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REVIEW ARTICLE

The Continuous and Fractionated Game Format on the Training Load in Small Sided Games in Soccer

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Abstract:

The training load has become relevant for coaches in recent years. Several studies were carried out to verify the impact on the training load during the performance of small-sided games in soccer. However, recent research is now focused on the effects of using different methods and the study of different recovery times on training load in SSG deserves more attention. In this brief review, we critically analyze the impact of using different training methods and different recovery time, inferring with their impact on the external and internal training load during the performance of Small-Sided Games in soccer. The correct choice of training method can help coaches to increase the performance of their teams and achieve the proposed training objectives.

Keywords: Soccer, Different training methods, Continuous format, Fractionated format, Different recovery times, External load, Internal load.

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1. INTRODUCTION

1.1. Problem Definition

Soccer is typically regarded as an intermittent sport [1] with multiple unpredictable actions. Therefore, it is important for soccer training to recreate the dynamic nature of the game to be representative of all competition requirements. According to the literature, these demanding standards can be achieved by recreating the game through Small-sided Games (SSG) [2, 3]. In addition SSG, highlight similar combinations of technical, tactical, and physical players' abilities as those observed in full-sized matches [2, 4], several studies also showed the manipulation of some variables during these games, like the total duration, and the duration periods between repetitions (*i.e.*, the use of continuous or fractionated methods) [5, 6]. Regarding the duration of the exercise, the literature described that using the continuous or fractional method, during the performance of SSG, for different periods of time causes different changes in the training load (TL) [6], particularly due to the changes that occur in the intensity distribution during the different performance periods [7].The use of SSG also allows the development of players' decision-making skills under pressure and fatigue [8]. Indeed, fatigue can significantly affect motor and perceptual processing [9 - 12], which has a direct relationship with physiological and metabolic failures during SSG. Therefore, correct control and monitoring of the training load is essential to prevent levels of fatigue from limiting the objectives to be achieved and to ensure that the technical and tactical objectives of the exercise are marked out according to the physical objectives. The training load has been described as the training variable that can be manipulated to elicit the desired training response [13], and can be classified as internal or external and reflects the requirements imposed on athletes [14, 15]; however, some questions remain unanswered, such as those relating to the use of the continuous and fractional methods as well as the manipulation of three critical variables related to SSG prescription: time duration, interval of rest, and number of repetitions.

The present review highlights the impact on internal and external loads resulting from the application of the continuous and fractionated methods in SSG. It also aims to give importance to the effects of different recovery durations between repetitions on training load during SSG. Ultimately, a review is necessary to summarize the findings and new evidence on changes in training load resulting from performing SSG using continuous or fractional methods and with different recovery time. To search for relevant publications and ensure the quality of the articles, the following databases were used: Web of Science (the modules "Core" and "Medline"), Scopus and PubMed. Articles that were published in 2020 or before and in English were considered. The search strategy comprised

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search terms that combined one of the two primary keywords ("soccer" or "football") with a second keyword (small-side games" or "small and conditioned games") and a third keyword ("recovery time", "training load", "continuous method", "fractionated method"), using the boolean operator. The inclusion criteria for these articles were: (1) relevant data on: training load, training method (continuous/fractional) and / or recovery time, during SSG; (2) the participants included amateur and / or professional male and female soccer players; and (3), the articles were published in English. Studies were excluded if: (1) not included data relevant to this study; and (2), were conference abstracts. The articles were screened based on an assessment of both the title and the abstract. All articles without a clear focus of the investigation were excluded. In total, 133 articles were considered relevant for this review. These articles were read in detail by two senior researchers with substantial experience in the field (including relevant publications) and assessed for relevance and quality. Articles that did not meet the criteria were excluded. After this step, 25 articles remained.

