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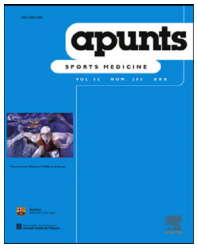

ORIGINAL ARTICLE

Contextual situations in competitions that influence well-being and recovery of Futsal athletes before home official matches

Márcio Aparecido Rinaldo[a], Edirley Guimarães de Souza[a], Karina Alves da Silva[a], Paulo Cesar Cardoso[b], Vinícius Flávio Milanez[c], Solange de Paula Ramos[a,*]

[a] *Study Groups on Tissue Regeneration, Adaptation, and Repair, State University of Londrina, Londrina, Brazil*
[b] *Member of Brazilian Futsal technical committee*
[c] *Study Groups on Tissue Regeneration, Adaptation, and Repair, University of West of São Paulo, Presidente Prudente, Brazil*

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KEYWORDS
Psychological stress;
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Abstract
Introduction: contextual variables associated with competitive stress may affect the perception of the well-being and recovery of futsal athletes.
Material and Methods: twenty male professional futsal players responded to the Hooper Index (HI) and Total Quality of Recovery Scale (TQR) two hours before eleven official matches. Data were collected on age, predicted game difficulty, distance from the previous game, time interval since the previous game, ranking of the team and opponent, and outcome of the previous game of the team and the opponent (defeat/draw/win). Multivariate logistic regression analysis and the Spearman rank-sum test were used to identify stressors that influenced HI and TQR scores, considering $p<0.05$.
Results: the HI was higher in the National League (11.2 ± 2.9 a.u., $p<0.005$) compared to the State championship (10.0 ± 2.4 a.u.). The DOMS were higher in National League ($p<0.001$) and games preceded by victory ($p<0.005$). The HI (r=-0.53, $p<0.001$), age (r=-0.18, $p<0.01$), and muscle pain (r=-0.39, $p<0.001$) correlated with the TQR. The TQR was higher in games preceded by defeat (15.5 ± 1.6) compared to victory (14.6 ± 1.7, $p<0.01$). The pre-game HI and TQR scores were not significantly different ($p>0.05$) in games that ended in victory, draw or defeat.
Conclusion: the results suggest that the DOMS scores of HI and TQR reported before at home official Futsal games are correlated with contextual factors including the level of championship and outcome of the last game.

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* Correspondance author at: Rodovia Celso Garcia Cid PR 445, Km 380, Jardim Portal de Versalhes I – Campus Universitário, CEP 86055-900, Londrina-PR, Brazil
E-mail addresses: ramossolange@uel.br, solangedepaularamos@gmail.com (S. de Paula Ramos).

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Introduction

Futsal is an indoor sport with intermittent and high-intensity demands, requiring a high degree of technical-tactical skills and psychological balance.[1-3] Approximately 22.6% of the average total distance covered by the players in the game (between 3100 and 4313 m) is through displacements at high (>15 km/h) and maximum (>25 km/h) speeds.[4-7] Futsal athletes play at 87.6% to 88.7% of the maximum heart rate, during more than 90% of the game[1,3,4,8-11] and report high (≈ 7.2 a.u.) rate of perceived exertion (RPE).[11,12] Therefore the athletes need to be in a well-being state and physically recovered to cope with the game demands.

The high physical demand during play, the presence of muscle damage, and accumulated fatigue are factors that can contribute to reduced physical performance and impaired sleep quality, indicating the need for recovery strategies and load monitoring in high-performance athletes.[13] The Hooper Index (HI) is a tool used to monitor the perception of well-being and stress of team sports athletes, having been popularized in futsal, due to its practicality of use and its sensitivity to variations in the state of recovery during periods of the season.[14,15] Studies suggest that the perception of well-being screened by HI may be influenced by the level of stress imposed by different phases of competition, periods of congested games, and characteristics of different sports.[16-18] Another simple recovery monitoring tool is the total quality of recovery scale (TQR).[19] The use of TQR to monitor the perception of recovery of athletes demonstrates that the increase in training or competitive load is inversely correlated with recovery.[19-21] Although these scales have been used to monitor training loads in team sports, it is not clear whether they are influenced by contextual situations during futsal seasons.

