

Physical performance and technical-tactical aspects in 4 vs. 4 small-sided games across various field formats among professional soccer players

IOANNIS ISPYRLIDIS¹, VASILLIOS GOURGOULIS², MICHAEL MITROTASIOS³, NIKOLAOS MANTZOURANIS⁴

^{1,2,4}Democritus University of Thrace, Department of Physical Education & Sport Science, GREECE

³National and Kapodistrian University of Athens, Department of Physical Education & Sports Science, GREECE

Published online: February 29, 2024

(Accepted for publication February 15, 2024

DOI:10.7752/jpes.2024.02059

Abstract

This study assessed the impact of varying pitch dimensions during 4 vs. 4 small-sided games on both physiological performance and technical-tactical aspects among professional soccer players. The sample comprised eight (n= 8) male players from a Greek Superleague team, with an average age of 20 ± 1.5 years, body mass of 73.9 ± 6.4 kg, and stature of 179.4 ± 46 cm. The players trained in 4 vs. 4 small-sided games with 1 goalkeeper, played in 4×5 min intervals with a 5 min rest period, across three playing formats: full pitch - half pitch - quarter pitch. In the small-sided games training, the players' heart rate and blood lactate were measured in real-time, while both video and visual observation recorded their technical-tactical parameters. During the 4vs4 training in the quarter pitch, the players' blood lactate concentration ranged from 6.02 to 6.65mmol/l⁻¹. Additionally, in 4 vs. 4 small-sided games in the half pitch the players' blood lactate ranged from 8.24 to 9.42mmol/l⁻¹, while their blood lactate concentration was measured as high as 9.65-11.28mmol/l⁻¹ during the whole pitch games. In contrast, no differences were recorded in the players' heart rate in any one of the Small-Sided-Games in the three training formats. Regarding the players technical-tactical parameters, the current study reported that the smaller the pitch dimension of the small-sided games the greater the amount of the players' mistakes in passes accuracy, 1vs1, shots and goal-scored.

Key Words: training, physical adaptations, internal loads, tactics.

Introduction

The soccer players' performance during a match depends, among others, on their physical condition, technique and tactics (Weineck, 1992; Bangsbo, 1999). All these parameters should not be treated separately, but should be considered as a whole, because they constantly interact with each other (Gatti, 2016). For this reason, simulated games are used nowadays during training, in small-sided games (SSGs) with a limited number of players, in order the players to receive specific stimuli and to practice simultaneously their physical condition and the various technical and/or tactical skills (Tessitore et al., 2006). The small-sided games are commonly adopted as a training method because of their similarity with the intensities of the match (Aguar et al., 2012). The effectiveness on technical and tactical aspects, (Sanchez-Sanchez et al., 2017), the enhancement of physiological and physical variables (Faude et al., 2014), the examination of players' kinematic characteristics (Mallo & Navarro, 2008; Gaudino, Alberti & Iaia, 2014) and the improvement of motor learning parameters simulate the match (Gonçalves et al., 2016). Furthermore, the above-mentioned parameters could simultaneously developed by increasing the players' strength, speed and endurance (Owen, 2011).

Furthermore, the small-sided games have a significant effect on physiological, technical and tactical aspects by manipulating game constraints such as field dimension, number of players, and game rules. Consequently, different SSGs formats result in different heart rate responses (HR), the percentage of maximal heart rate (%HR_{max}) and blood lactate (BLa) concentration (Impellizzeri et al., 2006; Hill-Haas et al., 2011). The SSGs formats in larger pitches demand more intensive action than formats in smaller pitches (Casamichana & Castellano, 2010; Bujalance-Moreno, Latorre-Román & García-Pinillos, 2019). Regarding the physical parameters, the SSGs formats played on medium and large areas demand greater covered distance, sprints and accelerations/decelerations (Hodgson, Akenhead & Thomas, 2014). Furthermore, it has been suggested that the SSGs formats with different rules affect physiological adaptations. In particular, SSGs protocols, by stopping the ball on the line to score, demand greater HR and BL_a than shot goals to score while the SSGs format with one touch rule showed a higher average HR (Halouani et al., 2017).

