Effects of Different Recovery Times on Internal and External Load During Small-Sided Games in Soccer

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Background: The ability to maintain a high intensity of exercise over several repetitions depends on recovery from previous exercises. This study aimed to identify the effects of different recovery times on internal and external load during small-sided soccer games.

Hypothesis: An increase in recovery time will increase the external training load and decrease the internal exercise load, which will result in a greater physical impact of the exercise.

Study Design: Cross-sectional study.

Level of Evidence: Level 2.

Methods: Twenty male semiprofessional soccer players participated in the present study. They performed the same exercise (5-a-side game format) continuously (1 × 18 minutes) and repeatedly/fractionated (3 × 6 minutes) with different recovery times (30 seconds, 1 minute, 1.5 minutes, and 2 minutes). Their internal load (ie, average heart rate (HR) and maximum HR) and external load (ie, total distance, maximum speed, and ratio meters) were measured using an HR band and an inertial device equipped with a global positioning system, respectively.

Results: The manipulation of recovery times induced differences in the internal and external load. For the same total duration, the external and internal load indicators exhibited higher values during the fractionated method, particularly with short recovery periods.

Conclusion: The application of small-sided soccer games with different recovery times induced varying responses in training load. To maintain high physical performance and high training load, the fractional method with short recovery periods (ie, 30 seconds) should be used. In contrast, to carefully manage players' efforts and decrease response to training load, continuous or fractional methods with longer recovery periods (ie, 1-2 minutes) should be used.

Clinical Relevance: The proper prescription of recovery time between exercises facilitates enhanced training efficiency and optimized performance.

Keywords: soccer; training load; recovery time; fatigue; small-sided game manipulation

In soccer, the capacity of players to continuously promote tactical and strategic adaptations to game dynamics requires high levels of physical conditioning. Small-sided games (SSGs)[22,24] have been proposed as a tool for developing such capabilities in the context of performance while highlighting similar combinations of the technical, tactical, and physical abilities required in full-sized matches.[1,14,24] SSGs enhance technical and tactical development as well as specific fitness capacities such as endurance (aerobic and anaerobic) and agility.[22] Based on previous research, SSGs are favored by soccer coaches to improve players' performance.[14,16,24,26,28]

Indeed, SSGs have shown characteristics that allow the optimization of tactical and physical components.[1] In addition, previous research has shown that manipulation of SSG duration

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and recovery periods between repetitions[25] (ie, continuous or fractionated methods), previous information about exercise duration,[19,20] and other variables (ie, pitch size, number of players, coach encouragement, rules, or using goalkeepers) allow different SSG intensities and technical/tactical adaptations.[14,25]

Beacuse of the variety of behaviors required for SSGs, exercises without any control could promote soccer players' fatigue.[11] Thus, the correct manipulation of SSG duration and recovery periods between repetitions—according to the physical effort defined for the exercises—should be ensured by coaches, since the ability to manipulate or maintain a high exercise intensity across multiple exercise repetitions is dependent on the recovery from previous exercise.[3] A previous study[28] found that shorter recovery periods induced greater internal loads and increased displacement at low intensity in young soccer players when comparing 3-a-side SSG formats performed on an 18 × 30 m field over 4 repetitions (4 minutes per repetition) with passive recovery times of 1, 2, 3, or 4 minutes between repetitions, respectively. Another investigation[29] carried out with senior players (who played in the 2nd Australian division) did not show differences in physiological and technical indicators for different recovery times (30 and 120 seconds) under repetitions of 6 × 2 minutes performed in 3-a-side SSGs on a 15 × 20 m field. Dellal et al[16] used rest periods of 1, 1.5, and 2 minutes between similar repetitions in 2-, 3-, and 4-sided games, respectively, and their results showed less homogeneity in heart rate (HR) for a recovery time of 2 minutes. In another investigation, McLean et al[29] analyzed the effect of increasing the recovery time from 30 to 120 seconds during SSG repetitions and concluded that there were no changes to the HR parameters between the analyzed conditions. HR, running intensity, and distance covered have been associated with decreased training load and increased fatigue.[5] From a physiological perspective, blood lactate, and H+ accumulation, glycogen depletion, phosphocreatine (PCr) depletion, dehydration, intramuscular acidosis, and insufficient Ca^{2+} within muscles were indicated as factors that may contribute to the accumulation of fatigue during each exercise repetition.[2,11,29] Moreover, neural transmission failures, motivational mechanisms, and practice contexts[11,29] have also been associated with fatigue and increased need for load control during exercise.