Among the contextual stressors associated with the team sports competitions, the importance of the game,[22] the quality of the opponent,[18,23-26] the time interval between games,[16,27,28] and the displacement between games[28,29] have been cited. Although the HI and TQR are perceptual scales that have been related to the physical and technical performance of team sports players,[30,31] it is necessary to identify the contextual factors that potentially influence the perceptual measures reported by athletes during competition. The present study aims to evaluate the influence of contextual factors of futsal competition (opponent quality, performance in previous games, championship) on HI (fatigue, stress, sleep quality, and muscle pain) and TQR before official games during a period of national and state-level championship game coincidence.

Material and methods

Subjects

Twenty male professional futsal players (26.0 ± 4.8 years, 74.2 ± 4.9 kg and 1.76 ± 0.04 cm) from a team that participated in the State Futsal Championship, in the 1st division of the state of Paraná, and the National Futsal League (first national division) were evaluated in eleven official games between April and July 2019. The inclusion criteria were to be a professional scaled athlete in state and national championship games and attendance of > 90% in regular training. Exclusion criteria were: sickness, injury, use of anti-inflammatory drugs in the week the game was performed, or continuous use of anxiolytic or antidepressant drugs. This study was approved by the Ethics Committee for Research with Human Beings of the State University of Londrina (protocol n. 3.389.340) and the players signed an Informed Consent Form before the beginning of the study.

Study design

This is a longitudinal observational study. After prior familiarization with the research instruments, the players were individually interviewed two hours before the start of the matches, to collect data on the HI and TQR. Data were collected on games played at home (Figure 1) during a congested period of games including the State Championship and National League Championship. During this period, there were 28 games (14 state and 14 National League games), 16 games at home, with a minimum interval of two, and a maximum interval of 10 days between consecutive games. Debut games from the State and National Leagues were not included. Five at-home games were excluded because it was not possible to collect the HI and TQR scales of all players who had been in-game. Only players who played at least five minutes in the game were included in the analysis.

The variables considered to be sources of stress associated with the championship were collected from the official futsal league website of the national and state championships.

Hooper index

The HI is based on scales of perceived quality of sleep, fatigue, stress, and DOMS.[16,32,33] The HI consists of four seven-point Likert scales, with values ranging from "very, very good" (score 1) to "very, very bad" (score 7), for sleep, fatigue, stress, and DOMS. The HI was applied two hours before the start of each game, by a trained researcher, individually. All athletes were previously familiarized with the instrument and each domain was explained to the volunteers according to the original definitions of the scales.[32] The HI was calculated by the sum of the subscales.

Total quality of recovery (TQR)

Two hours before each game, a researcher applied the TQR scale, as proposed by Kenttä and Hassmen.[19] The TQR addresses the perceived recovery on a scale ranging from 6 (not at all recovered) to 20 (fully recovered).

Contextual sources of stress during the championships

The variables associated with the stress produced by the championships included:

