



The Influence of the Number of Players on Workload during Small-Sided Games among Elite Futsal Players

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ABSTRACT Small-sided games are a specific form of training in which exercise intensity can be manipulated mainly by modifying external factors. The aim of this study was to determine the influence of a number of players during small sided futsal games on metabolic responses and distance covered at elite senior futsal players. Fifteen top level Czech futsal players (males, aged 26.81 ± 5.30 ; body height = 176.10 ± 4.34 cm; body weight = 71.31 ± 5.30 kg, and peak heart rate = 191.23 ± 5.4 beats•min⁻¹) participated in the study. Heart rate, blood lactate concentrations, distance covered, and rate of perceived exertion were monitored during small-sided futsal games. We found significant differences between blood lactate concentration values and perceived exertion; it was significantly higher during 3vs3 and 4vs4 small-sided games than during 6vs6 games. When we compared the distance covered by players, we found significantly higher distance covered during 4vs4 than in 6vs6 games. The results of this study demonstrated that the small-sided games 3vs3 and 4vs4 were valuable tools to develop specific futsal fitness. As the most intensive, the 4-a-side game was found.

KEY WORDS Heart Rate, Specificity, Distance Covered, Tactical Metabolic Training.



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WORKLOAD DURING SMALL-SIDED GAMES IN FUTSAL

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Introduction

Futsal is the indoor version of soccer, and the organizing body remains FIFA (Barbero-Alvarez, Soto, Barbero-Alvarez, V., & Granda-Vera, 2008). Futsal is played between two teams of four field players and one goalkeeper player, on a 40×20 m pitch with 3×2 m goals. The match lasts two equal periods of 20 minutes, but, like basketball, the clock is stopped for some events (Barbero-Alvarez, D'Ottavio, Granda Vera, & Castagna, 2009).

Futsal is a game of intermittent high intensity and sizeable distances covered during match play (Bangsbo, Mohr, & Krstrup, 2006; McMillan, Helgerud, Macdonald, & Hoff, 2005). The futsal match is 70–80 min long; the players make approximately 6 to 8 alternations. Distances covered at the top level ranged from 2575 to 4313 m (Dogramaci, Watsford, & Murphy, 2011; Barbero-Alvarez et al., 2008). Mean heart rate moves from 174 to 176 beats per minute and 83–87 % of the game time is spent over 85% of peak heart rate (Barbero-Alvarez et al., 2008; Tessitore et al., 2008). Because of the game duration, soccer is mainly dependent upon aerobic metabolism (Stolen, Chamari, Castagna, & Wisloff, 2005), which is why specific aerobic conditioning is needed (Stone & Kilding, 2009).

Small-sided games (SSG) have been extensively studied as they are very popular as a conditioning tool in amateur and elite football (Randers, Nielsen, Bangsbo & Krstrup, 2014). Small-sided games became a popular method of developing soccer specific aerobic fitness (Impellizzeri et al., 2006). The high specificity of loading, decision making under pressure of opponents, and keeping players motivated were the most significant advantages of using SSG in soccer training (Reilly, 2005). The researchers have examined variables that may affect the intensity of SSG in all games (soccer, handball, basketball, etc.) such as dimensions of the pitch number of players, rule modifications, continuous and intermittent modality, goalkeepers' participation, and coach encouragement (da Silva et al., 2011; Hill-Haas, Coutts, Rowsell, & Dawson, 2008; Hulka, Weisser,

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& Belka, 2016; Rampinini et al., 2007; Impellizzeri et al., 2006). The aim of this study was to determine the influence of the number of players during small-sided futsal games on metabolic responses and distance covered among elite senior futsal players.

