

Effects of consecutive futsal games on the physical performance of U-20 school athletes

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Abstract:

Background and study aim: It is common for students to engage in school competitions; however, these competitions typically do not allow for games to be played with intervals longer than 24 hours between them. The aim of the present study was to investigate the effects of consecutive futsal games on the physical performance of under-20 school athletes. Material and Methods: Ten school athletes (17.9 ± 1.2 years, 173 ± 9 cm, 63.0 ± 4.6 kg, and 21.2 ± 2.7 kg.m⁻²) participating in a school futsal competition were assessed on consecutive days, with a 24-hour interval between each game. Assessments were conducted before three games and 17 hours after the third game. The following variables were evaluated in this order: Total Quality of Recovery (TQR), reactive agility (RA) and non-reactive agility (NRA), 5 and 10-m sprint, and counter-movement jump. The internal load of the games was measured using the session Rating of Perceived Exertion (sRPE). Results: TQR decreased 17 hours after the third game. There was a decline in the performance of NRA with dribbling, NRA with touch, RA with touch, and in the 10-m sprint 17 hours after the third game. The sRPE was higher in the third game compared to the first game. There was no change in RA with dribbling, counter-movement jump, and 5-m sprint throughout the games. Conclusions: The results demonstrate that a sequence of three futsal games with intervals of only 24 hours impairs performance in agility and speed, decreases the perception of recovery, and increases the perception of perceived stress in the game.

Keywords: Athletic performance, school competition, agility, muscle recovery, muscle damage.

Introduction

Futsal is a dynamic sport characterized by intermittent actions supported by acyclic movements (Castagna et al., 2009). This sport engages all energy supply systems, with predominant high-intensity stimuli such as jumps, sprints, directional changes, and dribbling defining its nature (Naser et al., 2017; Spyrou et al., 2020). The speed, power, and agility exhibited by athletes enable diverse movements during technical and tactical actions in a futsal match (Ribeiro et al., 2020). These physical attributes play decisive roles, constituting a significant portion of crucial actions within the game (Naser et al., 2017; Sekulic et al., 2021).

The intensity and movements in futsal distinguish it from other sports, as players consistently perform both offensive and defensive functions at high intensity. Futsal is characterized by multiple fast sprints and exhibits more high-intensity phases compared to other intermittent sports (Barbero-Alvarez et al., 2008; Spyrou et al., 2020). Analyzing the recovery time during a match reveals that the work-to-rest ratio in futsal is approximately 1:1. In other words, the time a player spends standing still, walking, or trotting is nearly equivalent to the time spent running at high intensity (Barbero-Alvarez et al., 2008).

In the context of school sports, it is common for young athletes to engage in competitions with games on consecutive days, often with a maximum 24-hour interval (Chaves et al., 2018). This brief recovery period may be inadequate for young athletes, as demonstrated in a study involving soccer players (Rezende et al., 2021). Considering that muscle recovery can range from 48 hours to more than seven days after physical exercise (Paulsen et al., 2012), participants in school futsal competitions, particularly with consecutive matches, may not achieve full physical recovery for subsequent games, potentially impacting sports performance.

Following physical training sessions or competitions, athletes typically experience a transient decrease in physical performance, lasting minutes or even hours (Barnett, 2006). This underscores the importance of recovery analysis in coaches' planning. While there may be a decline in physical performance during and after matches or futsal competitions, there is limited data on the duration of this impairment and the mechanisms underlying these declines. Understanding these factors is crucial for organizing futsal tournaments played on consecutive days. Studies with futsal players in consecutive-day matches suggest that a 24-hour interval between games may be insufficient for players' physical performance recovery during a competition (Freitas et al., 2014; Hübner et al., 2020).

In light of these considerations, quantifying the extent to which athletes participating in school competitions recover physically and evaluating their agility between games becomes pertinent for physical education teachers and futsal coaches. Addressing this question is not only essential for the sport's development but also aids in planning school competitions to define optimal intervals between games, promoting athletes' recovery and enhancing their performance. Thus, the present study aims to assess the effects of consecutive futsal games on the physical performance of under-20 school athletes.