It is clear that several studies have used the SSGs in order to evaluate their effects on players' performance. However, the lack of consistency in the designing of the games, the samples age variation among studies and the playing rules among the SSGs make the comparison difficult. Moreover, although training staff is responsible for a great number of players that should work together team-tactics, the majority of the studies assess the effects of the SSGs with few players (2 vs. 2 to 6 vs. 6) on physiological, physical and technical-tactical adaptations in the

game (Sanchez-Sanchez et al., 2018). Different SSGs formats may show different responses and therefore they may be used for a different purpose as part of the soccer training. In addition, the SSGs formats with fewer players (2 vs. 2 & 3. vs. 3) that maintain duration, pitch size and rules of the game resulted higher HR, HR_{max} and B_{La} of the players than the formats with larger number of players (Aguiar et al., 2013). For this reason, the aim of the present study was to evaluate the effects of the pitch dimensions differentiation during the 4 vs. 4+1GK small-sided games (SSGs) in both physiological performance (heart rate-HR & blood lactate-BLa) and technical-tactical parameters in professional soccer players.

Methods

Participants

Eight (n=8) male professional players were recorded. Their age was 20 ± 1.5 years, their body mass was 73.9 ± 6.4 kg and their stature was 179.4 ± 46 cm. The evaluated players were members of one soccer club that ranked in the top-10 in the *Superleague Greece* (1st Division). The experimental protocol was approved by the institutional review board and was in accordance with the Declaration of Helsinki.

Experimental design

The studied players trained in SSGs 4 vs. 4+1GK with the same intensities and playing rules in three different pitch dimensions: 100x64m (whole pitch) - 64x50m (half pitch) - 33x44m (quarter pitch). The players performed each separate SSGs format once a week after a day-off with a duration of 5min x 4set with a resting interval of 5min (1:1) after a standard warm-up routine. At the trainings, each player wore in a personal vest a portable transmitter for the real-time recording his HR.

The transmitter was a Polar Team Pro tracking system ([©]*Polar Electro, Sports instruments, Kempele, Finland*) with high frequency 10Hz GPS and 200Hz MEMS motion tracking sensor. Capillary samples were taken 1min post-exercise from a pre-warmed finger of the subject's preferred hand, measuring the blood lactate (BLa) concentration. The capillary blood from each sampling was analyzed with the use of a calibrated mini Photometer Dr. Lange (mod. LP 20) in order to evaluate the player's blood lactate concentration. Prior to the SSGs 4 vs. 4 trainings, the players HR in the blood lactate of 4mmol.l^{-1} estimated by the use of the *FeldStufen-test* in a 400m track (Wieneck, 1992). The trainings with the SSGs in the different pitch formats were recorded in both video and visual observation (evaluation sheet-per-player) in order to record the players' technical-tactical parameters: short passes-long passes-accuracy of passes-dripping-1 vs 1-double pass-shot-goal scored).

Statistical analysis

Descriptive statistics were calculated for each variable including means (M) and standard deviations ($\pm$ SD). The normal distribution of the data was verified using the *Kolmogorov-Smirnov* test. The non-parametric *Friedman-test* and *Wilcoxon-test* for dependent variables were performed while the players' performance variables in relation to the SSGs format were compared by using the post-hoc *Bonferroni* test. The level of significance was set as $p < 0.05$.