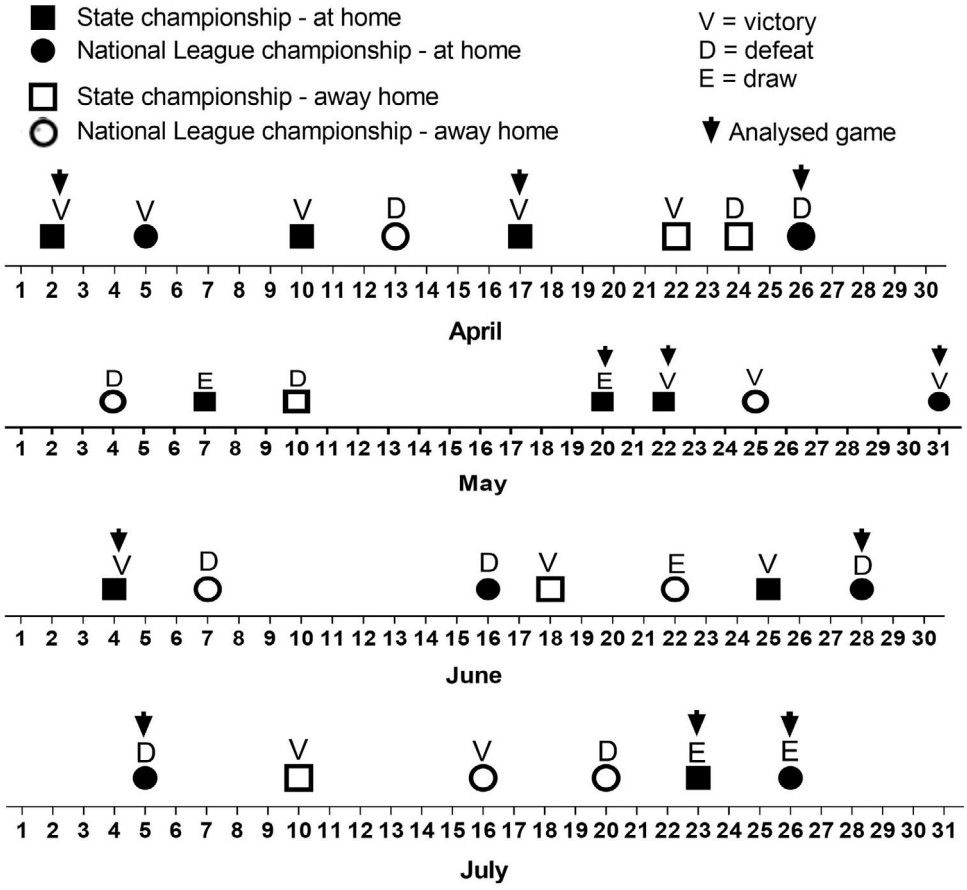

Figure 1 The sequence of games played and results in the State Championship and National Futsal League from April to July 2019.

- Championship level: National League or State Championship.
- Result of the evaluated team's previous game: defeat, draw, or victory.
- Result of the next opponent's previous game: defeat, draw, or victory
- Position of the team in the ranking of the championship being played in the evaluated game.
- Opponent's position in the championship ranking, on the day of the evaluated game.
- Days elapsed since the previous game.
- Displacements on the road (km) to dispute the previous game.

The predicted game difficulty represents the team (players and coaching) perception of the next game's difficulty.[34] The predicted game difficulty was calculated from data of the classification of the opposing team on game day, training days between games, and travel distance between games, as described by Kelly and Coutts (2007). The teams' classification was verified game by game, according to the official table on the National Futsal League website (https://ligafutsal.com.br) and the Paraná Indoor Football Federation website (http://www.futsalparana.com.br) which provide the scores and ranking of the teams in each round of the championships.

Statistical analysis

Data normality distribution was assessed using the Shapiro-Wilk test. Data with normal distribution are expressed as mean and standard deviation. Nonparametric data are expressed as median and interquartile range from 25 to 75%. Comparison of HI and TQR between games was determined with the one-way ANOVA test with Tukey post hoc test (parametric data) or Kruskal-Wallis test with Dunn post-test. Differences in HI and TQR between the National League and state championship were detected with the Student's *t*-test (parametric data) or Mann-Whitney U test. Associations of HI and TQR with age and championship variables were determined using multiple linear regression analysis. The predictor variables were added to an unadjusted multiple linear regression model to identify the global value of the coefficient of determination (r^2) and the variables that showed statistical significance ($p < 0.05$) were retained in an adjusted model. The adjustment of the regression model was performed using a stepwise and backward approach, retaining predictive variables that are statistically significant. The variance inflation factor was used to determine the multicollinearity between the predictors included in the

final model. The predicted game difficulty was not included in the regression analysis as it presented collinearity with the opponent's classification and the interval between games. The correlations between the HI and TQR and the significant predictors in the adjusted linear regression were determined using Pearson or Spearman's correlation tests (non-parametric data). The correlations were considered weak if $0.3 < r < 0.5$, moderate if $0.5 \leq r < 0.7$, and strong if $r \leq 0.7$. The study variables were considered statistically significant if $p < 0.05$. GraphPad Prisma 5.0 (GraphPad, La Jolla, USA) and Epi Info 7.0 (Center for Disease Control and Prevention, www.cdc.gov/epiinfo) were used for statistical analysis.

The sample size was estimated based on a minimum of five games in National League games and State championships. The statistical power was calculated *a posteriori* using number of total observations (174 records of HI and TQR), partial r^2, and the number of predictors computed in multiple linear regression. For HI analysis, the statistical power achieved 98%, and for TQR the power was 82%, considering $P<0.05$.

