

Muscle Recovery Strategies Applied to Soccer Players: A Narrative Review

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Abstract

Post-exercise recovery in sports is important, for the athlete a good recovery is essential for better performance in training and games. The aim of the study was to analyze which muscle recovery is most used after soccer game. The study is a narrative review, in which five studies were selected. Inclusion criteria were articles in English and Portuguese, articles from 2009 to 2021 were selected. Exclusion criteria were articles that are not English and in Portuguese, articles before 2009, review studies, dissertations, guidelines and animal studies. The databases used to search for the studies were Pubmed, Lilacs and Google Scholar. The descriptors were: soccer and recovery; soccer players and muscle recovery; soccer players and recovery; soccer and recovery; soccer players and rest. The study had a total five articles Where four of them had cryotherapy, two of them being favorable to itself as the best method, passive recovery and the two had better results for it and a massage study. According to the analysis of the studies, active recovery was more effective when compared to cryotherapy and passive recovery. Sports massage has not had significant results, but when recovery periods are short and other methods are not possible.

Keywords: Muscle Performance; High Performance Sports; Therapies

Introduction

Modern soccer began in 1863, when the practice was universalized and the first rules were created. Followed by the English Soccer Association, which until today governs the sport in England (Brazilian Soccer Association, 2021). In Brazil, soccer arrived around 1894 with the return of Charles Miller from England, Where he brought to the country two balls and the explanation of the practice and rules [1]. Its evolution is mainly due to studies and systematizations in various actions in the game, considered a sport with several variables, these studies and systematizations become a very Strong tool for its growth [1]. Physical preparation is a big factor within possible to help maintain player's performance, Where strength, power and intensity are boosted and improved

with recovery protocols, given that with the increasingly tight schedule in sport, recovery between efforts gains more and more space to help and maintain the best performance of athletes [2].

In soccer, athletes are exposed to several stimuli Where strength is a fundamental attribute that guarantees their good performance in games [3]. The presence of strength within a soccer game is remarkable, whether in kicks, sprints, races, among others [4]. High-intensity functional performance is directly linked and working together with strength in soccer, sudden changes in directions, slowdowns, within the game are very important in aiding actions such as dribbling and marking [5].

We can highlight power in soccer, among the physical qualities it is one of the most important for good individual performance, being directly linked to game acts such as jumps, kicks and sprints [6]. Jumping power, starting power and deceleration power have a huge importance for soccer [7].

The energy of soccer players is primarily due to aerobic metabolism, which is related to the ability to maintain a certain intensity by means of rest between high intensity stimuli [8]. Soccer is an intermittent exercise, due to constant changes in intensities in the races, those with high intensity are extremely important in the result of the match [9].

Cryotherapy is the therapeutic application of cold, which can be applied with ice on the subcutaneous skin, resulting in a decrease in muscle and joint temperature, will cause a constriction of venules and arterioles, reducing possible swelling and reducing the risk of injury [10]. It can also be done in cold water immersion, usually up to the waistline, relieving muscle pain and injuries resulting from physical exercise [11]. Cold water immersion has the power to attenuate accumulated muscle metabolic by products, reducing muscle damage caused in athletes, so muscle pain is part of everyday life, cryotherapy has short-term analgesic power, making it an important tool in the post-game recovery process [12].

Active recovery is a widely used post-exercise recovery model, where low and moderate intensity exercises are performed [13]. Widely used in soccer, it has been performed between 30% to 60% of the maximum energy consumption, with a minimum duration of 15 minutes, it has the power to help the removal of lactate and accelerate the pH normalization process [14]. Active recovery follows some aspects linking physical capacity, time, type of exercise and intensity [15]. There is a need for more studies regarding active recovery protocols [16]. This study is relevant because it addresses a little-studied issue, which is post game recovery, and it is important for professionals working in the field of soccer, and it is important to analyze how the literature analyzes and addresses this issue.

Objective of the Study

The objective of the study is to analyze which muscle recovery is most used after a soccer game.

Methods

Types of Study

The type of study performed is a narrative review with a qualitative approach. A narrative review is considered adequate to analyze and present the general developments of the studies under a qualitative perspective [17]. A qualitative research is not tied to numerical representation, it generates a deepening of an organization, social group, etc. In it, the scientist is at the same time the subject and the objective of his research, the development is unpredictable and the researcher's knowledge is limited and partial, with the objective of the sample being to produce in depth and illustrative information, regardless of its size, what is important is that it brings new information [18].