2. SUMMARY OF PREVIOUS RESEARCH

Prior investigations on the influence of the continuous and fractionated training methods on training load are inconclusive and present contradictory outcomes [3, 4, 6, 7, 16 - 18]; however, changes in training load may occur during SSG [19] as well as improvements in aerobic capacity [3]. Still, the type of changes induced in the internal and external loads and their causes remain controversial among the scientific community. In this regard, some authors [6, 7, 18, 20] have suggested that increasing repetition duration brings an increase in physiological responses, specifically heart rate (HR) [4] and % max.HR [3, 17]; therefore, the continuous method induces a greater internal load compared to the fractionated method. In the same line of investigation, other authors [3, 21] state that the physiological responses are similar regardless of the training method chosen by the coach, while divergent opinions are presented in other investigations [22, 23]. Regarding external load indicators, previous studies that compared SSG performed using both methods with real game situations inferred that, although the intensity is higher in real game situations, the workload is higher during the performance of SSG regardless of the format, particularly in relation to the distance traveled per minute [24], in addition to other variables that have been analyzed (*e.g.*, the intensity of displacements made [25], total distances traveled, and total distances traveled at high intensities [26, 27], but more research is required about this topic. In general, the investigations conducted suggest that both training methods can be used for physiological adaptations and match-specific conditioning, but further research is needed to identify which training method is most efficient for SSG. In addition to selecting the training method, coaches must consider the recovery time chosen between each repetition performed since the ability to maintain high intensities is directly related to the ability to recover quickly from previous repetitions performed [28]. In this regard, it has been suggested [29] that short recovery periods can cause increases in training load ; however, other approaches suggest that there are no differences between different recovery time [30], while another study suggests that longer recovery periods showed less homogeneity of the heart rate (HR) [31].

3. EXPLANATION OF SUBJECT MATTER

The literature describes that the performance of an exercise using the continuous or fractionated methods can cause changes in the training load [6], especially due to the changes that are verified in the intensity distribution during the different periods of performance [7]. Usually, the SSG is prescribed using the fractionated method [32], although the continuous training method is more similar to the demands of the real game [25]. One of the aforementioned studies [7] concluded that during the total duration of SSG, the value of HR is smaller with shorter repetitions (*e.g.*, 2 min) compared to longer repetitions (*e.g.*, 6 min). Collectively, these results may suggest that when considering the total duration of the SSG, the continuous method induces higher HR responses compared to the fractionated method with shorter repetitions. Some possible justifications for these results have been identified, such as the additional rest between repetitions that causes decreases in HR [25] and a pacing effect that can encourage players to set the pace of the game [33]. Finally, some studies also show that SSG performed under the continuous or fractionated formats displayed identical physiological responses for both training regimes [3, 18]. In this respect, a study [21] also observed no differences in physiological indicators when comparing both training methods. Collectively, these results suggest that both regimes can be used for physiological adaptations and match-specific conditioning. The development of the player's physical condition is one of the essential factors for performance [34] and also depends on the interaction between exercise duration and subsequent recovery periods, as well as exercise intensity and recovery [1]. Indeed, the recovery period between sets may result in an increased HR response in the following series, thus better removal of substrates during the stipulated rest period [35], which allows physiological recovery and higher intensities of work in the following repetitions [5]. Although most studies on SSG are prescribed with short rest intervals, some recent studies have used variations in recovery time (*e.g.*, 10 min to 30 min) [2]. The training load is relevant in the player's physical state since performance optimization is only achieved from post-training and competition recovery periods; thus it is necessary to consider an optimum balance between the stress resulting from the stimulus and adequate recovery intervals [36]. Exercise variables such as duration, recovery, and intensity are therefore considered the predominant vectors of the training load [37].

4. CONTRADICTIONS AND PROBLEMS

Usually, the SSG is prescribed by the fractionated method [32], although the continuous training method is more similar to the demands of real games [25]. One of the aforementioned studies [7] concluded that during the total duration of SSG, the value of HR is smaller with shorter repetitions (*e.g.*, 2 min) compared to longer repetitions (*e.g.*, 6 min). These results seem to suggest that the continuous method induces higher HR responses compared to the fractionated method with shorter repetitions, considering the total duration of SSG. Some

possible justifications for these results have been identified, such as the additional rest between repetitions that cause decreases in HR [25] and a pacing effect that can induce players to set the pace of the game [33]. In addition, the duration of repetitions may be a determining factor to be considered, as shorter and successively shorter repetitions appear to cause lower % max HR compared to longer repetitions [3, 4, 17]. Contrary to this evidence, a study comparing the use of longer and shorter repetitions found that the physiological responses were similar [3].

