therefore, agility is considered a factor necessary for success in soccer (Harman et al., 1990). In more recent research also showed that successful performances in a team sport, such as soccer, requires the ability to change direction, as well as decision-making skills (Lesinski et al., 2017; Loturco et al., 2017). Furthermore, it has been suggested that agility is one of the key performance indicators that should be part of standardized physiological tests and training goals for soccer players (Svensson and Drust, 2005).


Corresponding Author, KOMSIS THEOCHARIS Email: thnkomsis@gmail.com

However, the most effective training methods used to improve performance incorporate conditions similar to a real soccer game (Aguiar et al., 2012). In training, small side games (SSGs) are widely used as a means of simultaneously improving technical skills and fitness. In SSGs, the smaller field size and reduced number of participants is used to simulate the game situations and demands of a real game such as the fact that players are often required to make decisions under conditions of stress and fatigue (Jones and Drust, 2007; Rampinini et al., 2007). In addition, it has been suggested that SSGs can be a valid substitute for traditional running exercises to improve endurance, as well as a solution for simultaneously practicing technical skills (Hill Haas et al., 2008; Dellal et al., 2011b). Consequently, SSGs can be characterized as a high-intensity intermittent training method that allows the improvement of specific physical capacities of soccer, under realistic conditions of match phases (Bujalance-Moreno et al.,2017).

Knowing the impact of a widespread training method as SSGs training on these two very important performance factors (speed, agility) in soccer is crucial for periodisation and program structuring especially within in-season periods where the training time is minimized and performance is the main target. The aim of the present study is to examine the effects of a 4-weeks SSGs training intervention on the agility and sprinting ability of professional soccer players in season.

## Material & Methods

*Participants*

Twenty-four male professional soccer players (3 Central Defender, 4 Full Backs,4 Central Midfielders, 4 Attack Midfielders, 6 Wingers, 3 Strikers) with age (26±3,45y), height (1,81± 3,78m), body weight (75,23±5,62 kg), BMI (24,17 ±1,59kg/$m^2$) of second professional Greek league participated in this study. They were randomly assigned to small side games training group (SSG, n=12) or a control group (CG, n=12). This study was conducted in season, when participants attended soccer training sessions five times per week and played competitive matches at least once a week. All players and coaches were informed of the protocol and the experimental risks and signed an informed consent document before participating in the investigation.

| Participants | |
|---|---|
| n | 24 |
| Age (y) | 26 ± 3,45 |
| Height (m) | 1,81 ± 3,78 |
| Bodyweight (kg) | 75,23 ± 5,62 |

**Table 1: Participants**

*Materials*

The anthropometric characteristics Height and Body Weight were recorded using a stadiometer (Seca 222, Hamburg, Germany) and a calibrated bascule (Seca 634, Hamburg, Germany) after the body mass index (BMI) was calculate (Weight / Height2).

*Photocells*

Two pairs of photocells (Autonics, BX5M – MFR – T)), consisting of two beams, each with two pairs of photocells and an automatic digital timer (SaintWienDigitalTimerType H5K), with minimum time measurement, measurement error ±0, were used to measure the agility ,01sec.

*Procedure*

In order to examine the changes in agility and sprinting ability after the 4-weeks meso-cycle periodized small side games training, all players were tested two times, pre and post of the intervention. The participants were asked not to engage in any high intensity exercise during the 72 h before the testing sessions and to have a meal at least 2 h before the beginning warm up. Body mass was measured the same days of testing but in the morning before breakfast. All the test sessions were carried out on a grass soccer field after a typical 15min soccer warm up consisting of low intensity running, active stretching and striding. The participants were motivated and encouraged to reach the best score possible in every test. The order of the tests was 30m linear sprint and Illinois agility test.

After the firsts data collection(pre-testing), 12 SSGs training sessions were performed within the four weeks in-season meso-cycle. During the intervention period all the players performed identical session and it was insured that all the players received the same training routines except for the SSGs training exercises. Whereas SSGgr performed small side games, Cgr kept performing traditional physical training that consist of technical-tactical sessions during the study period. SSGs training was scheduled three times per week, over a four-weeks meso-cycle. Apart from these trainings, each player participated in one match on the weekend. All the tests performed again after the intervention at the same order and under the same conditions (post-testing).