Inclusion and exclusion criteria

Inclusion criteria were articles in English and Portuguese, articles were selected between 2009 and 2021, the outcome has to be related to some type of recovery the study participants are professional athletes or from base category, be experimental studies. Exclusion criteria are: articles that are not in English and Portuguese, articles before 2009 were also excluded, review studies, dissertation, guidelines and animal studies.

Selection of studies

The databases used to search for the studies were Pubmed, Lilacs and Academic Google. The descriptors were: soccer and muscle recovery, soccer players and muscle recovery; soccer play and recovery; soccer and recovery; soccer play and rest. Thus, 213 articles were selected in the databases, 200 were excluded after reading the title, leaving 13 articles (4 PUBMED, 1 LILACS, 8 ACADEMIC GOOGLE); and 8 excluded after reading the abstract. For the final work, three were 5 articles that were published between 2009 and 2019, which will be read in an exhaustive and thorough manner.

Results

The total number of study participants was 67, where all were made with high-level athletes, one of which was a study with professional athletes and the others were from youth categories. Cryotherapy was the most cited type of recovery among the selected articles, followed by passive recovery, which was mentioned in three studies.

Author	Participants	Objective	Methodology	Types of Recovery	Results
Bezerra, <i>et al.</i> 2015 [19]	19 athletes professional medium age 25 years	Evaluate the effect of cryotherapy immediately after the game and for three days of recovery on muscle pain levels	Athletes were separated into two groups: GP and GC, after playing a game. GP performed passive recovery without and kind of effort, CG performed immersion in cold water (10°C) up to the waistline for 10 minutes. Two hours before the games, the questionnaire was applied (Borg's Cr10, SPP) and after the games, in a period of 24, 48 and 72 hours, the players were submitted to the protocols and answered the questionnaire again	Passive Recovery; Cryoterapia	Cryotherapy has an analgesic effect observed by the decrease in the subjective sensation of pain
Browstein, <i>et al.</i> 2019 [20]	11 athletes base of category medium age 22 years	To examine the effect of wearing lower body clothing with CPCM on the recovery of neuromuscular function after competitive soccer matches	The test group players used CPCM at 15° C while the GC used CPCM at room temperature, both for 3h.	Cryotherapy through clothing	The players noticed that in both outfits they were moderately effective in improving recovery, with no difference between the two
Ferrari, <i>et al.</i> 2013 [21]	23 athletes of sub-17 category	Compare different types of recovery methods on blood lactate (La-) removal and anaerobic performance of soccer players	Blood samples were collected during recovery intervals, immediately after and two, four, six, eight and ten minutes after T1 for blood lactate measurement, after that all athletes performed T2 again to observe the behavior of anaerobic performance on the three recovery methods	PR n = 8; AR n = 8; GR n = 7	There was a greater removal of blood lactate for RA, when compared to GR and PR. Active recovery proved to be more efficient for the removal of blood lactate when compared to passive and active recovery
Gassi <i>et al.</i> , 2011 [13]	4 athletes of sub-20 category	To compare the effect of different types of recovery on the blood lactate removal speed in soccer players, after performing a collective training	Blood lactate concentration was measured immediately, after training, 10 minutes and 30 minutes after. After the end of the collective, the athletes started the recovery programs (active recovery, passive recovery and ice bath)	Active Recovery; Passive Recovery; Cryoterapia	Active recovery is the most effective in terms of speed of lactate removal in high level players compared to passive. The ice bath did not differ significantly from other recovery strategies
Lopes, <i>et al.</i> 2009 [22]	10 athletes of base category medium age of 15 and 20 years.	Observe the effectiveness of massage application in relation to lactate removal after exercise	The sample was divided two groups: Test Group received the intervention of sports massage for a period of 10 minutes right after the training session and the Control Group (n = 5), did not receive intervention of sports massage, remaining at rest for the same period.	Sports Massage	Massage for being a means of recovery when periods for recovery are minimal, making interventions with other methods impossible

AR: Active Recovery; CPCM: College Phase Change Material; GC: Control Group; GP: Passive Group; RG: Ice Immersion Recovery; RP: Passive Recovery; SPP: Subjective Perception of Pain; T1: Rast Test; R2: Rast Test.

Discussion

The aim of study was to analyze the types of muscle recovery among soccer players after the soccer game. Two studies showed that cryotherapy is the most effective type of recovery when compared to passive recovery, they Brownstein., *et al.* [20] and Bezerra., *et al.* [19]. Two studies that compared active recovery with cryotherapy and with passive recovery also gave positive results, which were Gassi., *et al.* [13] and Ferrari., *et al.* [21]. On the other hand, sports massage had no positive results in recovery seen in the study by Lopes., *et al.* [22].