Results

The *Feldstufen-field-test* showed that the studied players' maximal speed was $4.50 \pm 0.13\text{m.s}^{-1}$, the maximal heart rate was recorded as high as $197.9 \pm 4.30\text{b.min}^{-1}$ while their maximal blood lactate concentration was recorded $13.10 \pm 2.88\text{mmol.l}^{-1}$. Furthermore, the players' speed in the anaerobic (lactate) threshold was estimated in $3.50 \pm 0.32\text{m.s}^{-1}$ and in $176.8 \pm 7.60\text{b.min}^{-1}$. Regarding the players' blood lactate concentration in relation to the different pitch dimensions, no significant interactions were recorded among the 4x5min of 4 vs. 4 SSGs ($F_{6,42}=0.835$, $p=0.55$). In contrary, the dimensions of the playing formats caused a significant differentiation in the physical performance of the players in each one 4 vs. 4 SSGs training ($F_{2,42}=13.05$, $p<0.05$). The *Bonferroni* multiple comparisons revealed that the players' blood lactate concentration did not significantly differ in the 1st set of the 5min of the 4 vs. 4 SSGs in the amount of playing formats, while in the 2nd set of the 4 vs. 4 SSGs significant differences were reported only between the trainings in quarter pitch and whole pitch. Similarly, during the 3rd and 4th set of the 4 vs. 4 SSGs, significant differences were recorded in the players' blood lactate among the games in the quarter pitch compared to the SSGs format in half and whole pitch, (Table 1)

Table 1. The players' blood lactate (BLa) during the 4 vs. 4 SSGs in different playing format, (mean $\pm$ SD).

Pitch dimensions	33x44m	64x50m	100x64m
Blood lactate (mmol.l ⁻¹)			
1 st set	6.34 $\pm$ 1.37	8.24 $\pm$ 1.40	6.65 $\pm$ 2.96
2 nd set	6.65 $\pm$ 1.97*	8.54 $\pm$ 2.36	11.00 $\pm$ 2.98
3 rd set	6.02 $\pm$ 1.20●	9.42 $\pm$ 1.74▲	11.20 $\pm$ 4.19
4 th set	6.05 $\pm$ 1.21#	9.20 $\pm$ 2.19^	11.28 $\pm$ 3.05

Abbreviations: ●, *, #, ▲, ^, playing formats vs set, $p<0.05$

Moreover, the players' heart rate during the 4th set of the 5min 4 vs. 4 SSGs were measured with a significant interaction in relation to the factor "pitch dimension" ($F_{6,42}=3.17$, $p<0.05$). However, no statistical differences were observed in the players' heart rate during the 4x5min of the SSGs in three playing formats, (Table 2).

Table 2. The players' heart rate during the 4 vs. 4 SSGs in three playing format, (mean±SD).

Pitch dimensions	33x44m	64x50m	100x64m
Heart Rate (b.min ⁻¹)			
1 st set	176.0±7.34 [•]	175.6±5.63 [*]	178.3±7.90 [#]
2 nd set	181.6±7.38 [•]	181.1±7.73 [*]	182.7±8.31 [#]
3 rd set	181.5±6.94 [•]	181.6±4.50 [*]	180.8±7.54 [#]
4 th set	179.0±7.50 [•]	181.7±5.72 [*]	181.1±9.35 [#]

Abbreviations: [•], ^{*}, [#] playing formats vs set, $p<0.05$

Regarding the percentage of the time in which the players' heart rate was recorded higher than their estimated heart rate in the lactate threshold of 4mmol.l⁻¹, significant interaction was observed in the training formats in all playing pitch and in each set (5min) of the SSGs ($F_{6,42}=2.85$, $p<0.05$). Analyzing the interaction among the pitch dimension formats with the sets of the above training method, significant differences were confirmed only in the quarter pitch dimension of the 4x5min set of SSGs ($F_{3,5}=11.074$, $p<0.05$). However, no significant differences were recorded among each separate set of 4x5min of the SSGs and the three different pitch dimensions: 100x64m (whole pitch)-64x50m (half pitch)-33x44m (quarter pitch), (Table 3).