The results obtained from the aforementioned studies were distinct and inconclusive because different physical responses and varying impacts on training load were noted. Some of the discrepancies between related studies could be attributed to the different conditions used (eg, goals, game format, number of players, or coach encouragement).[16,26,27,34]

The existing literature suggests that variations in training load (ie, internal and external load) can occur during SSGs when using the continuous or fractional training method because of variations in intensity distribution during the different periods of execution.[17] Also, different recovery times can induce variations in training load[16,26,29] since the performance of the next repetition directly depends on the effect of the recovery period that precedes it.[4] Additionally, since different game formats (ie, 2-a-side to 10-a-side) induce different training load responses (ie, internal and external load),[9,13,25,26] we consider that it may be important to verify the effects of different recovery periods in specific game formats (eg, 5-a-side). To the best of the authors' knowledge, no previous study has investigated the effects of recovery time in the 5-a-side format, which has been described to induce physiological responses similar to a real game situation (80% to 90% maximum HR) [14,33] and cause higher perceived exertion values when compared with 4-a-side and 6-a-side formats.[35]

Therefore, the present study aimed to investigate the effects of different recovery durations between repetitions of 5-sided SSGs in training load on semiprofessional soccer players. This study hypothesized that increasing recovery time will increase the external and internal training load of the exercise, thereby leading to a higher physical impact of exercise (ie, higher indicators of training load) because of a higher capacity for the removal of metabolic waste and the resynthesis of PCr resulting in the higher physical and physiological responses of players throughout the exercise process.

METHODS

Experimental Approach to the Problem

A cross-sectional field study was used to examine the differences between a continuous format (1 × 18 minutes) and a fractionated (3 × 6 minutes) time distribution in terms of the internal and external loads of players playing SSGs (5-a-side). The fractionated method was performed 4 times with different recovery times (30 seconds, and 1, 1.5, and 2 minutes). Players were divided based on their positions, tactical/technical levels, and physical capacities.[19] Teams' constitutions and respective opponents were maintained throughout the study. The aim of the game was to outscore the opposing team. The external load of the players was measured using a global positioning system (GPS).

The present study was conducted using an adapted version of the protocol used by Branquinho et al[9] over a 5-week period (in April and May) during the in-season (2018/2019). During the weeks before the experiment, players were familiarized with the different SSG formats and materials used in this study. Five training sessions were held on an outdoor artificial grass pitch during the same day and time (from 5 PM until 7 PM; average recorded temperature, 14°C) over 5 different weeks to control for the fatigue, cardiac variation, and work performed in preceding days. After a standard 15-minutes warm-up, 1 of the 5 SSG formats was played in randomized order during each session. During the SSGs, coaches did not provide any encouragement. Additionally, several balls were distributed around the edge of the pitch to maximize the effective playing time by ensuring that play could quickly resume whenever a ball went out of play.[12] During rest periods of the intermittent SSG format, water was allowed and provided to players.

Subjects

Twenty male semiprofessional soccer players (age 23.9 ± 2.1 years; height 1.78 ± 0.06 m; body mass 75.7 ± 5.8 kg) with 10.1 ± 3.8 years of experience participated in the present study during the in-season (2019/2020). The regular training of the team involved 4 sessions during the week (lasting approximately 90 minutes) as well as a competitive match. All players were informed of the study design and its requirements as well as the possible benefits and risks. To gain approval from the local ethics committee and follow the principles of the Declaration of Helsinki for human studies, all players had to provide written informed consent before the commencement of the study.