Results

Twenty futsal athletes were monitored during 11 official National League games ($n = 5$) and state championships ($n = 6$). Sixteen athletes (80%) participated in 11 (100%) games, one athlete (5%) participated in six (54.5%) games, and three athletes (15%) participated in five (45.4%) games.

The team won five (45.7%), drew three (27.2%), and lost three (27.3%) of the evaluated games. Athletes had a three to seven-day break between games when they played National League games, and three to 10 days between games played in the state championship ($p = 0.70$, Dunn's test), with an average interval of 4 ± 2 days between games for both competitions.

The median travel distance to dispute the previous game in the state championship was 172 km (range 25 to 75% = 0 to 234) and in the national league was 203 (101 to 283) km ($p = 0.42$, $U = 3509$). Two state championship games and three national league games were preceded by home games (no displacement from the previous game).

The predicted difficulty of each game is shown in Figure 2a, and there was no statistical difference ($p = 0.94$, $t = 0.06$) between the competitions (Figure 2b). The average HI score of game 6 (National League) was higher in comparison to game 2 (State championship) (Figure 2c). Mean HI was higher in the National League games in relation to the state championship games (Figure 2d). The mean TQR score of game 5 (state championship) was lower compared with games 4 (state championship) and 9 (National League) (Figure 2e). However, the mean TQR scores of the National League were not significantly different from state championship games (Figure 2f).

Predicted game difficulty showed a weak positive correlation ($r = 0.18$, $p = 0.01$) with the HI, but did not present a significant correlation with the TQR ($r=-0.10$, $p = 0.15$). The HI and TQR showed an inverse and moderate correlation ($r=-0.53$, $p<0.0001$).

No significant differences were observed in the sleep ($p = 0.74$, KS=6.8; Figure 3a), fatigue ($p = 0.22$, KS= 12.9; Figure 3b), and stress ($p = 0.07$, KS=16.8; Figure 3c) subscales of the HI. The DOMS subscale ($p = 0.0007$; KS= 30.5) showed increased levels in games 6 and 8 compared to game 2 (Figure 3d).

Multivariate linear regression analysis showed that the HI was associated with age, TQR, and championship (Table 1). However, no significant correlation was detected of HI with age ($r = 0.11$, $p = 0.14$).

The HI DOMS subscale was associated with age, TQR, victory (concerning defeat), and championship (Table 2). However, the DOMS did not show a significant correlation with age ($r=-0.06$, $p = 0.37$), and showed a small correlation ($r=-0.39$, $p = 0.001$) with the TQR. The median [25 to 75% quartiles] DOMS score was higher in games preceded by victory (4 [3 to 4] arbitrary units) compared to draws (3 [2 to 3] a.u., $p<0.01$) and defeats (2 [2 to 3] a.u., $p<0.005$). The National League games (3 [3 to 4] a.u.) had a higher median of DOMS compared to the state championship games (3 [2 to 3] a.u., $p = 0.001$).

Multivariate linear regression of the TQR with the study variables showed a low coefficient of determination ($r^2=0.09$) and was only associated with age (-0.07 ± 0.02; $F = 7.36$; $p = 0.007$) and victory (concerning defeat) in the previous game (-0.85 ± 0.27; $F = 9.51$; $p = 0.0002$). The TQR showed a negative and weak correlation with age ($r=-0.18$, $p = 0.01$). The mean TQR score ($p<0.01$, $F = 4.7$) in games preceded by victory (14.6 ± 1.7 a.u.) was lower than in games preceded by defeat (15.5 ± 1.6 a.u., $p<0.01$).

The HI ($p = 0.22$, $F = 1.51$), DOMS ($p = 0.37$, KS=1.51), and TQR ($p = 0.72$, $F = 0.36$) in the pre-game moment were not statistically different concerning the games that ended with a defeat, draw, and victory (Figure 4).

Discussion

The results of the present study demonstrated that the athletes' well-being presented a moderate correlation with the TQR. DOMS was the only factor in the HI influenced by the contextual stressors associated with the championships, including TQR, previous game outcome, and opponent's level. Concerning TQR, the only associated stressor was the result of the previous game, with games preceded by victory presenting a lower pre-game recovery. In addition, younger athletes reported better TQR scores between games.