Table 3. The players' percentage of heart rate (%HR) which recorded as the HR higher than their lactate threshold (4mmol.l⁻¹) during the 4 vs. 4 SSGs in selected playing formats, (mean±SD)

Pitch dimensions	33x44m	64x50m	100x64m
% Heart Rate (b.min ⁻¹)			
1 st set	58.0±20.07 [•]	46.3±35.52 [*]	61.5±26.27 [#]
2 nd set	86.5±7.09 [•]	76.0±22.31 [*]	84.2±13.7 [#]
3 rd set	81.0±11.91 [•]	80.0±23.58 [*]	74.0±18.8 [#]
4 th set	72.3±12.79 [•]	84.2±11.59 [*]	78.0±20.72

Abbreviations: [•], ^{*}, [#] differences among set, $p<0.05$

The *Friedman-test* for dependent samples proved a significant effect of the playing dimensions during the 4x5min set of the SSGs in the amount of goal-scored, in the shots, in the players' defensive actions, in the long passes and in the accuracy of the passes. Additionally, no significant interactions were observed in the players' technical skills of short passes, ball dribbling and double-passes, (Table 4).

Table 4. The players' technical-tactical parameters recorded during the 4 vs. 4 SSGs in different pitch dimensions, (mean±SD)

Technical-tactical parameters	33x44m	64x50m	100x64m	<i>Friedman test-x²</i>
Goal-scored	2.37±1.06 [*]	1.12±0.83	0.87±0.83	7.76
Shots	6.62±3.85 [*]	2.62±1.84	2.37±1.30	12.80
1vs1	8±3.50 [*]	6.37±2.38 [*]	3.50±1.41	9.80
Dribbling	7.12±2.99	7.25±2.81	6.50±4.24	0.50
Long passes	0.00±0.00 [*]	2.75±2.18	3.00±2.00	11.40
Short passes	20.62±11.68	18.87±4.35	18.12±4.39	0.06
Passes out of target	4.00±3.02 [*]	0.87±0.64	0.87±1.12	7.26
Double passes	1.00±0.75	0.50±0.75	0.37±0.51	2.15

^{*} $p<0.05$

The *Wilcoxon-test* showed that in 4 vs. 4 SSGs in the quarter pitch format, the goals were significantly more than the goals in the SSGs in the half pitch ($z=-1.98$, $p<0.05$) and also there were more shots ($z=-2.52$, $p<0.05$), no long passes ($z=-2.40$, $p<0.05$) and more passes out of target ($z=-2.38$, $p<0.05$). In addition, no significant differences were reported in the SSGs in the quarter pitch in the defensive actions ($z=-1.35$, $p=0.175$). Furthermore, in the SSGs in the quarter pitch there were a significantly greater amount of goal-scored ($z=-2.15$, $p<0.05$), more shots ($z=-2.52$, $p<0.05$), a significantly lower number of long passes ($z=-2.53$, $p<0.05$), significantly more short passes out of the target ($z=-2.11$, $p<0.05$) and significantly more defensive actions ($z=-2.11$, $p<0.05$) in relation to the whole pitch format. Finally, in the half pitch SSGs in relation to the whole pitch playing format, no significant differences were recorded in the amount of goal-scored ($z=-1.41$, $p=0.15$), shots ($z=-0.64$, $p=0.51$), long passes ($z=-0.17$, $p=0.86$) and short passes out of the target ($z=-0.07$, $p=0.94$). In contrary, significant differences were reported in the players' technical activities in half pitch in relation to the whole pitch only in the players defensive action, ($z=-2.37$, $p<0.05$).