Data Collection

All SSGs involved 5-a-side soccer (with goalkeepers) with the aim of scoring as many goals as possible, as per the method described by Branquinho et al[9] and Casamichana et al.[13] The field area was kept constant during the study (40 × 40 m), as per the method described by Branquinho et al.[9] Two SSG formats were used: 1 continuous (SSGCONT, 1 × 18 minutes) and 4 fractionated (SSG30, 3 × 6 minutes + 30 seconds of recovery time between sessions; SSG60, 3 × 6 minutes + 1 minute of recovery time between sessions; SSG90, 3 × 6 minutes + 1 minute 30 seconds of recovery time between sessions; SSG120, 3 × 6 minutes + 2 minutes of recovery time between sessions). All SSGs were monitored to evaluate the internal and external load of each format.

Internal Load

The internal load was measured by recording HR using a GARMIN HR band (Garmin Ltd), which sent data to the inertial device via Ant+ technology.[30] The average HR (HR Avr) and maximum HR (HR Max) values registered in each SSG format were considered for analysis.

External Load

The external load was recorded using WIMU inertial devices (Real Track Systems). WIMU incorporates a GPS chipset that tracks players locations in outdoor conditions[31] with high accuracy (50 cm).[6] Variations in external load (eg, total distance, maximum speed, and ratio meters) were recorded by tracking data via GPS with a sample frequency of 10 Hz. Data were analyzed using the SPRO analysis program (Real Track Systems) and the velocity was adjusted in 4 intensity ranges: moderate (12-18 km/h), high (19-21 km/h), very high (22-24 km/h), and maximum speed (≥24 km/h).

The collected data were imported into a computer and analyzed using SPRO (Real Track Systems).

Statistical Analyses

A descriptive analysis was performed and standard deviations were determined. Comparisons between the different game formats were inferred through standardized mean differences computed with pooled variance and respective 90% confidence intervals.[15,23] The limits for statistics were set as follows: trivial (0.2), small (0.6), moderate (1.2), large (2.0), and very large (>2.0), according to the method described by Hopkins et al.[23] The differences in means (ie, SSGCONT vs SSG30SSGCONT vs SSG60, SSGCONT vs SSG90, SSGCONT vs SSG120, SSG30 vs SSG60, SSG30 vs SSG90, SSG30S vs SSG120, SSG60 vs SSG90, SSG60 vs SSG120, and SSG90 vs SSG120 sessions for each condition) and comparisons across all conditions were expressed in percent units with 90% confidence limits (CLs). According to the methodology of Batterham et al,[7] the smallest observable differences were estimated from the standardized units multiplied by 0.2. Probabilities were used to make a qualitative probabilistic mechanistic inference about the true effect (ie, if the probabilities of the effect being substantially higher and lower were both >5%, the effect was reported as unclear; if not, the effect was clear and reported as the magnitude of the observed value).[19] The scale for interpreting the probabilities was as follows: possible (25%-75%), likely (75%-95%), very likely (95%-99%), and most likely >99%.[23]

RESULTS

The results (Table 1 and Figure 1) show the variation in training load between SSGs (ie, SSGCONT vs SSG30, SSGCONT vs SSG60, SSGCONT vs SSG90, SSGCONT vs SSG120, SSG30 vs SSG60, SSG30 vs SSG90, SSG30 vs SSG120, SSG60 vs SSG90, SSG60 vs SSG120, and SSG90 vs SSG120). In general, the fractionated method revealed a higher impact on the external load and subtle changes in the internal load of the players. However, for the same duration of exercise during SSGs, short recovery periods (ie, 30 seconds) induced significantly higher internal and external loads on players.

External Load

Regarding the total distance covered, the results revealed a likely increase of 92.1 ± 76.2 m (small effect) between SSGCONT versus SSG30 and a most likely decrease of −129.3 ± 49.1 m (small effect) between SSG30 versus SSG60. In the same line, there were very likely decreases of −157.4 ± 77.8 m (moderate effect) and −128.5 ± 84 m (moderate effect) between SSG30 versus SSG90 and SSG30 versus SSG120, respectively. Regarding the maximum speed, likely increases of 0.7 ± 0.9 km/h (trivial effect) and 0.7 ± 0.6 km/h (trivial effect) were observed between SSGCONT versus SSG120 and SSG60 versus SSG120, respectively. In the same line, a very likely increase of 1.1 ± 0.6 km/h (trivial effect) was noted between SSG90 versus SSG120.