Material & methods

Participants

The study involved ten male under-20 school futsal athletes (aged 17.9 ± 1.2 years, with a height of 173 ± 9 cm, body mass of 63.0 ± 4.6 kg, and a body mass index of 21.2 ± 2.7 kg.m⁻²). These athletes possessed over one year of experience in the sport, engaging in training sessions at least twice a week for the past six months. Inclusion criteria specified that athletes should be free from musculoskeletal injuries in the lower limbs during the competition period. Participants were instructed to abstain from consuming alcohol and caffeine 24 hours before and during the competition period. Additionally, they were advised not to use medications that could potentially alter their performance. Following an explanation of the study's objectives and procedures, participants and their guardians provided their informed consent by signing the Informed Consent Form. The study received approval from the Research Ethics Committee of the Federal Institute of Sudeste of Minas Gerais (CAAE: 25981519.0.0000.5588).

Experimental design

The national-level school futsal competition comprised a group stage (8 groups with 3 teams in each group), followed by quarter-finals, semi-finals, and the final. During the group stage, teams played against each other, with the top team from each group advancing to the quarterfinals in an Olympic crossing system. Subsequently, the semifinals and final were contested by the victorious teams from the previous phase. The evaluated athletes participated in three consecutive days of competition, engaging in two group stage matches and one quarterfinal match. Each game had a duration of 40 minutes (two periods of 20 minutes with a 5-minute break between each half) and consistently occurred at the same time of day, between 3 pm and 4 pm. A 24-hour break separated each game. Prior to each match and 17 hours after the third game, the following assessments were conducted: 1) Total Quality of Recovery (TQR), 2) reactive agility (RA) and non-reactive agility (NRA) (Figure 2), 3) sprints of 5 and 10 meters, and 4) vertical jump with a counter-movement. These evaluations were consistently performed in the mentioned order and within the time frame of 9 am to 10 am. Additionally, the internal load of each game was documented using the session Rating of Perceived Exertion (sRPE) method. Athletes were acquainted with the procedures and instruments used a day before the competition commenced. Prior to measuring the performance variables, participants engaged in a preparatory activity consisting of 5 minutes of light running, followed by 5 minutes of combined exercises (jumping, running, and changes in direction), and 5 minutes of dynamic stretching.

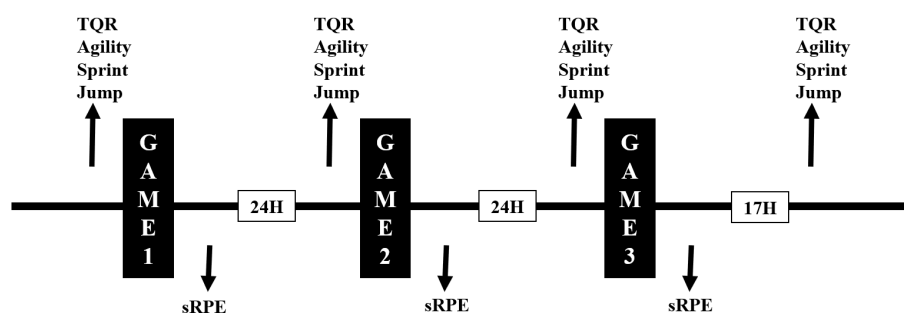


Figure 1. Experimental design of the study. TQR: Total Quality of Recovery; sRPE: session Rating of Perceived Exertion.

Recovery status

Athletes were requested to assess their recovery status using the TQR scale (Kenttä & Hassmén, 1998) by responding to the following question: "How do you feel about your recovery now?" (Kenttä & Hassmén, 1998). The scale ranges from "6," indicating not at all recovered, to "20," signifying fully well recovered.

Reactive and non-reactive agility

Agility was assessed through the NRA and RA tests, specifically designed for futsal (Sekulic et al., 2019). The tests followed a Y pattern, maintaining consistent distances between them. In the RA test, the participant's route was signaled by a light at the end of the trajectory, illuminating either the left side (A) or right side (B) after

passing through the photocell positioned 1 meter from the start (Figure 2a). Meanwhile, in the NRA test, the route was pre-established and communicated to the participant. Both the NRA and RA tests were conducted in two scenarios: first, participants carried the ball during the course (Figure 2a); second, participants completed the route and simply touched the ball at the end (Figure 2b). In summary, the protocols included the following variations: NRA with ball dribbling to the A side (NRA_DA) and B side (NRA_DB) (Figure 2a), NRA with ball touching the A side (NRA_TA) and B side (NRA_TB) (Figure 2b), RA with ball conduction (RA_D) (Figure 2a), and RA with ball touch (RA_T) (Figure 2b). Participants underwent two attempts for each variation, instructed to navigate the course to the cone and return to the starting position as swiftly as possible. The time taken for the tests was recorded using a photocell placed at the beginning of the course (Multi Sprint, Hidrofit®, Belo Horizonte, Brazil). If the ball was lost during the test with ball conduction, the attempt was halted and resumed after a 2-minute interval. All participants were already familiar with and had prior knowledge of the tests.

