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Original Article

EFFECTS OF FIVE CONGESTED FUTSAL MATCHES ON RELATIVE INTENSITY, STRESS SYMPTOMS AND MUSCLE SORENESS

EFEITOS DE CINCO PARTIDAS CONGESTIONADAS DE FUTSAL NA INTENSIDADE RELATIVA, SINTOMAS DE ESTRESSE E DORES MUSCULARES

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RESUMO

O objetivo do estudo foi avaliar o impacto de cinco partidas congestionadas na intensidade relativa, nos sintomas de estresse e nas dores musculares de atletas de futsal feminino. Oito atletas de futsal feminino (20,1±3,1 anos; 58,6±5,2kg; 160,0±5,0cm;) foram submetidas a cinco partidas consecutivas, com intervalo de descanso de aproximadamente 24 horas. A intensidade relativa da partida foi medida com a avaliação da percepção de esforço da sessão. Para sintomas de estresse foi utilizada a análise diária das demandas de vida dos atletas e a escala visual analógica de dor foi utilizada para avaliar a percepção de dor muscular dos atletas. A ANOVA de Friedman foi utilizada para comparação das variáveis dependentes entre as partidas, adotando valor significativo quando p<,05. Estes foram aumento da PSE da sessão ($\chi^2(4) = 30,00$, p<,05) e intensidade relativa da partida ($\chi^2(4) = 31,43$, p<,05) ao longo das partidas; observaram aumento nos sintomas de estresse ($\chi^2(4) = 30,19$, p<,05) e dor muscular ($\chi^2(4) = 29,96$, p<,05) também durante a competição. Partidas sucessivas de futsal com curto intervalo de descanso entre elas causam grande estresse psicofisiológico, demonstrando aumento da intensidade relativa, dos sintomas de estresse e da percepção de dor muscular.

Palavras-chave: Esportes coletivos. Estresse psicofisiológico. Intensidade relativa. Dor muscular

ABSTRACT

The aim of the study was to evaluate the impact of five congested matches on the relative intensity, stress symptoms and muscle pain female futsal athletes. Eight female futsal athletes (20.1±3.1 years; 58.6±5.2 kg; 160.0±5.0cm;) were submitted to five successive matches, with a rest interval of approximately 24 hours. The relative match intensity was measured with session rating of perceived exertion. To symptoms of stress was used the daily analysis of life demands in athletes and the visual analog scale of pain was used to assess the muscle soreness perception of the athletes. Friedman's ANOVA was used to compare of the dependent's variables between the matches, adopting significant value when p <.05. These was increase of the session RPE ($\chi^2(4) = 30.00$, p<.05) and relative match intensity ($\chi^2(4) = 31.43$, p<.05) through the matches; observed an increase in stress symptoms ($\chi^2(4) = 30.19$, p<.05) and muscle soreness ($\chi^2(4) = 29.96$, p<.05) also during competition. Successive futsal matches with a short rest interval between them cause great psychophysiological stress, demonstrating an increase in the relative intensity, stress symptoms and perception of muscle soreness.

Keywords: Team sports. Psychophysiological stress. Relative intensity. Muscle soreness.

Introduction

In intermittent team sports such as futsal, athletes must demonstrate excellent intermittent endurance, repetitive sprint ability, and lower limb strength[1]. Additionally, they need to maintain technical skills, including high-level shooting and passing, along with adequate agility and coordination[1]. In contemporary elite futsal, clubs often compete in numerous matches throughout the season with inadequate recovery time. Insufficient rest and regeneration between matches may expose players to the risk of overtraining and competing before they have fully recovered[2].

Maintaining performance during intensified phases of competition is crucial; for this to occur, an appropriate balance between effort and recovery is essential[3]. Participation in a

congested match schedule might induce a decrease negatively their mucosal immunity and capacity to perform certain technical actions[4], and a greater incidence of upper respiratory tract infections[5]. In addition, the ability to perform acceleration actions is compromised when consecutive matches occur without adequate recovery time, thus demonstrating accumulated fatigue because of a congested competition schedule[6].

A single football match can induce short-term muscle damage and significant inflammatory responses[7]. Consequently, athletes competing in successive matches face a higher risk of residual fatigue, potentially affecting both their physiological and physical performance[8]. Monitoring psycho-physiological stress, known as relative intensity (IR), is crucial for making evidence-based decisions about managing these demands. This approach helps reduce injuries and enhance team performance[9]. Effective intensity management informs strategies such as rotating players during games, which is vital for maintaining a low injury rate during periods with congested schedules[10].