***Anthropometrical***

Height(m) and body weight(kg) were measured at the beginning of the first testing session, while body mass (BMI) was calculated by means of the following equation (Weight / Height2). A stadiometer (Seca 222, Hamburg, Germany) and a calibrated bascule (Seca 634, Hamburg, Germany) were used for that purpose.

***Speed test***

Sprint evaluation was accomplished through a speed test that was carried out in a straight 30 m line (Maio et al.,2010; Smilios et al., 2005). Sprint times (s) were measured by two pairs of photocells (Autonics, BX5M – MFR – T) in the beginning and in the end of the 30m line. The athletes started in the same line of first pair of photocells in order to ensured that their initial speed was zero. The players performed 2 trials with a 3 min recovery period between. The fastest result was recorded for further analysis.

***Illinois agility test***

Illinois agility test was used as a field test in order to measure the agility of the players. Eight cones total and two pairs of photocells (Autonics, BX5M – MFR – T) was used for this test. The cones make a rectangle with 10m and 5m sides, two of them showed the start and finishing points and four the turns. The four inside cones make a straight line and had 3,3m distance between of them (Figure1). The players began the test with one foot on the starting line in a frontal erect position, and time measurement started when subjects passed the first photoelectric cells. We did not provide a starting signal so that the subjects were able to individually start the test. Thus, reaction time did not influence our findings.

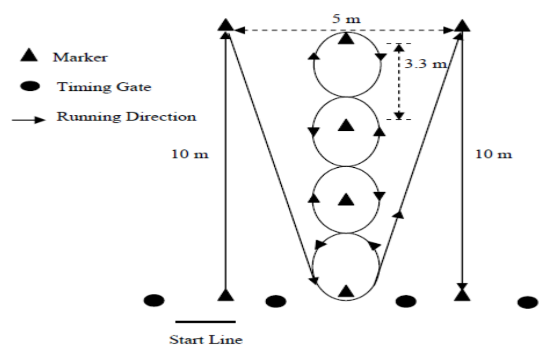



**Figure 1: Illinois Agility Run Test**

***Small side games detailed training program***

***Table 2: Small side games detailed training program***

| Week | Day at Micro-cycle | SSG trainings per week | Number of Playes | Pitch Dimensions (m) | Sets | Duration (min) | Rest (min) | Area per player($m^2$) |
|---|---|---|---|---|---|---|---|---|
| | MD-4 | | 3v3 | 30x25 | 4 | 2 | 1 | 125 |
| | MD-2 | 3 | 4v4 | 35x30 | 4 | 3 | 1,3 | 131,25 |
| 1 | MD-1 | | 6v6 | 45x30 | 2 | 3 | 1,3 | 112,5 |
| | MD-4 | | 3v3 | 30x25 | 4 | 3 | 2 | 125 |
| | MD-2 | | 4v4 | 35x30 | 4 | 4 | 1,3 | 131,25 |
| 2 | MD-1 | 3 | 6v6 | 45x30 | 2 | 3 | 1,3 | 112,5 |
| | MD-4 | | 3v3 | 30x25 | 5 | 3 | 2 | 125 |
| | MD-2 | | 4v4 | 35x30 | 4 | 4 | 1,3 | 131,25 |
| 3 | MD-1 | 3 | 6v6 | 45x30 | 2 | 3 | 1,3 | 112,5 |
| | MD-4 | | 3v3 | 30x25 | 3 | 2 | 1 | 125 |
| 4 - | MD-2 | | 4v4 | 35x30 | 3 | 3 | 1,3 | 131,25 |
| unload | MD-1 | 3 | 6v6 | 45x30 | 2 | 3 | 1 | 112,5 |

**Statistical analysis**

Statistical analysis was conducted using SPSS 18.0 for Windows and the significance level was set at $P \leq 0.05$. Data were tested with two-way analysis (2x2 ANOVA) with repeated measure (groups x measurement). In variables that were significant interaction we continue with paired t test.