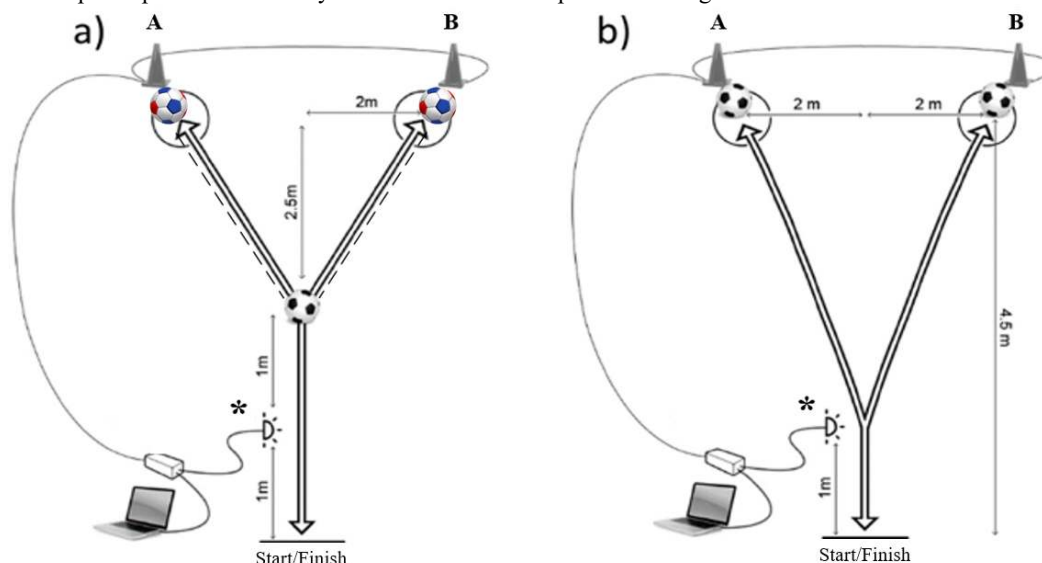


Figure 2. Adapted figure of the reactive and non-reactive agility test as proposed by Sekulic *et al.* (2019). (*) Photocell

5 and 10-m sprint

Performance in the 5 and 10-meter sprints was assessed utilizing three photocells (Multi Sprint, Hidrofit®, Brazil). One photocell was positioned at the starting point, while the others were placed in a straight line at 5 and 10 meters from the starting point. The running time was recorded with the Multi Sprint software (Multi Sprint, Hidrofit®, Brazil). Participants were instructed to complete a single attempt, running the 10 meters as swiftly as possible.

Counter-movement jump

Performance in the counter-movement jump was assessed utilizing a contact mat (Multi Sprint, Hidrofit®, Brazil), and the jump height was determined by the Multi Sprint software (Multi Sprint, Hidrofit®, Brazil). Participants executed a single attempt, following instructions to place their hands on their hips and jump as high as possible (Sattler *et al.*, 2012). The range of motion was automatically selected.

Internal game load

The intensity of each futsal game was gauged using the sRPE scale (Foster *et al.*, 2001). Following each game, participants were directed to provide an overall assessment of the game's intensity by utilizing the sRPE scale. They answered the question: "How intense was the game?" Numbers ranging from 0 (rest) to 10 (maximum effort) were employed to quantify the intensity of the game (Foster *et al.*, 2001). Participants verbally reported the corresponding number.

Statistical Analysis

Data are expressed as mean $\pm$ standard deviation. Data normality was guaranteed by the Shapiro Wilk test. Data were analyzed using repeated measures analysis of variance (ANOVA) with Holm-Sidak post hoc. In addition, the partial eta squared (η_p^2) was calculated and classified as no effect ($\eta_p^2 < 0.04$), minimum effect ($0.04 < \eta_p^2 < 0.25$), moderate effect ($0.25 < \eta_p^2 < 0.64$), and large effect ($\eta_p^2 > 0.64$) (Ferguson, 2009). The significance level adopted was $P < 0.05$.