Monitoring relative intensity (RI) in combination with psychophysiological responses has been suggested to prevent unwanted adaptations[11]. Relative intensity is assessed through objective instruments (e.g., heart rate, blood lactate) and subjective measures (e.g., perceived stress rate), both of which have accepted applicability in various sports[12,13]. Sports science encompasses multiple components that require careful observation; it is essential to consider aspects beyond the dynamics of relative intensity[13]. The possible impact of psychophysiological stress on the wellness status of players (and recovery, naturally) should also be considered in a well-implemented player monitoring cycle[13,14].

Sports teams use various methods and tools to systematically monitor post-match fatigue to evaluate recovery and assess athletes' readiness for subsequent training and competition[15]. In a congested match calendar, estimating fatigue from matches is crucial for adopting appropriate recovery and training intensity strategies. Poor management of training intensity within a microcycle between matches can negatively impact neuromuscular and perceptual recovery[16]. Methods to quantify psycho-physiological stress include questionnaires, diaries, physiological monitoring, and direct observation[17]. Therefore, monitoring the impact of relative intensity on athletes' well-being and recovery should be integral to the athlete monitoring cycle[13,18,19].

The investigation within the sport has its predominance in men, such monitoring psychophysiological stress in combination with wellness status become essential, mainly within women's sports in which funding, both for training structures and competitions that occur during congested periods[20]. These schedules would affect physical performance across consecutive matches and, notably, during the latter decisive matches (semifinal and final)[6]. Low-cost, easy-to-apply and non-invasive tools during training and competitions have previously been used as simple tools to monitor the immune response and prevent excessive psychophysiological stress. Therefore, the study aimed to evaluate the impact of five congested matches on the relative intensity, stress symptoms and muscle pain of female futsal athletes. Based on previous studies[2,15,17], it was hypothesized that competition with successive matches leads to an increase in psychophysiological stress.

Methods

Sample

Eight female futsal athletes (20.1±3.1 years; 58.6±5.2 kg; 160.0±5.0cm; 22.8±1.9 kg/m2) engaged in five successive matches, with a rest interval of approximately 24 hours between matches. The inclusion of athletes occurred according to their participation in at least 75% of the playing time in each match. The athletes were considered healthy and in the same training period. Before the competition, athletes participated in 15 to 17 hours of

weekly training (5 to 8 training sessions, including small-sided games, technical and tactical training, and gym strength training sessions) with one official match per week. The recovery strategies during the period between the match were identical. All athletes and the technical committee were previously informed about the procedures and objectives of the investigation and agreed to participate voluntarily. This study was approved by the University's ethics committee (n°: 1,706,413).

Design

The athletes were monitored during the Brazilian Women's Futsal Championship. The matches were between 4:00 pm and 6:00 pm. The matches were played in two 20-minute halves, according to the rules of the Brazilian Futsal Confederation. The relative intensity was measured daily, approximately 30 minutes after the matches. The psychophysiological responses were assessed daily, starting in the morning after the first match and ending in the morning after the last day of competition (Figure 1). (Match 1: won 6 x 0; match 2: won 2 x 0; match 3: won 3 x 1; match 4: won 2 x 1; match 5: lost 0 x 2).

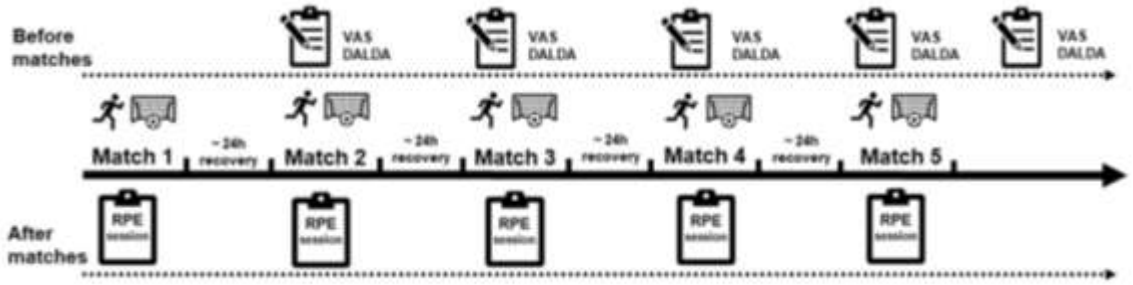

Figure 1. Experimental design.
Legend: VAS = Visual analog scale; DALDA = Daily Analysis of Life Demands in Athletes; RPE = Rating of Perceived Exertion. . **Source**: Authors

Procedures

Relative Match Intensity

The relative competitive match intensity was measured from the Session Rating of Perceived Exertion (RPEs)[21,22]. This method is the product of the session/game duration (in minutes) by the score reported on the CR-10 scale recorded after the match. The monotony was determined by the ratio between the average of the matches relative intensities by its standard deviation. At the same time, the strain was determined by the monotony product by the sum of the competition's intensities[21].