Although younger athletes are more susceptible to anxiety,[35] which may contribute to altering the perception of well-being, there was no direct correlation between age and the total HI score. However, the age of the players was negatively correlated with TQR. A study of futsal players showed that younger subjects tend to have faster physical and perceptual recovery on the TQR scale after training sessions.[30] This factor may have contributed to a greater perception of recovery before the games in younger athletes and calls for special attention of team staff for recovery perception in older athletes.

Several factors reported in the literature influence athletes' perception of well-being and recovery, opponent's quality,[22,23,36] including trips between games[28] and interval and quality of recovery between training sessions.[16,23,37] Despite no difference in predicted game difficulty and TQR between championships, the HI seemed to increase in

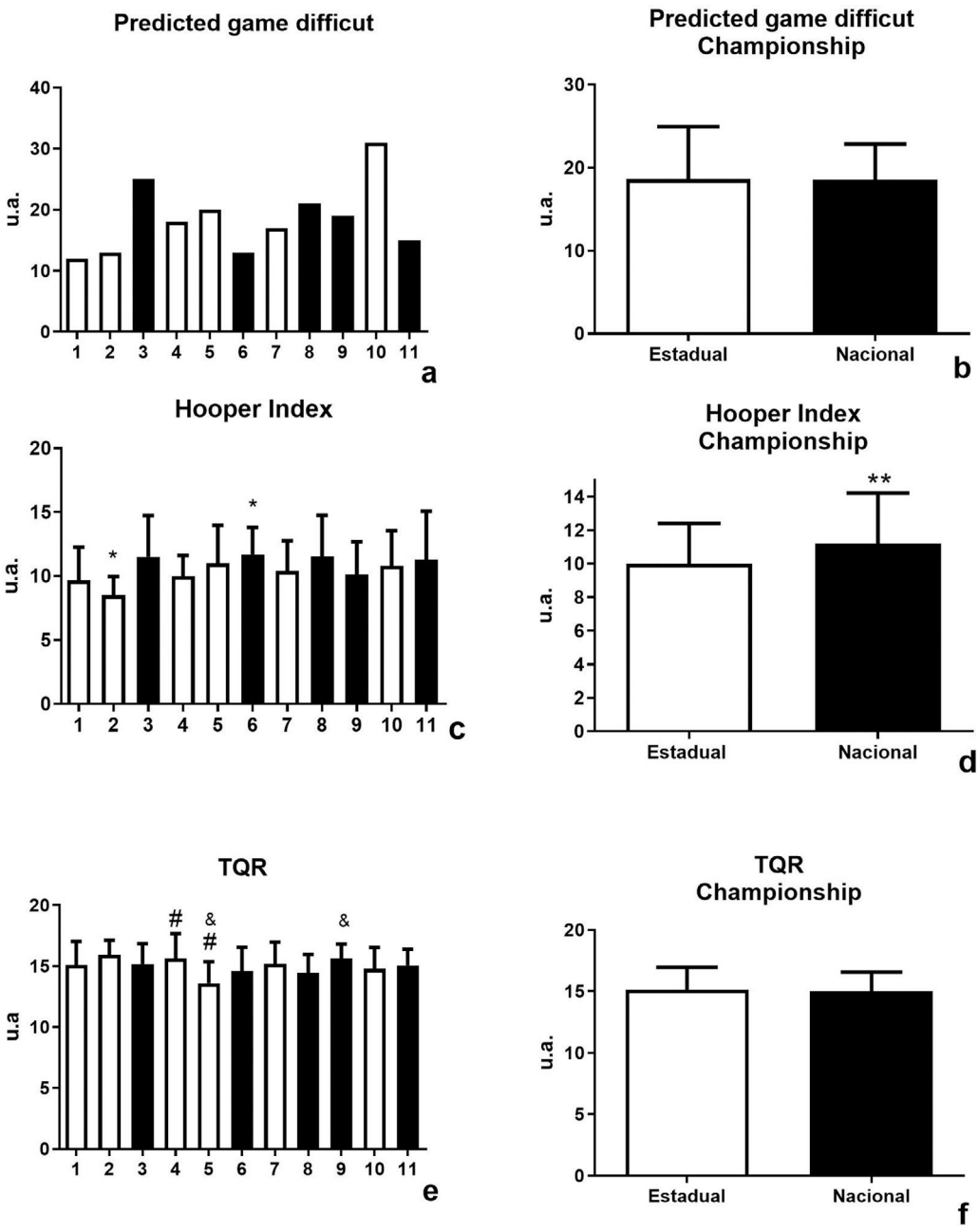

Figure 2 The predicted game difficulty, Hooper Index, and total quality of recovery (TQR) in National League and State championship games. Mean and standard deviation of HI and TQR. * $p<0.05$, Tukey test; ** $p<0.01$, Student's *t*-test; # $p<0.05$ and & $p<0.05$, Dunn's test.