Analysis of the moderate-intensity travel speed demonstrated likely decreases of −45.1 ± 37.7 m (trivial effect) and −58.7 ± 48.9 m (small effect) between SSG30 versus SSG60 and SSG30 versus SSG90, respectively. However, likely increases of 47.5 ± 39.0 m (trivial effect) and 41.2 ± 31.7 m (small effect) were observed between SSGCONT versus SSG30 and SSG90 versus SSG120. Similarly, the high-intensity displacement velocity analysis demonstrated likely increases of 15.7 ± 16 m (trivial effect), 13.6 ± 14.9 m (trivial effect), and 17.0 ± 17.2 m (small

Table 1. Descriptive statistics on the different condition variables[a]

Variables	SSGCONT: 18-min Game, Continuous	SSG30: 3 × 6-min Game, 30-s Recovery	SSG60: 3 × 6-min Game, 1-min Recovery	SSG90: 3 × 6-min Game, 1-min 30-s Recovery	SSG120: 3 × 6-min Game, 2-min Recovery	Change in Mean, % ± 90% CL
Maximum HR, beats/min	183.50 ± 11.67	189.30 ± 11.67	185.35 ± 9.23	187.50 ± 6.45	185.40 ± 9.93	(a) 5.8 ± 4.8** ↑; (b) 1.9 ± 4.6; (c) 4.0 ± 4.5** ↑; (d) 1.9 ± 4.5; (e) –4.0 ± 4.4** ↓; (f) –1.8 ± 3.5* ↓; (g) –3.9 ± 4.2**↓; (h) 2.2 ± 3.3* ↑; (i) 0.1 ± 4.1; (j) –2.1 ± 2.7* ↓
Average HR, beats/min	165.70 ± 14.79	172.65 ± 8.59	166.40 ± 12.12	168.75 ± 7.59	167.75 ± 10.07	(a) 7.0 ± 6.2** ↑; (b) 0.7 ± 6.4; (c) 3.1 ± 6.3; (d) 2.1 ± 5.7; (e) –6.3 ± 4.9** ↑; (f) –3.9 ± 3.8**↑; (g) –4.9 ± 4.4** ↑; (h) 2.4 ± 4.7; (i) 1.4 ± 5.4; (j) –1.0 ± 3.1* ↓
Total distance, m	2033.25 ± 174.58	2125.35 ± 161.60	1996.05 ± 173.22	1968 ± 221.83	1996.90± 245.11	(a) 92.1 ± 76.2** ↑; (b) –37.2 ± 83.1; (c) –65.3 ± 112.2; (d) –36.4 ± 123.9; (e) –129.3 ± 49.1**** ↓; (f) –157.4 ± 77.8***↓; (g) –128.5 ± 84.6*** ↓; (h) –28.1 ± 78.9; (i) 0.9 ± 85.8; (j) 28.9 ± 35.5* ↑
Maximum, speed, km/h	24.43± 1.33	24.60 ± 2.04	24.43 ± 1.84	24.07 ± 1.95	25.16 ± 1.91	(a) 0.2 ± 0.8; (b) 0.0 ± 0.9; (c) –0.4 ± 0.8; (d) 0.7 ± 0.9** ↑; (e) –0.2 ± 1.0; (f) –0.5 ± 1.0; (g) 0.6 ± 0.9* ↑; (h) –0.4 ±0.8; (i) 0.7 ± 0.6** ↑; (j) 1.1 ± 0.6*** ↑
Moderate, m	464.41 ± 101.07	511.96 ± 113.33	466.83 ± 110.92	453.22 ± 118.71	494.43 ± 127.64	(a) 47.5 ± 39.0** ↑; (b) 2.4 ± 41.9; (c) –11.2 ± 47.5; (d) 30.0 ± 50.0* ↑; (e) –45.1 ± 37.7** ↓; (f) –58.7 ± 48.9** ↓; (g) –17.5 ± 52.2; (h) –13.6 ± 43.1; (i) 27.6 ± 42.0* ↑; (j) 41.2 ± 31.7** ↑
High, m	68.74 ± 29.97	84.39 ± 40.47	82.34 ± 37.64	76.15 ± 36.81	85.76 ± 41.58	(a) 15.7 ± 16** ↑; (b) 13.6 ± 14.9** ↑; (c) 7.4 ± 11.4* ↑; (d) 17.0 ± 17.2** ↑; (e) –2.1 ± 14.9; (f) –8.2 ± 12.0* ↓; (g) 1.4 ± 11.3; (h) –6.2 ± 9.9* ↓; (i) 3.4 ± 12.6; (j) 9.6 ± 12.6* ↑