Discussion

The relevant bibliography suggests that the energy production of the players must be connected to the pre-season and in-season trainings in a soccer team (Reilly & Williams, 2003). Furthermore, in current literature there is a disagreement regarding the characteristics of the training elements, which could lead to the improvement of the aerobic or the anaerobic performance of the players. For instance, while the Arcelli and Ferreti (1998) proposed that the mechanism of the lactate blood production of the players was maximized during 100m incline shuttle runs, Hasan (2023) says that the above training method increases their blood lactate concentration more than the 15-20mmol.l⁻¹ values which are not recorded in the players during an official match. In addition, Bangsbo (1999), measured the match-play blood lactate of the players from 3mmol.l⁻¹ to 10mmol.l⁻¹ while Hill-Haas, Dawson & Impellizzeri (2011) recorded the players' blood lactate accumulation between 8mmol.l⁻¹ and 12mmol.l⁻¹ with the values of 12mmol.l⁻¹ to be recorded only from the midfielders. The above blood lactate values of the players could be interpreted from the variety of playing intensities during a match (Bangsbo, 1999), the team formation (Ispirlidis et al., 2020) and whether the team plays in home or in away match (Gomez et al., 2018). Thus, in contemporary soccer the energy pathways must be orientated in training methods simulating the match-play performance with sub-group games such as the 4 vs. 4 SSGs (Barra & Rossetti, 2014).

From the results, it was shown that the greater the SSGs pitch format, the greater the blood lactate concentrations of the studied players. During the 4x5min of the SSGs in whole pitch, the present study confirmed the high blood lactate concentration of the trained professional players. More specifically, during the 2nd 5min of the above training the players' BLa was significantly higher than the values in the SSGs in the quarter pitch. Additionally, during the 2nd 5min of the 4 vs. 4 SSGs in whole pitch the players' blood lactate concentration was recorded higher than in the 4 vs. 4 SSGs in half pitch but without significance. Moreover, during the 3rd and 4th 5min of the SSGs, the players' blood lactate concentrations were significantly higher in both whole pitch and half pitch playing formats regardless the training in the quarter pitch. Furthermore, the players' blood lactate mean values during the SSGs in whole pitch ranged from the 1st to 4th 5min between 9.65mmol.l⁻¹ and 11.28mmol.l⁻¹ concentrations which were similar to that measured in professional players during an official match (Ispirlidis et al., 2020). In contrast, during the SSGs in the half pitch format, the players' blood lactate concentration were recorded from 8.24mmol.l⁻¹ to 9.42mmol.l⁻¹, while in 4 vs. 4 SSGs in quarter pitch format the studied players' blood lactate ranged between 6.02mmol.l⁻¹ and 6.65mmol.l⁻¹.

In addition, the players' heart rates were recorded 46.3% and 86.5% higher than the total loading duration of the training without any significant differences regarding the pitch dimensions in each one of the 5min of the SSGs. The above finding confirms that the 4 vs. 4 SSGs, regardless the playing format, represent the training intensities for the improvement of the cardiovascular system of the professional players (Dellal et al., 2008). Additionally, the heart rate of the players did not differ significantly in relation to the amount of SSGs formats. This finding is in accordance with the bibliography that has proven that in high-intensity training loads the elevation of the players' blood lactate concentrations did not simultaneously follow the increase of the players' heart rate (Aasgaard & Kilding, 2020). Also, in 4 vs. 4 SSGs in half pitch this study proved that the players' anaerobic lactate pathway of energy production was lower simulating the match performance and in conjunction with the literature could be the most proper training method enhancing the speed endurance capacity of the players (Giménez et al., 2018). Thus, from the players' blood lactate concentration during the SSGs in the quarter pitch, the current study recorded lower activation of their anaerobic lactate metabolism, which combined to the high loading of the cardiovascular system leads to the fact that the internal loadings of this training method simulate the players' aerobic and anaerobic demands in an official match (Asci, 2016).

In the technical-tactical point of view, the present study showed that by shortening the playing format no significant differences were observed in the players' technical elements of short passes, dribbling and double passes (1-2). In contrary, in small pitch the playing style during the SSGs presented fewer long passes, great amount of goals-scored, shots, passes out of the target and defensive actions. It is evident that the small playing format during the 4 vs. 4 SSGs results in pressing conditions in the players causing a great amount of 1vs1 and a great number of passes out of the target. Therefore, it is of great importance to mention that the small-sided games, such as the 4 vs. 4 SSGs format in the quarter pitch dimension is a training method that improves the technical-tactical parameters in professional players (Ispirlidis, 2021).