National League games suggesting that the expectation regarding the level of the championship played may have influenced the perception of well-being. It should also be pointed out that opponents faced in the analyzed games were playing both competitions, and sometimes the studied team had played at the state championship and national league against the same opponent. Contrary to what was suggested in the literature, the results did not show an association between the well-being, recovery, and the predicted difficulty of the game, with the opponent's level, travel displacement, and the interval between games.

Traveling between games was identified as a stressor factor that can decrease sleep quality and increase the perception of fatigue in athletes.[38,39] Thus, traveling to play away games could have some effect on the HI, especially on sleep quality and fatigue scores, and on the TQR. A study of Australian soccer athletes demonstrated that, during travel, the athletes presented worsening sleep quality, with a reduction in total sleep time and sleep latency.[28] In long displacements (11 h flight), German rowing athletes presented disturbances in the quantity and worsening of sleep quality, for up to six days.[40] In the present study, no effect of travel

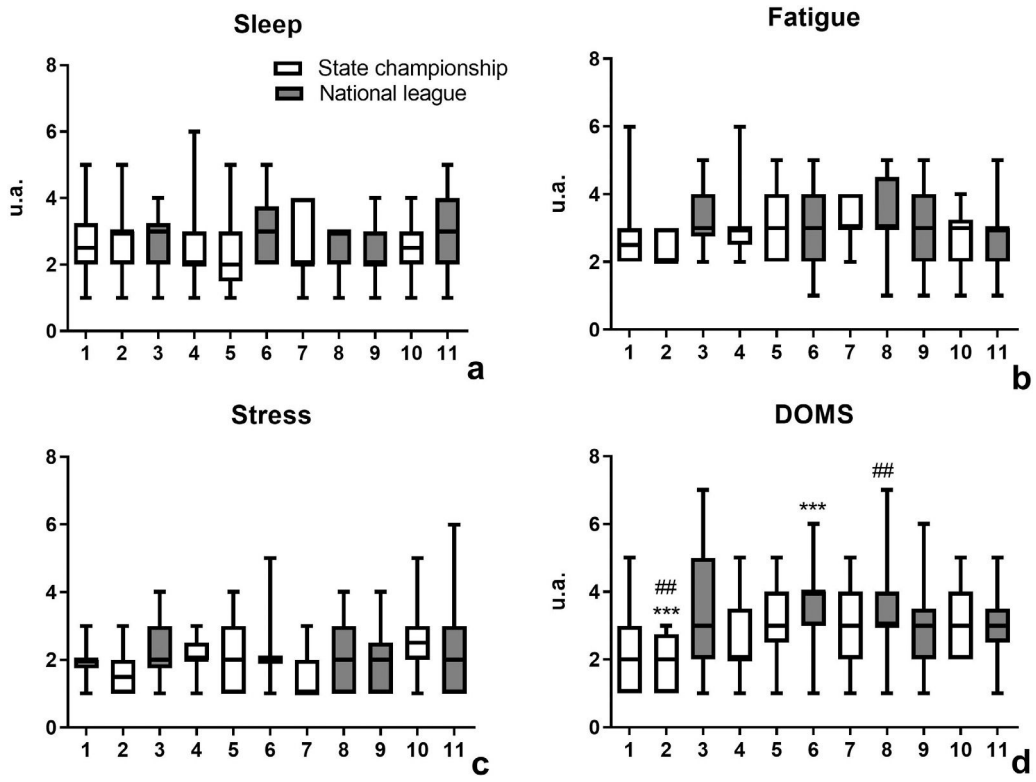

Figure 3 Median (25 to 75% quartiles) HI subscales for sleep (a), fatigue (b), stress (c), and DOMS (d) in state championship and National League games. ***$P<0.005$, ## $p<0.01$, Dunn's test.

before the games was found in relation to the state of well-being, especially in relation to sleep quality and fatigue, or TQR. However, most of the distances traveled by the futsal athletes were very short (2 h by bus), which may not impose significant stress.