Results

Table 1 presents the physical and psychometric variables. The TQR was significantly shorter 17 hours after the third game compared to the first game ($F= 5.13$, $p= 0.006$, $\eta_p^2= 0.363$). However, there was no significant difference in the TQR between the games ($p> 0.05$). The time in the 10-m sprint significantly increased 17 hours after the third game compared to the first, second, and third games ($F= 5.08$, $p= 0.006$, $\eta_p^2= 0.361$), but there was no significant difference in the 10-m sprint between games ($p> 0.05$). NRA_DB, NRA_TA, NRA_TB, and also RA_T had a shorter time before the first, second, and third games compared to 17 hours after the third game ($F= 4.29$, $p= 0.013$, $\eta_p^2= 0.323$; $F= 6.40$, $p= 0.002$, $\eta_p^2= 0.416$; $F= 8.37$, $p= 0.006$, $\eta_p^2= 0.493$; $F= 7.27$, $p= 0.009$, $\eta_p^2= 0.447$, respectively). However, there was no significant difference in NRA_DA, RA_D, 5-m sprint, and counter-movement jump throughout the competition ($F= 5.94$, $p> 0.05$, $\eta_p^2= 0.398$; $F= 3.25$, $p= 0.055$, $\eta_p^2= 0.265$; $F= 1.40$, $p= 0.269$, $\eta_p^2= 0.135$; $F= 2.10$, $p= 0.142$, $\eta_p^2= 0.189$, respectively). The sRPE was higher in the third game compared to the first game ($F= 3.71$, $p= 0.045$, $\eta_p^2= 0.292$), and there was no significant difference in the sRPE between the other games ($p> 0.05$).

Table 1. Mean $\pm$ DP of physical and psychometric variables during an under-20 school futsal competition.

	1st Game	2nd Game	3rd Game	17 h after
TQR	16.50 $\pm$ 1.70	14.80 $\pm$ 1.80	15.70 $\pm$ 1.05	13.50 $\pm$ 2.95*
NRA_DA	2.80 $\pm$ 0.20	2.80 $\pm$ 0.20	2.82 $\pm$ 0.16	3.05 $\pm$ 0.33
NRA_DB	2.92 $\pm$ 0.26	2.92 $\pm$ 0.23	2.77 $\pm$ 0.12	3.10 $\pm$ 0.23* [#]
NRA_TA	2.52 $\pm$ 0.15	2.45 $\pm$ 0.14	2.51 $\pm$ 0.12	2.68 $\pm$ 0.15* [#]
NRA_TB	2.46 $\pm$ 0.06	2.43 $\pm$ 0.07	2.54 $\pm$ 0.16	2.80 $\pm$ 0.33* [#]
RA_D	3.05 $\pm$ 0.16	3.03 $\pm$ 0.23	3.09 $\pm$ 0.28	3.29 $\pm$ 0.27
RA_T	2.63 $\pm$ 0.18	2.58 $\pm$ 0.14	2.64 $\pm$ 0.18	2.93 $\pm$ 0.27* [#]
5-m sprint (s)	1.19 $\pm$ 0.10	1.14 $\pm$ 0.09	1.15 $\pm$ 0.10	1.22 $\pm$ 0.13
10-m sprint (s)	1.93 $\pm$ 0.11	1.96 $\pm$ 0.12	1.98 $\pm$ 0.13	2.14 $\pm$ 0.22* [#]
Counter-movement jump	30.42 $\pm$ 3.99	32.00 $\pm$ 4.75	30.83 $\pm$ 4.15	28.65 $\pm$ 4.14
sRPE	7.60 $\pm$ 0.69	8.00 $\pm$ 0.81	8.60 $\pm$ 1.17*	-

TQR: total quality of recovery; NRA_DA: non-reactive agility with dribbling to the left side; NRA_DB: non-reactive agility with dribbling to the right side; NRA_TA: non-reactive agility with left side touch; NRA_TB: non-reactive agility with right side touch; RA_D: reactive agility with dribbling; RA_T: reactive agility with touch; sRPE: session Rating of Perceived Exertion. (*) $p<0.05$, different from the 1st game. (#) $p<0.05$, different from the 2nd game. (†) $p<0.05$, different from the 3rd game.

