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Comparisons of interval and continuous small-sided games on physiological and technical responses in futsal players

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Abstract

The objective of this study was to assess the effect of different game formats on the physiological and technical responses of recreational futsal players during interval and continuous small-sided games (SSG). Sixteen male recreational futsal players (age = 21.50 ± 1.21 years; height= 179.19 ± 7.01; weight: 72.81 ± 6.48) played interval and continuous SSG. The SSG interventions were assigned randomly to two training intervention groups, utilizing goalkeeper-based SSGs in both interval and continuous game forms. The games were played on a futsal half-court (20m x 20m) 4 vs 4 with a goalkeeper. Continuous game was played as 1 x 24 min, intermittent game was played as 6 x 4 min. In interval games, 4 minutes of rest is given between sets. The internal load was evaluated utilizing the heart rate (HR), rating of perceived effort (RPE) and enjoyment scale. Technical activities were carried out by utilizing video footage that was taken throughout all SSG sessions. Paired Sample T test analysis was performed to evaluate significant differences in performance between interval and continuous SSGs. After the interventions, HR, RPE, enjoyment, successful passes, unsuccessful passes, successful shot, unsuccessful shot, ball win ball lost and goal scores showed no significant difference between the interval and continuous SSG ($p > 0.05$). Although there was no significant difference in the results, it was observed that continuous game results were higher than interval game in heart rate and RPE values. The results indicate that continuous games create a greater physiological load. Future research may enhance the generalizability of results by conducting games with fewer participants on identical playing fields.

Introduction

Futsal is an extremely dynamic sport that demands constant movement from players and requires excellent technical skills and smart decision-making abilities (Praniata et al., 2019). To perform fast play, good defense and organized attack, basic skills such as chipping, passing, dribbling, control and shooting must be successfully performed in futsal (Sabdono et al., 2019; Taufik et al., 2021; Aryanti & Pangestu, 2021; Sullivan et al., 2021; Djaba et al., 2022). Additionally, 13.7% of the total running distance is at high intensity and 8.9% is sprinting (Barbero Alvarez et al., 2008; Barbero Alvarez et al., 2004). This structure of futsal increases the physical, technical, tactical, and psychological demands forced on the players (Barbero Alvarez et al., 2008). Coaches employ the small-sided games (SSG) training approach to repeat these demands at the same level as in a match (Katis & Kellis, 2009; Hill-Haas et al., 2011; Gabbett et al., 2009).

SSG training is a multifunctional approach employed by coaches, particularly in futsal and soccer to enhance athletes' physical, and psychological, technical and tactical abilities while exposing them in a competitive environment (Fitran et al., 2023; Berdejo-del-Fresno et al., 2015; Amani-Shalamzari et al. 2019; Costa et al., 2021; Arslan et al., 2021; Soylu et al., 2022; Aktas et al., 2014; Guven et al., 2016; Arguz et al., 2023; Yilmaz, 2024; Yilmaz & Soylu, 2024). A study comparing SSG and generic games in futsal, SSG technical characteristics higher than generic games and no difference between SSG and generic games for heart rate (HR) average (Costa et al., 2021). Amani-Shalamzari (2019) stated that SSG training was higher than generic fitness training in technical performance, but HR did difference between between groups.

Different SSG manipulations such as different rules, numbers of players and picth size have been applied in futsal (Hulka & Weisser, 2017; Evangelio et al., 2019; Pizzaro et al., 2021; Kose et al., 2023). Modifications of

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SSGs and tasks offered to players can facilitate the attainment of the intended level of exertion in their physiological, tactical, technical, and cognitive development (Junior et al., 2023; Hammami et al., 2018). Coaches require the knowledge and understanding of how and when to effectively organize SSG training sessions in order to successfully accomplish the stated practice objective (Mallo & Navarro, 2008). The time of SSG bouts is an important factor in designing a training program, since it directly affects the allocation and intensity of the exercises used (Fanchini et al., 2011). Several studies in the literature have examined the impact of SSG games played interval and continuous formats in soccer (Yücesoy et al., 2019; Hill-Hass et al., 2009; Köklü, 2012). However, there appears to be a lack of research in the existing literature that compares the impact of SSG played in interval and continuous formats in futsal. Considering the findings, this study was designed to fill in a gap in the research.