Lastella et al., 2019[28] observed that, although displacement caused changes in the quality of sleep if soccer athletes had a night's sleep before at home and away games, they did not display changes in the quality and quantity of sleep. Thus, the minimum interval of two days between games, observed in the present study, may have been enough to recover the quality of sleep. Furthermore, only one away game was played with a minimum break of two days. Although traveling between games did not cause changes in sleep quality in the present study, monitoring changes in sleep quality through the HI may be important, since the worsening in sleep quality is associated with decreased physical and technical-tactical performance, and fatigue, in addition to increasing the risk of injuries.[38,39,41]

The median interval of days between most of the games evaluated was less than the time recommended as necessary (>96 h) to reach proper recovery in the TQR score.[19]

Table 1 Multivariate linear regression analysis of the Hooper index, age, total quality of recovery (TQR), and sources of stress associated with state and national league championships.

	Multivariate linear regression analysis				Adjusted multivariate linear regression analysis			
Variable	Coef.	SD	F test	P value	Coef.	SD	F test	P value
Age (years)	−0.13	0.04	13.08	0.0003	−0.14	0.03	13.20	0.0003
TQR	−0.77	0.11	48.81	<0.0001	−0.80	0.10	58.00	> 0.0001
Time interval since the last game (days)	0.08	0.09	0.80	0.37				
Distance from the last game (km)	0.002	0.002	1.06	0.30				
Team's ranking in the championship	−0.002	0.24	<0.0001	0.99				
Opponent's ranking in the championship	−0.07	0.13	0.29	0.58				
Result of the previous game	1.02	1.46	0.48	0.48				
Draw/defeat	0.83	0.57	2.13	0.14				
Victory/defeat								
Opponent's results in the last game	−0.12	0.87	0.02	0.88				
Victory/defeat								
Championship (national/state)	1.06	1.66	0.40	0.52	1.07	0.34	9.23	0.002
Constant	24.53	2.84	74.49	<0.00 1	25.80	2.04	159.52	<0.0001
r^2				0.32				0.31

Table 2 Multivariate linear regression analysis of the delayed-onset muscle soreness (DOMS) of the Hooper index (HI) with age, quality of total recovery (TQR), and sources of stress associated with state and national championships.

	Multivariate linear regression analysis				Adjusted multivariate linear regression analysis			
Variable	Coef.	SD	F test	P value	Coef.	SD	F test	P value
Age (years)	−0.03	0.02	3.78	0.05	−0.03	0.01	4.32	0.03
TQR	−0.24	0.05	20.63	<0.0001	−0.24	0.05	21.47	<0.0001
Time interval since the last game (days)	0.07	0.04	0.77	0.09				
Distance from the last game (km)	0.001	0.001	2.59	0.10				
Team's rank in the championship	0.01	0.12	0.008	0.92				
Opponent's rank in the championship	−0.03	0.06	0.33	0.56				
Result of the previous game	−0.60	0.71	0.72	0.39	0.42	0.20	4.07	0.04
Draw/defeat	0.80	0.27	8.37	0.004				
Victory/defeat								
Opponent's results in the last game	0.24	0.42	0.34	0.55				
Victory/defeat								
Championship (National/state)	0.35	0.80	0.19	0.65	0.47	0.18	6.52	0.01
Constant	6.38	1.37	21.47	<0.0001	7.25	1.04	48.52	<0.0001
				$r^2 = 0.25$				$r^2 = 0.23$

Cumulative fatigue in futsal players may be a concern since it can alter the explosive capacity for field displacement, although it does not alter the speed and accuracy of shots.[42] After futsal matches, there is an increase in creatine kinase levels and a reduction in vertical jump height after 24 h,[8,43] suggesting that at least 48 h of recovery between games are required. However, it is not clear in the literature, how much time is needed for a futsal athlete to fully recover after matches. Therefore, congested game schedules may not provide adequate recovery for athletes and may increase stress scores and decrease the perception of recovery. In this sense, the use of HI could be an important pre-game monitoring strategy, as it assesses fatigue and DOMS (an exercise-induced muscle damage marker). However, contrary to expectations, short recovery intervals between games did not demonstrate effects on the perception of fatigue and DOMS. The results of the present study suggest that the perception of well-being in futsal players in the season was not associated with the time interval between games, not even for DOMS. The situation analyzed is similar to the one studied by Clemente et al. (2019) who also observed that congested periods (two games per week) produced less impact on the HI, due to the adjustment of loads and training between games. A limitation of the present study was the lack of authorization from the team to monitor loads between games.