Methods

Participants

The research study involved a total of 15 top level Czech futsal players (males, age 26.81 ± 5.30 years; body height $=176.10 \pm 4.34$ cm; body weight $=71.31 \pm 5.30$ kg, and peak heart rate $=191.23 \pm 5.4$ beats·min $^{-1}$) who played in the highest nationwide Chance Futsal League in 2014/15, Futsal Champions League, and UEFA Futsal Cup. Players were in four team sessions per week. Therefore, the players in our sample had several years of experience. Prior to data collection, the players were informed about the purpose of the measurement, signed the informed consent related to Helsinki declaration, and the results were provided to the players on an individual basis. The involvement of the players was voluntary, and the results were used only for the study.

Procedures

To analyse the internal response to players' load during measured small-sided games, we applied heart rate monitoring during the measurement using the TEAM Polar2Pro system (Polar Electro, Kempele, Finland). We expressed the measured data as a percentage of HRpeak (Capranica, Tessitore & Guidetti, 2001; Hulka, Cuberek & Belka, 2013) and we used six HRpeak zones (as described below) according to Barbero-Alvarez et al. (2008), and Duarte, Batalha, Folgado and Sampaio (2009) because of the possibility of better comparing our gained data with other studies. Mentioned authors defined HRpeak zones conception as follows: $< 65\%$ HRpeak, $65\% \leq HR \leq 85\%$ HRpeak, $> 85\%$ HRpeak.

Blood lactate concentration was measured by Lactate Scout+ before and after every small-sided game. RPE was assessed with the 15-point Borg scale (Borg, 1998) after finishing every small-sided game and friendly basketball match.

The SSG were recorded with two Canon HF10 video cameras (each with a resolution of 1280×720 pixels). Each camera was used to record a separate half of the court (20×20 m) according to Hulka, Cuberek & Svoboda (2014). Video records were analysed per a standardized procedure using a software package (Video Manual Motion Tracker 1.0, Faculty of Physical Culture, Palacky University Olomouc, Czech Republic). This method enables the recording of the total distance covered during a match. Additionally, it allows for measurement of the immediate and average velocity of the players during a match or training. Next, the intensity profile of player's performance was grouped, according to Barbero-Alvarez J., Soto, Barbero-Alvarez, V. and Granda-Vera (2008) and Bishop and Wright (2006), to movements performed by low intensity activity executed with velocity 0 to $3.00\text{ m}\cdot\text{s}^{-1}$, and included inactivity to $0.10\text{ m}\cdot\text{s}^{-1}$, walking from 0.10 to $1.00\text{ m}\cdot\text{s}^{-1}$, and jogging from 1.10 to $3.00\text{ m}\cdot\text{s}^{-1}$. The movements performed by medium intensity activities executed with velocity from 3.10 to $5.00\text{ m}\cdot\text{s}^{-1}$ were generated by the second group, and the maximal intensity activity with the velocity over $5.10\text{ m}\cdot\text{s}^{-1}$ was generated by the last group.

All measurements were on a 20×40 m indoor court. Two weeks before the measurement, the participants took a maximum load field test "Yo-Yo intermittent level 1 recovery test" (Bangsbo, Iaia, & Krustrup, 2008) to determine peak heart rate (HRpeak). The measurement took place every Tuesday after the Monday regeneration session. For every measured session, only one type of SSG was applied in three repetitions. The time of work was 4 minutes, and we used a four-minute recovery according to Casamichana and Castellano (2010), and Duarte, Batalha, Folgado, and Sampaio (2009). We tracked the changes during SSG with different numbers of players (3vs3, 4vs4, 5vs5, and 6vs6). Every measured session was started by warm-up twenty minutes long, which consisted of five minutes of passing and shooting drill (jogging tempo), ten minutes of dynamic whole body stretches, and brief high-intensity runs with the ball.

Statistical data analysis

For statistical data processing, we used the SPSS statistical software (17.0 version; SPSS Inc., Chicago, IL). Because of small sample size, a non-parametric Kruskal-Wallis test and post hoc Dunn's nonparametric comparison were used. The level of significance was determined at an alpha level of $p<0.05$.

Results

The distance covered and appropriate metabolic responses of players during the observed small-sided games are shown in Table 1. Metabolic response was expressed by mean heart rate, the percentage of peak heart rate, blood lactate concentration after work, and Borg scale.