In this context, the objective of this study was to examine the impact of 4v4 SSG games played for interval SSG (6 x 4 minute) and continuous SSG (1 x 24 minute) on HR, ratings of perceived exertion (RPE), enjoyment, and technical skills in futsal.

Methods

Participants

Sixteen recreational futsal players (age = 21.50 ± 1.21 years; height= 179.19 ± 7.01 cm; weight: 72.81 ± 6.48 kg) participated in the study. Players have been playing futsal recreationally for at least 3 years. Players were instructed to abstain from participating in any type of physical activity for a duration of two days and to abstain from eating for at least three hours before to the SSG. The study was conducted in compliance with the ethical guidelines for human experimentation outlined in the Declaration of Helsinki, together with any subsequent modifications. Ethics Committee approval of the study was approved by Osmaniye Korkut Ata University (2024/E.191844).

Procedure

This study investigated the variables of HR, RPE, enjoyment successful passes, unsuccessful passes, successful shot, unsuccessful shot, ball win, ball loss and goal score results in the interval and continuous 4v4 SSG. The characteristics of small sided games are given in Table 1.

Measurements

Psychophysiological responses

The present study utilized psychophysiological measurements, including the HR, RPE, enjoyment, RPE and enjoyment were collected between bouts and after in all games. Polar V800 (Polar Electro Oy, FI-90440 Kempele, Finland) device was utilized to ascertain the HRs of participants during games. This specialized equipment is able to measure the pulse from the wrist in addition to recording the pulse. The perceived exertion of the players was evaluated using a validated 20-point Borg scale after each session of the SSGs in order to measure the internal training intensity (Foster et al., 2021). The validity and reliability of this scale in evaluating the amount of effort have been demonstrated in prior study (Impellizzeri et al., 2004). A standardized question "How was and how did you feel the exercise?" was employed to maintain uniformity. The participants were requested to provide their responses on an individual basis, and they were also made familiar with the scale in advance. This was done to eliminate any instances of possible bias. The RPE scale extended from 6 to 20, with higher ratings indicate increased intensity. Participants reported their degree of enjoyment during the exercise regimen using a Likert scale ranging from 1 to 7. This scale measured their enjoyment during the rest times between sets and at the end of the session. The validation of the enjoyment scale was conducted by Raedeke (2007) and Soylu et al. (2023) to assess exercise enjoyment in Turkish adolescents and adult athletes. The high score that the participant receives from the scale indicates that enjoys physical activity (Interval SSG or Continuous SSG format). How people feel

Table 1
Formats of small sided games.

Games	Set Durations (minutes)	Number of Sets	Rest Times Between Sets (minutes)	Goalkeeper	Field Sizes
4v4 Interval SSG	4	6	4	Yes	Half Court (20m x 20m)
4v4 Continuous SSG	24	1	0	Yes	Half Court (20m x 20m)

during exercise, the sense of enjoyment they experience, as well as their previous exercise experiences and beliefs about exercise, can be powerful influences on exercise avoidance (Ekkekakis et al., 2011; Williams et al., 2008). By using this method, individuals can improve their exercise experiences by predicting their future exercise participation, and information about important effects on future exercise behavior can be obtained (Raedeke, 2007).

Technical responses

The games were captured using high-definition video cameras to analyse the technological motions that occurred throughout the gaming sessions. The games were analyzed using a soccer-specific analysis program named e-Analyze Soccer (developed by Espor Digital Ltd. Inc. in Ankara). Successful passes, unsuccessful passes, successful shot, unsuccessful shot, ball win, ball loss and goal technical parameters are involved in the analysis. An certified coach expert in match and performance analysis, with extensive education, experience, and knowledge, evaluated the technical actions. The analysis was completed by a sole coach.