The effect of the opponent's quality also influences the physical and technical-tactical performance in team and individual sports[44-46] and the pre-competitive anxiety of athletes.[24,47] Thus, the opponent's competitive level could be a factor that alters the perception of well-being and chances of competitive success. In the present study, the opponent's quality was evaluated through the championship level (state or national), the opposing team's ranking in the championship classification, and the result of the opponent's previous game (win, defeat, or draw). According to Kelly and Coutts (2007), the opponent's quality (opponent's ranking) is an important stress factor that increases the perception of difficulty in the next game. In addition, confrontations with higher-level opponents also provoke a

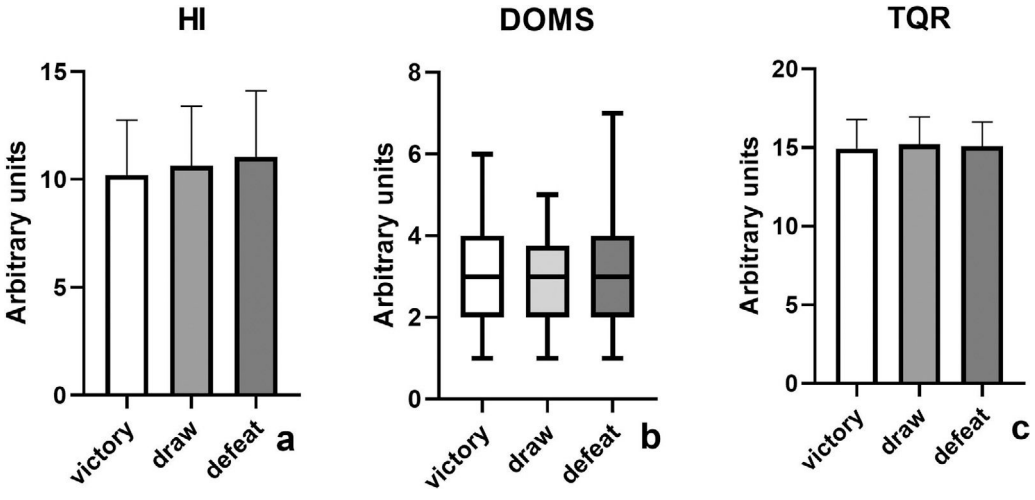

Figure 4 Mean (SD) HI and TQR values and median (25 to 75% quartiles) DOMS subscale of HI. a) Hooper Index score. b) HI DOMS score. c) Total quality of recovery score.

greater effort from team sports athletes,[48,49] which can cause greater fatigue. Contrary to expectations, neither the quality of the opponent nor the result of the opponent's previous game had any influence on the perceived well-being of the evaluated athletes.

The futsal athletes reported better recovery, despite the lower perception of well-being (due to DOMS) in games preceded by victory. Thus, winning games seem to impose greater physical demand (and may result in increased DOMS), but the perception of increased recovery suggests that athletes are more motivated after a game preceded by victory. However, the levels of well-being and TQR did not differ when the outcome of the game was victory, defeat, or draw. This demonstrates that other factors are decisive for the success of the match, such as technical-tactical organization during matches. Therefore, the HI and TQR indices need to be evaluated in association with other contextual and individual aspects to determine their usefulness or not in helping team coaches and team staff to make decisions for the team's squad on court and prescription of recovery interventions.

The results of the study demonstrate that level of competition was correlated with well-being but not the perception of recovery of futsal athletes. In addition, older athletes may notice less recovery between games. The physical aspects of muscle pain and recovery perception are influenced by victory in the previous game, requiring attention to the symptoms of muscle damage, despite the athletes' better perception of recovery.

Conflicts of interest

The authors declare that they don't have any conflict of interests.

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