Discussion

In view of the significance of physical performance in futsal (Castagna et al., 2009; Matzenbacher et al., 2014; Ribeiro et al., 2020; Spyrou et al., 2020), evaluating physical recovery becomes crucial for potential interventions in the event of a decline in athlete performance. Consequently, the objective of this study was to examine the impact of consecutive futsal games on the physical performance of under-20 school athletes. It was anticipated that a 24-hour interval between games would alter athletes' physical performance, particularly in agility tests. The initial hypothesis of the study was partially confirmed, revealing that the accumulation of consecutive games resulted in reduced performance in speed, agility, and the perception of recovery at the end of the competition.

Futsal, characterized by high-intensity, short anaerobic alactic stimuli interspersed with brief recovery periods, demands both aerobic and anaerobic contributions (Castagna et al., 2009; Rodrigues et al., 2011). The metabolic demands lead to an average heart rate of approximately 90% of the maximum heart rate during a match (Barbero-Alvarez et al., 2008; Castagna et al., 2009). This intense gameplay induces significant physiological stress, impacting physical performance in both the short and long term, potentially affecting recovery for subsequent matches (Rowse et al., 2011). Previous studies on futsal players in competitions with consecutive matches and a 24-hour interval demonstrated insufficient recovery of physical performance (Freitas et al., 2014; Hübner et al., 2020) and increased perceived stress during the competition (Hübner et al., 2020).

In terms of agility, non-reactive and reactive tests exhibited reduced performance in the fourth moment due to the accumulation of games. However, certain agility tests did not show significant changes throughout the matches, highlighting the need for further research on agility during consecutive futsal games. Agility, a crucial aspect for futsal players, is influenced by cognitive, perceptual, and physical abilities (Young et al., 2002; Sheppard & Young, 2006; Sekulic et al., 2019; Sekulic et al., 2021). The recovery process of agility appears to be predominantly linked to physical factors, despite the cognitive importance identified in some studies (Scanlan et al., 2014; Paul et al., 2016).

Regarding running performance, a 10-meter reduction in performance was observed 17 hours after the third game, indicating a delayed impact. However, no significant differences were found in the 5-meter race throughout the competition. These findings align with a study on under-19 school soccer players, suggesting a drop in the 10-meter run performance after two consecutive games with a 24-hour interval, attributed to potential muscle damage (Rezende et al., 2021). Notably, the present study involved futsal athletes, whose matches entail shorter durations and unlimited substitutions, possibly contributing to less physical stress compared to soccer (Taylor et al., 2017). Counter-movement jump results indicated no differences between the evaluated moments, suggesting that the 24-hour interval between matches may be adequate for the physical recovery of school athletes, particularly regarding the demands of the counter-movement jump.

This contrasts with a study on futsal athletes with four consecutive games and a 24-hour interval, reporting a decline in jump performance, attributed to muscle damage (Freitas et al., 2014). Discrepancies between studies may be related to the athletes' level, with professional competitions potentially imposing greater physiological stress compared to amateur competitions (Makaje et al., 2012). Psychometric variables revealed a decrease in TQR at the end of the competition compared to the beginning, echoing findings in soccer athletes (Chaves et al., 2018). This decrease in TQR may be associated with psychophysiological stress induced by exercise (Kenttä & Hassmén, 1998). The sRPE was higher after the third game compared to the first game. This result aligns with a study conducted with youth futsal players, which reported an elevated sRPE after the third game compared to the first game (Hübner et al., 2020).

The authors hypothesized that the increase in sRPE is linked to the heightened stress induced by the match's importance and intensity. In the study by Chaves et al. (2018), the accumulation of games with a 24-hour interval between them led to a higher sRPE in the semi-final match (i.e., fourth game) compared to previous games (i.e., group stage). According to these authors, the rise in sRPE was attributed to greater physiological stress caused by the game, possibly associated with the match's significance as it was a competition where the team needed to win to advance. This hypothesis appears applicable to the present study, given the elevation of sRPE in the third game, which coincided with an eliminatory phase match. Therefore, the stress induced by the accumulation of games, coupled with the third game occurring in the knockout phase of the competition, serves as potential indicators of the increased sRPE in this study.

Conclusions

The results obtained from the under-20 school futsal competition, featuring matches on consecutive days, reveal that a sequence of three futsal matches with only 24-hour intervals leads to a decrease in agility performance, a reduction in 10-meter speed, a decline in the perception of recovery, and an increase in the perceived stress during the game. These findings hold significance for the development and planning of school futsal competitions, highlighting the necessity for extended intervals between games. Additionally, they underscore the importance of coaches and teachers exploring strategies to expedite the muscle recovery of athletes.

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