Data Analyses

Descriptive values are presented as mean ± standard deviation (SD). The normal distribution was verified by the Kolmogorov-Smirnov test. A t-test was used to compare physical performance test variables between interval and continuous small-sided games (SSG). The data analysis was conducted using IBM SPSS Statistics version 26, developed by IBM Corporation in Armonk, NY, USA.

Results

Table 2 shows that there is no significant difference in terms of HR, RPE, enjoyment, successful passes, unsuccessful passes, successful shot, unsuccessful shot, ball win ball lost and goal ($p > 0.05$).

Discussion

The study findings indicate that there is no statistically significant difference in HR, RPE, enjoyment, successful passes, unsuccessful passes, successful shot, unsuccessful shot, ball win, ball loss and goal scored between interval and continuous 4v4 SSG.

Although the HR average and RPE results of continuoues SSG were higher than interval SSG, the difference was not statistically significant. The possible explanation for this outcome might be because the 20 x 20 m half court playing field used for SSG (4v4 with goalkeeper) is not a large enough area to create a difference in HR average and RPE values. Generally the soccer SSG (4v4) is played in a larger area 20 x 25 m (Owen et al., 2004), 24 x 36 m (Köklü et al., 2011; Köklü et al., 2012) and 25 x 32m (Soylu, 2021; Soylu et al., 2022) compared to the half court used in futsal. No comparative research has been found in the literature that investigates the impact of interval SSG and continuous SSG in futsal. However, there are similar studies in soccer. A smilar study found that there were no significant differences in %Hrmax between interval SSG and continuous SSG for 2-a-side, 3-a-side, and 4-a-side forms (Köklü, 2012).

Table 2

HR, RPE, enjoyment, and technical result of futsal players to 6 x 4 min Interval SSG and 1 x 24 min Continuous SSG conditions.

Variables	6x4 min Interval SSG	24 min Continuous SSG	Mean Difference	%95 CI	*p*
	Mean ± SD	Mean ± SD			
HR average	179.64 ± 8.60	183.25 ± 8.20	-3.61	-8.36 – 1.15	0.127
RPE	12.81 ± 2.53	13.81 ± 3.17	-1	-2.32 – 0.31	0.125
Enjoyment	33.16 ± 3.11	33.07 ± 3.32	0.09	-1.70 – 1.90	0.907
Successful pass	31.31 ± 13.00	27.25 ± 8.00	4.06	-2.30 – 10.43	0.194
Unsuccessful pass	9.81 ± 4.00	8.25 ± 3.44	1.56	-0.29 – 3.42	0.093
Ball win	3.06 ± 2.32	1.81 ± 1.47	1.25	-0.21 – 2.71	0.089
Ball lost	5.06 ± 2.91	4.25 ± 2.93	0.81	-1.11 – 2.73	0.381
Successful shot	4.69 ± 3.55	6.19 ± 3.62	-1.5	-3.14 – 0.14	0.070
Unsuccessful shot	4.06 ± 1.65	4.25 ± 2.35	-0.19	-1.16 – 0.79	0.688
Goal	1.88 ± 1.59	2.56 ± 2.03	-0.68	-1.59 – 0.22	0.127

**: Significant differences (p<0.05); HR: Heart Rate; RPE: Rating of perceived exertion; SSG: Small Sided Games; Min: Minutes.*

Another smillar study reported that the average HR mean results were similar in 5v5 continuous (1 x 16 min) SSG and interval (4 x 4 min/2 x 8 min) SSG (Casamichana et al., 2013). Contrary to these results, Hill-Haas et al. (2009) found that continuous SSG resulted in higher values for %HRmax and RPE compared to interval SSG. Other research indicate that %HRpeak responses were higher in 4v4 continuous (1 x 12 min) SSG and interval (2 x 6 min / 3 x 4 min) SSG (Farhani et al., 2022). Casamichana et al. (2013) stated that inclusion of a recovery time occurs as a result of rest provided by intermittent SSG may result in a decrease in HR values during following periods.