Symptoms of stress

To determine the symptoms of stress, the Daily Analysis of Life Demands in Athletes (DALDA) was used in its translated and validated version for the Portuguese language[23]. The instrument has two parts that represent the sources (A) and symptoms of stress (B). This instrument requires the athlete to rate each item, in each part of the questionnaire, as being "worse than normal", "normal", or "better than normal". Only the answers "worse than normal" in part B were retained for analysis, as in previous investigations[11,23].

Muscle soreness perception

The visual analog scale (VAS) of pain was used to assess the muscle soreness perception of the athletes. The scale consisted of a 100 mm line whose endpoints were labeled by "no pain" (left) and "unbearable pain" (right). The VAS ranges from 0 to 10 points and

can be subdivided into three levels: 0 to 2 mild muscle soreness, 3 to 7 moderate pain and 8 to 10 severe pain[24]. The athletes were instructed to report the pain presented in general only in the lower limbs, without the need to specify the anatomical point.

Statistical analysis

Data are expressed in descriptive statistics (mean, standard deviation, median, percentile [25-75%] and confidence interval [CI] 95%). Due to the small sample size, we chose to use non-parametric statistics. Thus, Friedman's ANOVA was used to compare the differences between the matches with Dunn's test as post hoc. The level of significance adopted was $p < 0.05$. The Hedges' g effect size was also measured and classified as 0.0 - 0.41 minimum effect, 0.42 – 1.15 moderate effect and ≥ 2.70 strong effect[25].

Results

Figure 2 (A and B) shows the median values (columns) and the individual values (points) of intensity and relative intensity of the athletes throughout the matches. During the competition, the RPE ranged from 3.00 [3.00-3.75] AU in the first match to 5.00 [4.00-6.00] AU in the fifth match. There was an increase of the session RPE through the matches ($\chi^2(4) = 30.000$; $p < .0001$), and both the first and second matches were lower compared to the fifth match (Median; percentile 25% - 75%, M1: 3.00; 3.00-3.75 vs M5: 6.00; 6.00-8.50, ES: 1.9 [moderate effect]; M2: 3.50; 3.00-4.00 vs M5: 6.00; 6.00-8.50, ES: 1.7 [moderate effect]). Match 1 was also lower than the fourth match (M1: 3.00; 3.00-3.75 vs M4: 6.00; 5.00-7.00, ES: 1.7: [moderate effect]) (Figure 2 A).

The relative match intensities were 630.00 ± 211.33 AU with high monotony index of 2.98 ± 0.54 AU. The competitive period caused a strain of 9,462.71 ± 2,412.94 AU. There was a significant increase in the internal competitive load during the matches ($\chi^2(4) = 31.436$; $p < .0001$). The relative intensity of match 1 was lower compared to the other matches (M1: 360.00; 360.00-450.00 vs M4: 720.00; 720.00-840.00, ES: 1.7: [moderate effect]; M1: 360.00; 360.00-450.00 vs M5: 960.00; 720.00-1050.00, ES: 1.9 [moderate effect]; M2: 3.50; 3.00-4.00 vs M4: 6.00; 5.00-7.00, ES: 1.5 [moderate effect] and M2: 3.50; 3.00-4.00 vs M5: 6.00; 6.00-8.50, ES: 1.7 [moderate effect]) (Figure 2 B).