**Results**

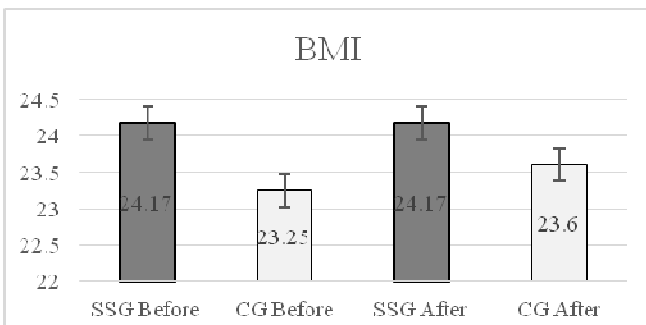
The results after Two-Way Anova analysis with repeated measurements, showed that there was statistically significant interaction in Agility but there was no statistically significant interaction in 30m Sprint, in Bodyweight and in BMI, as shown in the table below:

| Variables | P | T |
|---|---|---|
| **Bodyweight** | 0,245 | 0,809 |
| **BMI** | 0,994 | 0,809 |
| **30m Sprint** | 0,770 | 0,298 |
| **Agility** | 0,000 | 4,458 |

**Table 3: Variables**

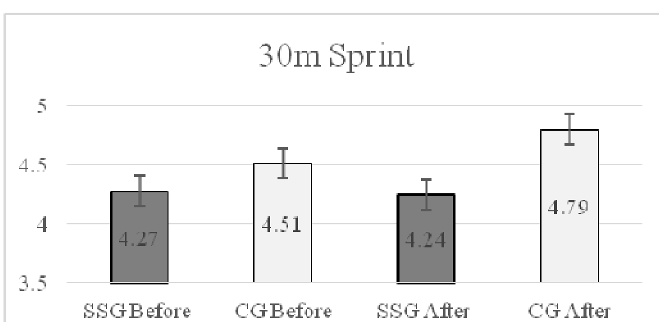

**Graph 1: Results of Bodyweight**

No significant difference was observed for Body Weight variables before and after of the intervention with p=0,245, t= 0,809, specifically there was no change from 75,23±5,62(kg) to 75,12±5,27(kg). No significant difference was observed in this variable for CG also.



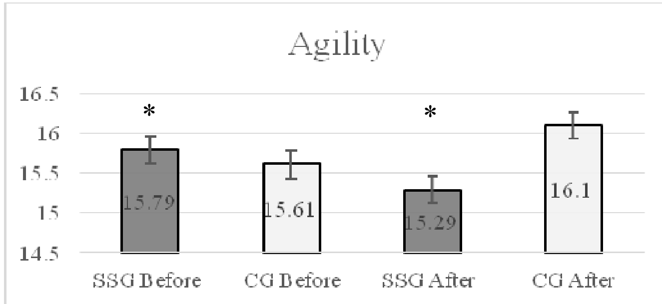

**Graph 2: Results of Body mass Index**

No significant difference was observed for BMI variables before and after of the intervention with p=0,994, t= 0,809, specifically there was no change from 24,17 ±1,59(kg/m$^2$), to 23,25 ±2,68(kg/m$^2$). No significant difference was observed in this variable for CG also.




**Graph 3: Results of 30m Sprint**

No significant difference was observed for 30m Sprint variables before and after of the intervention with p=0,770, t= 0,298, specifically there was no change from 4,27 ±0,30(s), to 4,51 ±0,40(s). No significant difference was observed in this variable for CG also.




**Graph 4: Results of Illinois Agillity test**

*There was a significant effect on Agility variables before and after of the intervention with p=0,000, t= 4,458, specifically there was change by decreasing the finishing time from 15,78 ± 0,50 (s) to 15,28 ± 0,38(s).

**Discussion**

The small side games training is a widespread training method and the primary benefits are that they appear to replicate the movement demands, physiological intensity and technical requirements of competitive game (Gamble P., 2004; Owen A., 2003; Gregson W & Drust B., 2000; Little T., 2009), while also requiring players to make decisions under pressure and fatigue (Gabbett T & Mulvey M., 2008).

Despite the extensive use of SSGs training in soccer, our knowledge about their effectiveness as a training tool for developing physical, technical and tactical skills in soccer players is not complete (Hill-Haas et al., 2011). There are varieties of exercises and training programs due to SSGs nature that can be modified with alterations of many variables, including pitch area, player number, coach encouragement, training regimen, rule modifications, and the use of goals and/or goalkeepers (Hill-Haas et al., 2011). The aim of the present study was to examine the effects of a 4-weeks SSGs training intervention on the agility and sprinting ability of professional soccer players during the season.