Conclusion

From the soccer science perspective the 4x5min set of 4 vs. 4 SSGs+GKs in the quarter pitch (33x44m) seems to be an effective training method for the improvement of the speed-endurance of the players due to the fact that it activates their anaerobic glycolysis simulating the match performance. Furthermore, the above training protocol proved that the players trained with a large number of technical-tactical parameters (passes-shots-defensive actions goal-scored). Similarly, the SSGs in the half pitch (64x50m) showed that the training loads were as high as the quarter pitch but with a significantly lower number of technical-tactical skills from the players. Finally, the 4 vs. 4 SSGs in whole pitch (100x64m) was characterized as an extremely intensive training format because the players' blood-lactate values were recorded higher than in a match. Simultaneously, in this

training format, the players did not present any improvement in the technical-tactical parameters, which are necessary in the matches. Thus, soccer trainers should carefully select the appropriate SSGs format according to the aim of the training and the expected results regarding the team's tactical aspects and/or the players' physical conditioning. Future research could evaluate parameters such as the muscle lesions caused by the small-sided games and assess their use as a training method in the microcycle sessions in order to protect the players from injuries and muscle damages.

References

- Aasgaard, M. & Kilding, A.E. (2020). Does man marking influence running outputs and intensity during small-sided soccer games? *Journal of Strength and Conditioning Research*, 4(11), 3266-3274.
- Aguiar, M.V., Botelho, G.M., Gonçalves, B.S. & Sampaio, J.E. (2013). Physiological responses and activity profiles of football small-sided games. *Journal in Strength and Conditioning Research*, 27(5), 1287-1294.
- Aguiar, M.V., Botelho, G.M., Lago, C., Maças, V. & Sampaio, J.E. (2012). A review on the effects of soccer small-sided games. *Journal in Human Kinetics*, 33, 103-113.
- Arcelli, E. & Ferretti, F. (1998). *Fussball konditionstraining*, BFP, Versand Anton Lindemann: Leer.
- Asci, A. (2016). Heart Rate Responses during Small-Sided Games and Official Match Play in Soccer. *Sports*, 4(31), 1-7.
- Bangsbo, J. (1999). *Physiological demands*. In B.Eklom (Ed), *Football (Soccer)* (pp 43-59), London: Blackwell Scientific.
- Barra, R. & Rossetti, A. (2014). *Gli small sided games*. Editore: allenatore, (p.52) 55054, Bozzano.
- Bujalance-Moreno, P., Latorre-Román, P.Á. & García-Pinillos, F. (2019). A systematic review on small-sided games in football players: Acute and chronic adaptations. *Journal of Sports Science*, 37(8), 921-949.
- Casamichana, D. & Castellano, J. (2010). Time-motion, heart rate, perceptual and motor behaviour demands in small-sides soccer games: Effects of pitch size. *Journal of Sports Science*, 28(14), 1615-1623.
- Dellal, A., Chamari, K., Pintus, A., Girard, O., Cotte, T. & Keller, D. (2008). Heart rate responses during small-side games and short intermittent running training in elite soccer players. A comparative study. *The Journal of Strength & Conditioning Research*, 22(5), 1449-1457.
- Faude, O., Steffen, A., Kellmann, M. & Meyer, T. (2014). The effect of short-term interval training during the competitive season on physical fitness and signs of fatigue: A crossover trial in high-level youth football players. *International Journal in Sports Physiology and Performance*, 9(6), 936-944.
- Gatti, P. (2016). *La Periodizzazione Tattica. Come e perche*. Editore: Editoriale Sport Italia, Via Masaccio 12, 20149, Milano.