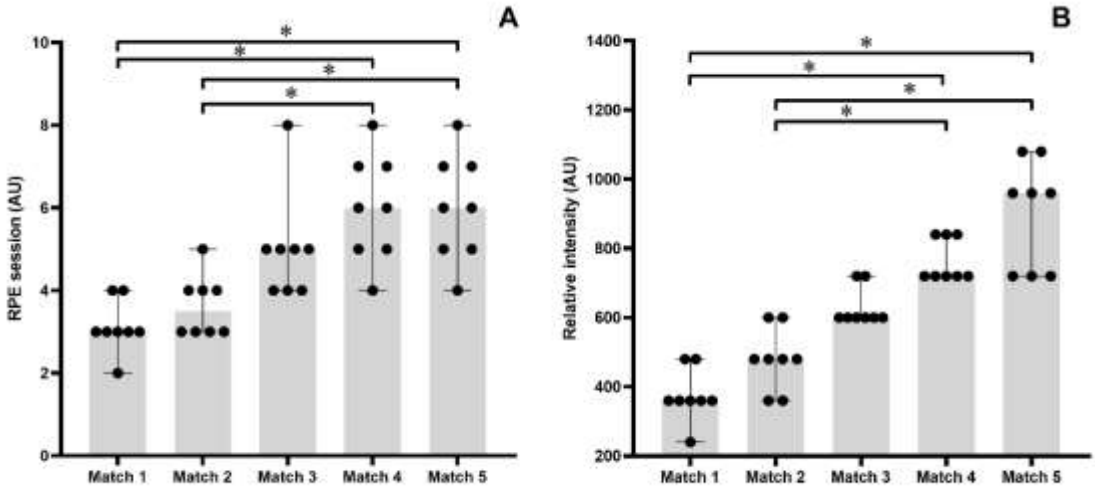

Figure 2. Session RPE and relative intensity throughout the five matches.
*Significant difference $p < .05$. **Source**: Authors.

Figure 3 (A and B) shows the dynamics of the variable symptoms of stress and muscle

pain of the athletes throughout the matches (median [columns] and individual values [points]). Regarding stress symptoms, was observed an increase in stress symptoms in matches 4 and 5 compared to matches 1 and 2 ($\chi^2(4) = 30.192$; $p < .0001$) (M1: 1.00; 0.00-2.75 vs M4: 4.50; 3.00-6.00, ES: 1.7: [moderate effect]; M1: 1.00; 0.00-2.75 vs M5: 5.50; 4.00-6.75, ES: 1.9 [moderate effect]; M2: 1.50; 1.00-3.50 vs M4: 4.50; 3.00-6.00, ES: 1.5 [moderate effect] and M2: 1.50; 1.00-3.50 vs M5: 5.50; 4.00-6.75, ES: 1.7 [moderate effect]) (Figure 3 A).

Muscle soreness increase during competition ($\chi^2(4) = 29.960$; $p < .0001$), starting from mild pain in the first match (1.50; 0.25 - 2.00 AU) and reaching moderate pain (6.50; 5.00-8.00 AU) after the fifth match. Muscle soreness in the fourth and fifth match was greater compared to the first (M1: 1.50; 0.25-2.00 vs M4: 5.00; 4.00-6.75, ES: -2.7 [strong effect]; M1: 1.50; 0.25-2.00 vs M5: 6.50; 5.00-8.00, ES: -3.4 [strong effect]), and the match 2 was lower compared fifth match (M2: 3.00; 2.00-3.75 vs M5: 6.50; 5.00-8.00, ES: -2.5 [strong effect]) (Figure 3 B).

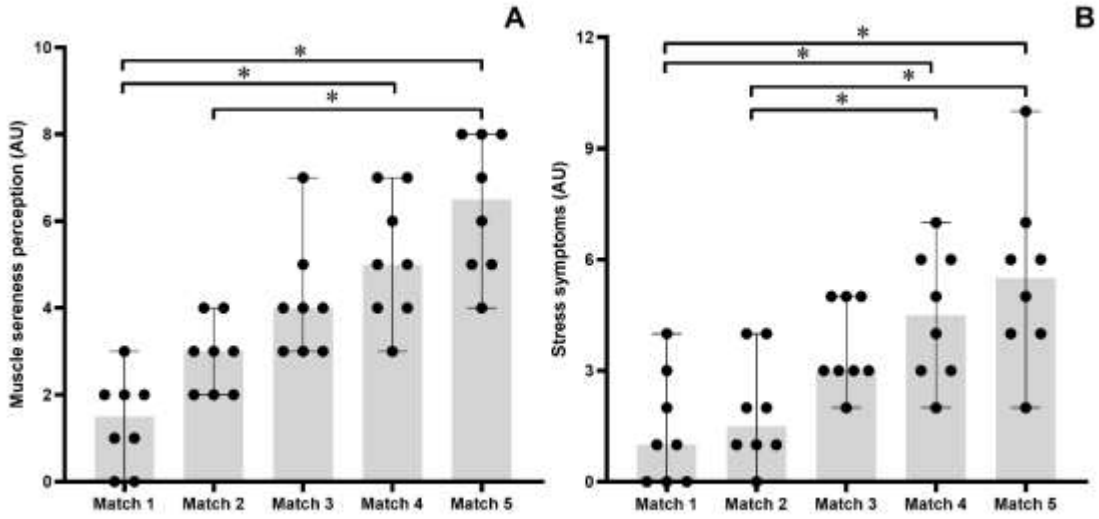

Figure 3. Symptoms of stress and perceived muscle sereness throughout the five matches.
*Significant difference $p < .05$. **Source**: Authors.