The results obtained revealed that this training program improved agility, however, in 30m sprint no significant changes were found. Our findings are consistent with the research of Bujalance-Moreno et al.,2018.

The ability to change direction while sprinting is considered essential for successful participation in most team and individual sports. It turns out that the SSGs training intervention could have a positive effect on agility that is a crucial performance factor for soccer and also being a time-efficient training method because technical and tactical aspects can be trained at the same time (Impellizzeri et al., 2006).

Also, in previous researches with SSGs were not found significant changes in sprint performance (Hill-Haas et al., 2009; Radziminski et al 2013; Impellizzeri et al.,2006). The lack of change in sprint performance suggests that more specific training strategies are required given the importance of sprinting in soccer, coaches should consider adding focused training blocks to improve that quality.

As for the anthropometric characteristics, there was no significant difference in body weight and BMI. A result which agrees with the literature, because fat percentages decrease in pre-season due to the increased number of trainings and is maintained during in-season (Reilly, 1996; Bekris et al., 2016).

Previous studies (Impellizzeri et al., 2006; Chamari et al., 2005) have reported improvements in endurance with SSGs training and more specific at running economy and Vo2max in soccer players. It also appears that similar fitness and performance gains can be made with SSGs as is achieved with traditional interval training methods (Hill-Haas et al., 2011). The present study has proven that SSGs training could also cause physical performance improvements in other areas and might be an alternative to traditional training focused on physical condition.

**Conclusion**

In conclusion, it is well known that SSGs simulated real game situations and with this type of training is able to develop fitness parameters of players while technical and tactical elements are concomitantly. Many researches shown the correlation between SSGs and fitness parameters and this study come to fill in about some crucial parameters of fitness for performance in soccer as agility and speed.

This study proves that a 4 weeks SSGs based training program improve agility but doesn’t improve speed in professional soccer players during the season. In other words, the use of a SSGs based training can be beneficial for many training aspects including agility but more specific training strategies are required for sprinting developing in soccer training. Also, these programs are a time-efficient training method due to the effect in many aspects of players performance especially during in-season that training time is limited, the main target is performance and team’s schedule is full of matches and travelling.

This data will be a very useful tool for coaches and fitness coaches in order to develop programs and to organize the periodisation. Future studies are required to increase the understanding of the interaction between the technical, tactical and physical demands of SSGs, and how these can be manipulated to improve the training process for soccer players.

**References**

Aguiar M, Botelho G, Lago C, Maças V, Sampaio J. (2012). A review on the effects of soccer small-sided games. J Hum Kinet 33: 103-113.

Bangsbo J. (1994). The physiology of soccer-with special reference to intense intermittent exercise. Acta Physio Scand Suppl 619:1–155

Bangsbo, J. (1992). Time and motion characteristics of competition soccer. Science and Football, 6, 34-40.

Bujalance-Moreno, P., Garcia-Pinillos, F., A. Latorre-Roman., P. (2017) Effects of a small-sided game-based training program on repeated sprint and change of direction abilities in recreationally-trained soccer players. The Journal of Sports Medicine and physical fitness 58(7-8):1021-8

Chamari K, hachana y, Kaouech f, Jeddi r, Moussa-chamari i, Wis- loff u. endurance training and testing with the ball in young elite soccer players. Br J Sports Med 2005; 39:24-8.

Dellal, A., Hill-Haas, S., Lago-Penas, C. and Chamari, K. (2011b) Small-sided games in soccer: amateur vs. professional players' physiological responses, physical, and technical activities. Journal of Strength and Conditioning Research 25, 2371-2381.

Di Salvo V, Baron R, González-Haro C, Gormasz C, Pigozzi F, Bachl N. (2010). Sprinting analysis of elite soccer players during European Champions League and UEFA Cup matches. J Sports Sci; 28:1489-1494.

Ekblom, B. (1986). Applied physiology of soccer. Sports medicine, 3(1), 50-60.