(continued)

Table 1. (continued)

Variables	SSGCONT: 18-min Game, Continuous	SSG30: 3 × 6-min Game, 30-s Recovery	SSG60: 3 × 6-min Game, 1-min Recovery	SSG90: 3 × 6-min Game, 1-min 30-s Recovery	SSG120: 3 × 6-min Game, 2-min Recovery	Change in Mean, % ± 90% CL
Very high, m	17.85 ± 12.00	28.11 ± 25.47	29.33 ± 21.78	26.25 ± 20.67	26.90 ± 15.09	(a) 10.3 ± 9.4** ↑; (b) 11.5 ± 8.4** ↑; (c) 8.4 ± 7.4** ↑; (d) 9.1 ± 6.8** ↑; (e) 1.2 ± 9.8; (f) –1.9 ± 7.9; (g) –1.2 ± 6.8; (h) –3.1 ± 5.6* ↓; (i) –2.4 ± 7.3; j) 0.7 ± 5.8
Maximum intensity, m	2.98 ± 4.18	6.61 ± 8.81	6.26 ± 8.52	3.33 ± 4.92	6.72 ± 7.25	(a) 3.6 ± 2.6** ↑; (b) 3.3 ± 3.4** ↑; (c) 0.3 ± 1.8; (d) 3.7 ± 2.6** ↑; (e) –0.3 ± 3.8; (f) –3.3 ± 3.1** ↓; (g) 0.1 ± 3.6; (h) –2.9 ± 3.0** ↑; (i) 0.5 ± 4.0; (j) 3.4 ± 2.4** ↑

CL, confidence limits; HR, heart rate; SSG, small-sided game; ↓, decrease; ↑, increase.

[a]Differences in means (% ± 90% CL) are identified as follows: (a) SSGCONT vs SSG30; (b) SSGCONT vs SSG60; (c) SSGCONT vs SSG90; (d) SSGCONT vs SSG120; (e) SSG30 vs SSG60, (f) SSG30 vs SSG90; (g) SSG30 vs SSG120; (h) SSG60 vs SSG90; (i) SSG60 vs SSG120; and (j) SSG90 vs SSG120. Asterisks indicate the uncertainty in the true differences as follows: * = possible, ** = likely, *** = very likely, and **** = most likely.