Discussion

Our study investigated whether consecutive matches impact futsal athletes' relative intensity and psychophysiological responses. The study's main finding was that five consecutive match days increased relative match intensity, stress symptoms and perception of muscle soreness in professional female futsal athletes.

The relative intensity over the matches increased from 375 to 900 AU, noting that the athletes experienced high physiological stress during an official competition[21,23,24,26]. Furthermore, it reinforces that the sRPE can provide useful information for coaches regarding the relationships among the overall impact of a training session in futsal players[13,27]. The importance of monitoring monotony and strain throughout the training process, as such information is related to the risk of illness and overtraining. It is known that it is difficult to manipulate intensities during competitive periods; however, such findings allow for the adequate manipulation of training intensities throughout the season, and particularly before the competition, to adopt appropriate tapering strategies for the reduction in RIs before competitions is an appropriate strategy to minimize immune responses ensuring the athlete's ability to train and compete[28].

Monitoring players' responses (e.g., physiological and perceptual) to a soccer match is paramount to prescribing the optimal training dose at an individual level, minimizing injuries, and restoring physical performance for subsequent training and competition[29]. Currently, important attention has been given to the use of instruments that the athlete reports on how he/she is feeling during the training and/or competition periods, as such tools can contribute to managing stress psychophysiology in athletes[19]. As far as is known, this study was the first to report that periods with conditioned matches in professional futsal athletes increased the perception of stress symptoms. DALDA has been commonly used within training routines to investigate its response due to the intensification of futsal training[11,30]. In women's futsal athletes, Milanez et al.[11] suggested that in periods of performance acquisition, relative intensity values between 343 and 419 AU and between 2639 and 3060 AU strain values are the cutoff points for keeping low values of stress symptoms. Thus, it is supposed that the psychophysiological demands of the competitive week imposed on athletes (RI: 630 AU and strain: 9462.7 AU) were determinant for the changes in stress symptoms during competition. It is also noteworthy that the interaction of multiple sources of stress, sometimes not possible to measure, can contribute to different stress symptoms[31]. With this finding, to suggest using the DALDA questionnaire as an appropriate and simple monitoring tool for monitoring players exposed to high competitive loads during the congested period.

There was an increase in the athletes' perception of muscle soreness over the matches. Clemente et al.[32] recently found that periods with higher training loads have greater muscle soreness results. This study found that from the second match onwards, the perception of muscle pain increased significantly with a substantial increase in the relative intensity. Such increase in muscle soreness can be supported by the magnitude of the relative intensity experienced by athletes during official matches with short intervals of time, given that futsal athletes, when submitted to two weekly matches, experience greater intensities and consequently greater muscle soreness[33]. Additionally, the increase in muscle pain is related to the characteristics of the match, as it is a high-intensity intermittent activity with a large number of accelerations, decelerations and sprints; short recovery times between them; and various actions with changing direction[34].

Such, the congested period of match play alters various parameters in elite soccer players[35], and modern physical training in elite sport is characterized by the systematic and continuous assessment of data on competitive and training performances[36]. Our results suggest using low-cost, easy-to-apply and non-invasive tools as appropriate instruments to monitor changes in psychophysiological variables and thus identify the demands on athletes submitted to congested matches.

Although the present study offers a significant contribution to sports science, some limitations should be noted. The lack of control over the menstrual cycle of the athletes is one limitation, as this period can influence stress symptoms. Additionally, variations in court time and the perceived importance of each match, knowing they would advance to the next phase of the championship, could have influenced the athletes' effort during the games. Furthermore, the sample size is a limiting factor, and extrapolation of the results should be approached with caution. However, the use of effect size between comparisons adds robustness to the findings. It is worth noting that the evaluated athletes participated fully in all matches and maintained a consistent training routine, movement logistics, concentration environment, and feeding environment, thereby enhancing the study's internal validity. Despite these limitations, the results presented here offer important ecological validity, as they reflect an official competitive condition.

Conclusion

Successive futsal matches with a short rest interval between them cause great psychophysiological stress, demonstrating an increase in the relative intensity, stress symptoms, and perception of muscle soreness. As a practical application, it is recommended that coaches and staff monitor relative intensity responses, stress symptoms, and muscle pains during congested competitive periods. This approach helps understand and mitigate the impact of psycho-physiological stress, thereby preserving the health of athletes. Additionally, given the lack of control over the menstrual cycle, it is crucial to include this information in future studies due to its potential impact on the physiological responses of female athletes. Moreover, recommendations suggest that match schedules should be planned to ensure sufficient recovery time between matches and ensure game quality.

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