- Gaudino, P., Alberti, G. & Iaia, F.M. (2014). Estimated metabolic and mechanical demands during different small-sided games in elite soccer players. *Human Movement Science*, 14(36), 123-133.
- Giménez, J.V., Liu, H., Lipińska, P., Szwarc, A., Rompa, P. & Gómez, M.A. (2018). Physical responses of professional soccer players during 4 vs 4 small-sided games with mini-goals according to rule changes. *Biology of Sport*, 35(1), 75-81.
- Gómez, M., Mitrotasios, M., Armatas, V. & Lago-Peñas, C. (2018): Analysis of playing styles according to team quality and match location in Greek professional soccer, *International Journal of Performance Analysis in Sport*, 18(6), 986-997.
- Gonçalves, B., Marcelino, R., Torres-Ronda, L., Torrents, C. & Sampaio, J. (2016). Effects of emphasizing opposition and cooperation on collective movement behavior during football small-sided games. *Journal of Sports Science*, 34(14), 1346-1354.
- Halouani, J., Chtourou, H., Dellal, A., Chaouachi, A. & Chamari, K. (2017). Soccer small-sided games in young players: rule modification to induce higher physiological responses. *Biology of Sport*, 34(2), 163-168.
- Hasan, S. (2023). Effects of plyometric vs. strength training on strength, sprint, and functional performance in soccer players: a randomized controlled trial. *Scientific Reports*, 13:4256, doi: 10.1038/s41598-023-31375-4.
- Hill-Haas, S.V., Dawson, B. & Impellizzeri, F.M. (2011). Coutts AJ. Physiology of small-sided games training in football. *Sports Medicine*, 41(3), 199-220.
- Hodgson, C., Akenhead, R. & Thomas, K. (2014). Time-motion analysis of acceleration demands of 4v4 small-sided soccer games played on different pitch sizes. *Human Movement Science*, 33(1), 25-32.
- Impellizzeri, F.M., Marcora, S.M., Castagna, C., Reilly, T., Sassi, A., Iaia, F.M. & Rampinini, E. (2006). Physiological and performance effects of generic versus specific aerobic training in soccer players. *International Journal of Sports Medicine*, 27(6), 483-492.
- Ispirlidis, I. (2021). Effects of two different small-sided games protocols on physiological parameters of professional soccer players. *Journal of Human Sport & Exercise*, 16(2proc), S154-S161.
- Ispirlidis, I., Gourgoulis, V., Mantzouranis, N., Gioxtsidou A. & Athanailidis, I. (2020). Match and training loads of professional soccer players in relation to their tactical position. *Journal of Physical Education and Sports*, 20(3), 2269-2276.
- Mallo, J. & Navarro, E. (2008). Physical load imposed on soccer players during small-sided training games. *Journal in Sports Medicine and Physical Fitness*, 48(2), 166-171.

- Owen, A.L., Wong, D.P., McKenna, M. & Dellal, A. (2011). Heart rate responses and technical comparison between small-vs-large-sided games in elite professional soccer. *Journal in Strength and Conditioning Research*, 25(8), 2104-2110.
- Reilly, T. & Williams, M. (2003). *Science and Soccer*. New York: Routledge, USA.
- Sanchez-Sanchez, J., Hernández, D., Casamichana, D., Martínez-Salazar, C., Ramirez-Campillo, R. & Sampaio, J. (2017). Heart rate, technical performance, and session-RPE in elite youth soccer small-sided games played with wildcard players. *Journal in Strength and Conditioning Research*, 31(10), 2678-2685.
- Tessitore, A., Meeusen, R., Piacentini, M.F., Demarie, S. & Capranica, L. (2006). Physiological and technical aspects of "6-a-side" soccer drills. *Journal of Sports Medicine and Physical Fitness*, 46(1), 36-43.
- Weineck, J. (1992). *Optimales Fussballtraining. Teil 1. Das Konditionstraining des Fussballspielers*. Beitrage zur Sportmedizin. Bd.43. Med.Verl-Ges.