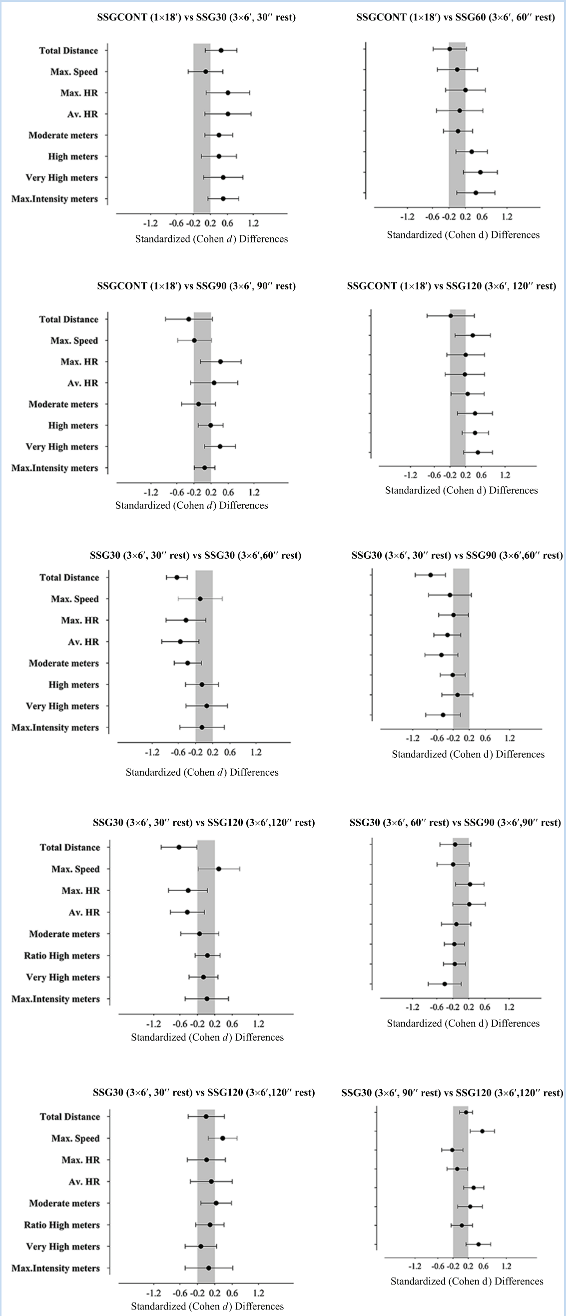

Figure 1. Standardized Cohen differences for comparative results of the SSGCONT vs SSG 30, SSGCONT vs SSG60, SSGCONT vs SSG90, SSGCONT vs SSG120, SSG30 vs SSG60, SSG30 vs SSG90, SSG30 vs SSG120, SSG60 vs SSG90, SSG60 vs SSG120, SSG90 vs SSG120, SSGs. Error bars indicate uncertainty in true mean changes with 90% confidence intervals. Av., average; HR, heart rate; Max, maximum; SSG, small-sided game.

effect) between SSGCONT versus SSG30, SSGCONT versus SSG60, and SSGCONT versus SSG90, respectively. Analysis of the very high-intensity displacement velocity revealed likely increases of 10.3 ± 9.4 m (small effect), 11.5 ± 8.4 m (small effect), 8.4 ± 7.4 m (trivial effect), and 9.1 ± 6.8 m (small effect) between SSGCONT versus SSG30, SSGCONT versus SSG60, SSGCONT versus SSG90, and SSGCONT versus SSG120, respectively. The analysis of maximum intensity displacement velocity revealed likely increases of 3.6 ± 2.6 m (small effect), 3.3 ± 3.4 m (small effect), 3.7 ± 2.6 m (small effect), and 3.4 ± 2.4 m (small effect) between SSGCONT versus SSG30, SSGCONT versus SSG60, SSGCONT versus SSG120, and SSG90 versus SSG120, respectively.

Internal Load

The result of HR Max showed likely increases of 5.8 ± 4.8 beats/min (moderate effect) and 4.0 ± 4.5 beats/min (small effect) when comparing SSGCONT versus SSG30 and SSGCONT versus SSG90, respectively. However, a likely decrease of −3.9 ± 4.2 beats/min (small effect) was demonstrated by comparing SSG90 versus SSG120. The HR Avr of the players revealed a likely 7.0 ± 6.2 beats/min increase (moderate effect) between SSGCONT versus SSG30. However, likely decreases of −6.3 ± 4.9 beats/min (small effect), −3.9 ± 3.8 beats/min (trivial effect), and −4.9 ± 4.4 beats/min (small effect) were demonstrated by comparing SSG30 versus SSG60, SSG30 versus SSG90, and SSG30 versus SSG120, respectively.

DISCUSSION

This study investigated the effects of different recovery durations between repetitions in SSGs. Overall, the results reveal that the manipulation of recovery times induced differences in the internal and external load. Moreover, for the same total duration, the external and internal load indicators tended to reveal higher values during the fractionated method, particularly with short recovery periods. While longer recovery periods (eg, 2 minutes) tended to cause an increase in the maximum speed of players, short recovery periods of 30 seconds tended to promote higher internal and external physical requirements during the exercise. Finally, a recovery period of 1.5 minutes allowed more distance to be traveled at different intensities when compared with the other recovery periods, except for the 30-second recovery period.