Concerning the results of our research, no significant differences were observed in the level of enjoyment. Tauer & Harackiewicz (2004) stated that increased enjoyment during training is effective in improving performance output. Furthermore, successful execution of technical movements can provide athletes to enjoy the game more. No significant difference was observed in the technical movement results of this study. Therefore, there is possible no difference in the enjoyment results of interval and continuous SSG formats. No study in the literature that evaluates interval and continuous SSG formats in terms of enjoyment in futsal. However, a study on soccer indicates that higher levels of enjoyment in a continuous format (1 x 12 min) compared to an interval format (2 x 6 min / 3 x 4 min) in 4v4 SSG (Farhani et al., 2022). Consistently playing the game in continuous SSGs can make athletes more motivated and the game can become more enjoyable.

Regarding technical performance no significant differences observed between interval SSG and continuous SSG in the successful passes, unsuccessful passes, successful shot, unsuccessful shot, ball win, ball loss and goal scored. A potential explanation for this result might be because the 20 x 20 m half court playing field utilized for SSG (4v4 with goalie) is insufficient in size to generate differences variations in technical moves. No study in the literature that compares the technical movements of interval and continuous SSG forms in futsal. However, a similar study conducted in soccer no significant differences in successful passes, unsuccessful passes, contact with the ball, shots on target, unsuccessful shots and goals scored of continuous (1 x 20 min) and interval (2 x 10 min / 4 x 5 min) forms in 3 v 3 and 5 v 5 SSG (Alcantara et al., 2021). In contrast to these findings, another research continuous (1 x 12 min) SSG successful passes results were higher than interval SSG (2 x 6 min / 3 x 4 min) in 4v4 SSG (Farhani et al., 2022). In this study, the game is 4 v 4, the playing field is 25 x 32 m. Thus, the player's m^2 per player rises in the 25 x 32 m^2 game compared to the 20 x 20 m playing field in futsal. For this reason, there may be differences in responses of interval and continuous SSG technical movements.

Limitation

Interpretations of the findings of this study should be made taking into account several limitations. Initially, the individuals involved in the study were young soccer players with amateur experience. Consequently, the results may not be applicable to different age groups, degrees of expertise, and competitive environments. Secondly, the study only employed psychological and technical measures in 4-a-side SSG goalkeeper forms.

However, different implications of these observed differences such as player numbers, mini goal and possession have not yet been investigated. Therefore these data may not comprehensively represent the impacts of physiological and technical factors.

Conclusion

In conclusion, the examination of the 4-a-side SSG outcomes provided valuable information about the impacts of interval and continuous game structures on several factors. Enjoyment, successful passes, failed passes, successful shoots, unsuccessful shots, winning the ball, losing the ball, and goals scored were no statistically significant difference between interval and continuous SSG form. Despite the HR average and RPE measurements for continuous SSG were higher compared to interval SSG, the difference were not statistically significant. This research provides important information about the application of interval and continuous SSG in futsal to coaches and practitioners who want to optimize their training regimes. Further research on formats such as different player numbers, different field sizes, mini-goal and possession may provide deeper insights into the complex dynamics between game structure and player development.

Authors' Contribution

Study Design: OY; Data Collection: OY; Statistical Analysis: OY; Manuscript Preparation: OY; Funds Collection: OY.

Ethical Approval

The study was approved by the Osmaniye Korkut Ata Üniversity Ethical Committee (2024/E.191844) and it was carried out in accordance with the Code of Ethics of the World Medical Association also known as a declaration of Helsinki.

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Conflict of Interest

The authors hereby declare that there was no conflict of interest in conducting this research.

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