Gabbett T, Mulvey M. Time-motion analysis of small-sided training games and competition in elite women soccer players. J Strength Cond Res 2008; 22 (2): 543-52

Gamble P. A skill-based conditioning games approach to metabolic conditioning for elite rugby football players. J Strength Cond Res 2004; 18 (3): 491-7

Gregson W, Drust B. The physiology of football drills. In- sight 2000; 3 (4): 1-2

Harman E.A, Rosenstein M.T., Frykman P.N., Rosenstein R.M. (1990) The effects of arms and countermovement on vertical jumping. Medicine and Science in Sports and Exercise 22, 825-833

Hill-Haas S, Coutts a, Rowsell G, Dawson B. Generic versus small- sided game training in soccer. int J Sports Med 2009; 30:636-42

Hill-Haas S, dawson B, impellizzeri f, coutts a. physiology of small-sided games training in football: a systematic review. Sport Med 2011; 41:199-220.

Hill-Haas, S., Coutts, A., Rowsell, G. and Dawson, B. (2008) Variability of acute physiological responses and performance profiles of youth soccer players in small-sided games. Journal of Science and Medicine in Sport 11, 487-490.

Impellizzeri f, Marcora S, castagna c, reilly T, Sassi a, iaia fM, et al. physiological and performance effects of generic versus specific aerobic training in soccer players. J Sports Med 2006; 27:483-92.

Jones, S. and Drust, B. (2007) Physiological and technical demands of 4 v 4 and 8 v 8 games in elite youth soccer players. Kinesiology 39, 150-156.

Kaplan, Turgut; Erkmen, Nurtekin; Taskin, Halil. The Evaluation of the Running Speed and Agility Performance in Professional and Amateur Soccer Players Journal of Strength & Conditioning Research: May 2009 - Volume 23 - Issue 3 - pp 774-778

Lesinski, M., Prieske, O., Helm, N., and Granacher, U. (2017). Effects of soccer training on anthropometry, body composition, and physical fitness during a soccer season in female elite young athletes: a prospective cohort study. Front. Physiol. 8:1093. doi: 10.3389/fphys.2017.01093

Little T. Optimizing the use of soccer drills for physiological development. Strength Cond J 2009; 31 (3): 1-8

Loturco, I., Kobal, R., Kitamura, K., Cal Abad, C. C., Faust, B., Almeida, L., et al. (2017). Mixed training methods: effects of combining resisted sprints or plyometrics with optimum power loads on sprint and agility performance

Maio alves J, rebelo a, abrantes c, Sampaio J. Short-term effects of complex and contrast training in soccer players' vertical jump, sprint, and agility abilities. J Strength cond res 2010; 24:936-41.

Owen A. Physiological and technical analysis of small-sided conditioned training games within professional football. Wrexham: SAGE Publications, 2003

Radziminski l, Rompa p, Barnat W, Dargiewicz r, Jastrzebski Z. a comparison of the physiological and technical effects of high- intensity running and Small-Sided Games in young Soccer players. int J Sports Sci coach 2013; 8:455-65.

Rampinini, E., Impellizzeri, F.M., Castagna, C., Abt, G., Chamari, K., Sassi, A. and Marcora, S.M. (2007) Factors influencing physiological responses to small-sided soccer games.

Reilly T., Williams A. M., Nevill A., Franks A. (2000). A multidisciplinary approach to talent identification in soccer. Journal of Sports Sciences, 18, 695–702.

Reilly, T., Howe, T., & Hanchard, N. (2003). 10 Injury prevention and rehabilitation. Science and Soccer, 136-147.

Sheppard JM, Young WB. (2006). Agility literature review: classifications, training and testing. J Sports Sci.24(9):919–932

Smilios i, Pilianidis T, Sotiropoulos K, antonakis M, Tokmakidis S. Short-term effects of selected exercise and load in contrast training on vertical jump performance. J Strength cond res 2005; 19:135-9.

Sporis G., Milanovicl L., Jukic I., Omrcen D., Molinuevo J. (2010). The effect of agility training on athletic power performance. Kinesiology, 42, 1, 65-72.

Svensson M., Drust B. (2005). Testing soccer players. Journal of Sports Sciences, 23, 6, 601-618.

Thomas K., French D., Hayes P. (2009). The effect of two plyometric training techniques on muscular power and agility in youth soccer players. Journal of Strength and Conditioning Research, 23, 332-335.