In particular, the results revealed that the fractionated method (eg, 6 minutes) with short recovery periods (eg, 30 seconds) induced further changes to the internal and external load. These results are in agreement with recent research,[18] where the use of a fractionated method also increased the physical and physiological demands of exercises.[18,21]

Through analyzing fractional exercises, previous research has also shown that short recovery periods allow players to improve their physiological performance, which emphasizes our findings.[26] A study revealed that increasing the recovery period duration from 30 to 120 seconds and separating serial SSG sessions significantly improved physiological recovery either systemically (HR) or locally (oxygenation of the vastus lateralis muscle, based on using near-infrared spectroscopy) in experienced semiprofessional players.[29] However, in our study, only the use of a 30-second recovery period promoted a generalized increase in both internal and external load indicators.

Previous match analysis studies[5,36] have also shown that soccer requires players to repeatedly produce maximal actions of short duration with brief recovery periods, which may be a key factor that can explain our results. Soccer requires a combination of movement at different velocities and players must repeatedly produce maximal or near-maximal actions of short duration with brief recovery periods.[11] It is also apparent that the 30 seconds of recovery in 6-minute SSGs could represent a typical game effort where players are exposed to short periods of recovery after moments of high intensity.

The obtained results may also have a psychophysiological justification. Players like to perform SSGs because the ball contact time is longer than any other exercise performed, which may result in increased motivation and enjoyment of exercise.[28] Thus, having stoppages longer than 30 seconds for recovering purposes may imply a strain of mental fatigue derived from stress related to the anxiety of wanting to play for as long as possible. Previous studies[8,10] revealed that decreased motivation has been associated with mental fatigue and can affect the level of effort one is willing to exert on tasks. Thus, in the present study, the increasing length of recovery periods may have increased physiological and psychological stress by preventing players from attaining optimal levels of arousal (and subsequent attentional levels) required to maintain high internal and external load indicators during exercise.

It was also apparent that a 2-minute recovery period has a positive effect on the "max speed" variable, while the recovery time of 1.5 minutes allowed more distance to be traveled at different intensities when compared with the other recovery times (except for the 30-second period). The positive effect of 2 minutes of recovery on the "max speed" variable could be due to the increased recovery duration, since SSGs are exercises that induce more acceleration and changes of direction with high intensity when compared with real game situations.[16] Thus, an increase in the recovery period allows players to maintain the ability to perform explosive actions of high intensity over time[32] (ie, sprints).

Furthermore, our study shows that greater distances were covered at various intensities with recovery periods of 1.5 minutes, which contradicts a previous study by Köklü et al.[26] In this previous study, the authors reported that 1 minute of recovery between repetitions was sufficient to cause significant increases in distances covered at low intensity, while recovery periods of 3 or 4 minutes were necessary to increase the distances covered at medium and high intensities.

Overall, this study emphasizes the differences caused by different recovery times in the training load during the performance of 5-a-side SSG based on the fractional training method. For coaches, these variables can be manipulated to manage physical effort and exercise fatigue by increasing or decrease the training load. For example, to maintain high physical performance and high training load to prepare players for real game demands during SSGs, the fractionated method with short time repetitions and short recovery periods (ie, 30 seconds) should be used. In contrast, to carefully manage players' efforts (eg, postcompetition muscle regeneration training) and decrease response to training load, continuous or fractionated methods with longer recovery periods (ie, 1-2 minutes) should be used. To ensure a lower training load, it would be advisable to select an exercise performed using the continuous method (eg, 18 minutes). To increase and develop maximum player speeds, SSGs should extend the recovery period between repetitions to 2 minutes. Once different recovery times induce different physical responses in the players, the coach can manipulate recovery times throughout the season in different phases (eg, preseason, competitive period and after the detraining period) depending on the desired level of motor skill development.

These findings provide new evidence on the relationship between exercise and recovery duration for small-sided soccer games that can help researchers, coaches, and athletes improve training efficiency and optimize performance. Future studies can use this methodology to include comparisons with other SSG formats and conditions to verify changes.

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