On the other hand, SSG could induce various responses in the external load. A previous study, which compared the SSG and a regular game performance, concluded that the level of intensity during the regular soccer game was higher compared to the performance of the SSG, although the distance covered per minute was greater during the SSG [24]. Another study [25] observed that a reduction in the number of players participating in the SSG caused a decrease in the distance covered and the amount of sprints performed. Other investigations [26, 27] reported that the inclusion of defensive strategies (*e.g*., man-to-man marking) by the coach promoted an increase in the total distance covered, at high intensities, while the inclusion of goalkeepers caused an increase in the number of accelerations [38].

Although the choice of training method is a fundamental factor in defining the training load, the recovery time between repetitions also plays an important role in the training load imposed by the exercise and should be carefully analyzed by the coaches. Given that the ability to maintain high intensities during exercise depends on the recovery from repetitions of previous exercises [28], Köklü *et al*. [29] reported that, when a coach selects the fractionated training method, the number of repetitions and duration of repetitions are considerably affected by the physical demands of the tasks. These results were corroborated by a study that investigated the effects of different recovery periods of 1, 2, 3, and 4 min, respectively [29]. The same conclusions were drawn from a study that had recovery periods of 30 s and 120 s and aimed to analyze variation in HR, the effects of oxygenation on muscles, and the movement demands resulting from the task [30]. In this respect, exercise duration and recovery time may be determining factors for controlling the training load and consequently, physical and physiological responses.

CONCLUSION

Overall previous studies have allowed coaches better control of training load during SSGs; however, some questions remain unanswered, such as those relating to the use of the continuous and fractional methods as well as, for example, the manipulation of three critical variables related to the SSG prescription: time duration, interval of rest, and number of repetitions. The current data highlights some lack of consensus in the use of both methods and the effects of manipulation on the variables identified remain inconclusive, and further studies are needed to clarify the topic due to its importance in training manipulation and control.

Following a new line of investigation, one recent study [39], which sought to respond to existing gaps in the literature, proposed new evidence that can be extremely useful for coaches in the prescription and control of training load during the performance of SSG. In this study [39], the effects of the continuous and fractionated formats on the training load were investigated during the performance of a five-a-side SSG involving professional soccer players. The players performed the same exercise using the continuous (1 x 24m) and fractionated (2 x 12m; 4 x 6m and 6 x 4m) method, and the results indicated that the use of the continuous method has a tendency to cause less impact on internal and external loads. Furthermore, the authors state that the increase in exercise fractionation through the fractionated method induced increases in the external load. In general, the study revealed that the application of SSG by the fractionated method tends to cause greater training load while performing SSG. The results [39] emphasize the importance of the coach in choosing the training method to be used, since the correct manipulation of this variable helps in the management of exercise fatigue and in the increase or decrease of the resulting training load. In addition, it introduced a new paradigm that uses both training methods. According to the author [39], the fractional method with short repetitions is appropriate if the coach intends to achieve high physical performance and high training load responses for the training unit. Conversely, if the objective is to perform careful management of the players' effort, to reduce the imposed training load, or to make players focus on learning content (*e.g*., tactical components), then the continuous method should be used. This study suggests new approaches for the use of the continuous and fractionated training method, as well as the importance of optimal recovery time when utilizing a five-a-side SSG format.

SUGGESTIONS FOR FURTHER RESEARCH

Following a new trend of investigation, and in order to respond to the gaps in the literature, future research can focus on the the relationship between exercise and recovery durations during SSG in soccer, since the manipulation of time duration, the interval of rest, and the number of repetitions are variables with lack of study and little consensus. Particularly and according to the literature gap, it may also be relevant to study the effects of the fractionated method in SSGs when considering the same total duration of exercise (total and in each repetition) and employing different recovery times. Other objectives can be tested: i) understanding and comparing the impact of a team's playing style on training load indicators, tactical behavior, and technical performance resulting from SSG applied by different methods; ii) comparing possible differences in the perception of the players' effort in performing different fractionated SSG formats with the same total duration and different recovery times; and iii) investigating changes in technical and tactical components based on the use of different training methods. Some of the findings could provide new insights for researchers, coaches, and athletes to improve training efficiency and optimize performances.

CONSENT FOR PUBLICATION

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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