We found significant differences between blood lactate concentration values ($H=9.21$; $p=0.041$), where it was significantly higher during 3vs3 ($r=0.001$) and 4vs4 SSG ($r=0.004$) than during 6vs6 SSG. Similarly, we found perceived exertion of players during SSG ($H=11.21$; $p=0.004$), because perceived exertion during 4vs4 ($r=0.005$) was higher than during 6vs6.

When we compared the distance covered by the players, we found significantly higher distance covered during 4vs4 than 6vs6 ($H=9.05$; $p=0.044$; $r=0.43$).

TABLE 1 Results of distance covered and metabolic response of players during observed small-sided games

	3vs3	4vs4	5vs5	6vs6
HR_{mean} (beats·min⁻¹)	161.46±8.97	164.20±6.92	158.67±7.16	156.27±7.87
% HR_{peak} (%)	84.44±4.69	85.17±3.01	83.05±3.74	82.24±4.12
BLa (mmol·L⁻¹)	7.76 ± 1.09*	7.25 ± 0.76*	5.53 ± 0.97	3.91 ± 0.71
Borg scale	14.25 ± 1.41	15.55±2.02*	13.25 ± 1.45	12.21 ± 1.63
Distance (m)	1732.91 ± 161.89	1776.08 ± 154.27*	1678.77 ± 173.38	1566.25 ± 151.21

Legend: * - statistical significant differences on level of P<0.05

Discussion

Small-sided games are a suitable instrument for football specific aerobic conditioning development (Little, 2009). To prevent the players from undertraining or overtraining, it is vital to know variables, which can influence the exertion of players during Small-sided games (Della, Hill-Haas, Lago-Penas, & Chamari, 2011). In this study, we wanted to determine the influence of the number of players on the exertion of players and their metabolic response. Measured SSG caused relatively lower metabolic response than futsal matched did (Barbero-Alvarez J. et al., 2008). However, According to Hoff, Wisloff, Engen, Kemi and Helgerud (2002) the values of 3vs3 and 4vs4 were considered to be a significant stimulus to the cardiovascular system. SSG 6vs6 and 5vs5 were not found to be a suitable instrument for-futsal specific aerobic conditioning development. Appropriate use of small-sided games is the way to work in the team with individualized training load, in which the endurance training, technical, and tactical training are connected (Hulka, Weisser, Belka & Hap, 2015).

Casamichana and Castellano (2010) found that the effective playing time could offer a potential explanation for the differences in the metabolic demands. As the individual playing area was reduced by the increased number of players, the frequency of motor behaviour increased, with a concomitant decrease in effective playing time. At the same time, the players covered less distance, spend more time stationary or walking, which leads to a lower physiological workload and lower ratings of perceived exertion during 6vs6 and 5vs5 (Aguiar, Botelho, Lago, Maças, & Sampaio, 2012). Moreover, with increased number of players, the tactical and technical demands of players grow.

According to our results, the most intensive SSG was 4vs4, not 3vs3 as expected. This fact can be explained by different tactical conception, based on positional plays. The size of exertion was able to be influenced by subconscious saving the energy because of the small number of players. The application of 3vs3 or 4vs4 SSG to the training session generated very similar exertion and metabolic responses of players. Thus, decreasing the number of players with the purpose of increasing exertion is useless.

We have found the differences in metabolic response measurement. While the measurement of heart rate showed no differences among SSG, the blood lactate concentration perceived exertion measurement showed the differences. We showed that heart rate was similar tendencies but not as sensitive as the other ones. It can be explained by different structures of intermittent performance. During 6vs6 and 5vs5, more recovery time was needed for lactate disposal.

Conclusion

The results of this study demonstrated that the small sided games 3vs3 and 4vs4 were valuable tools to develop specific futsal fitness. Appropriate use of small-sided games is the way to work in the team with individualized training load, where the endurance training, technical, and tactical training are connected. The 4-a-side game was found to be the most intensive .

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