In the study by Brownstein., *et al.* [20] a randomized crossover design in 11 semi-professional players was used for the method, where the season of these players started in August and ended in May and the study took place in the Middle of the season, and the objective was to assess the effectiveness of CPCM in recovery in days following the games. The study took place in six matches, where with five participants the study was carried out in matches one and two, three participants in matches three and four and another three after matches five and six. The test group had the CPCM cooled to 15°C and the control group the CPCM was at room temperature. Participants answered a questionnaire where subjective measures of fatigue were evaluated and in the pre-game they answered on a Likert scale how they felt the intervention effectiveness in the pre game and post-game recovery (72 hours). The study concluded the athletes reported believing that the CPCM had an effect, average for recovery and this would be considered an important finding in the effectiveness of recovery methods for relating intervention with individual preferences.

The study by Bezerra., *et al.* [19] had a sample of 19 professional players where two groups were separated: Passive with 11 players and Cryotherapy with 9 participants. For the characterization of the sample, the players underwent evaluations where height, weight and fat percentage were measured 48 hours before each game and, at the moment, a SSP questionnaire was used. After games, both groups were submitted to intervention in the periods 24, 48 and 72 hours after game and answered the SSP questionnaire again. The GP players made their recovery without making any physical effort which consisted of immersion up to the waist line in water at 10°C for 10 minutes. In the post-game the level of pain in both groups increased considerably, after 24 hours the GP still had an increase in the level of pain while in the CG decreased and in 72 hours the

level of pain was normalized for both groups. According to some authors, the short-term level of pain was caused by cryotherapy may be related to the reduction in muscle spindle activity and nerve conduction velocity. Therefore, it should be considered an important method of recovery after high-level games, considering its power in the feeling of recovery, thus occurring in the athletes with better performance in post-game training.

Both studies show us the power of cryotherapy, whether it has an analgesic effect in the short term or even in the athlete's belief after SSP questionnaires. The studies had different methodologies to employ cryotherapy in post-game recovery, where one used CPCM cooled for 3 hours post-game, the other immersed in cold water (10°C) for 10 minutes 24, 48 and 72 hours post-game. The second study brought us better results compared to passive recovery, the first one showed us a small improvement in recovery, but the sensation of pain the athlete's vision had a moderate improvement.

The study by Gassi., *et al.* [11] brought us three recovery models: active recovery, passive recovery and cryotherapy. The sample consisted of four under-20 players from Goias Esporte Clube, the tests were performed after three uninterrupted training sessions lasting 45 minutes, in collective training the minimum period of 72 hours was respected, where removed immediately after collective training, 10 minutes post-training and 30 minutes post-training. The recovery protocols were for PR, the athletes remained seated without making any kind of physical effort for a period of 30 minutes, for AR, the athletes performed a continuous trot on the field for 10 minutes, with an approximate speed of 12 km/h in intensity moderate, followed by 20 minutes of passive recovery. In GR, the athletes were submerged up to the waistline in water at 14°C for seven minutes in a sequence of 23 minutes of passive recovery. To verify the efficiency of each recovery strategy, the analysis of relative values was performed. The results showed a significance reduction only after 30 minutes, where AR had a reduction of 68,4%, RP 42.9% and GR 55.2%. We can highlight the efficiency of AR in terms of recovery and speed in lactic acid removal. The study concludes that AR is more effective for high-level soccer players when compared to PR and GR.

The study by Ferrari., *et al.* [21] had a sample composed of 23 soccer athletes from the under 17 category, at the club training took place for 4 hours a day, five days a week, with games held on

weekends. The athletes were submitted to T1 and the divided into three groups, eight athletes made up the PR group, where the athletes were in the sitting position for ten minutes at rest, another eight athletes in the AR group performed a ten-minute run with an intensity of 80% of the critical speed, in natural grass, the last GR group composed of seven athletes, were submerged for 10 minutes up to the waist line in water with a temperature between 8°C and 10°C. The three groups underwent blood collection immediately after T1 and two, four, six, eight and ten minutes after the test, and T2 was performed at this second moment to verify the impact of the different recovery protocols. When comparing the peak values of blood lactate after T1 there was no significant difference, however checking the removal of blood lactate AR obtained 47.62% compared to GR 16.9% and PR 18.20% it is concluded that AR is more effective among recovery methods.

The numbers in two studies gave us the power that active recovery has in removing blood lactate after physical effort, when compared to other recovery methods such as cryotherapy and passive recovery, activer recovery had a significant advantage between the protocols. The methodology applied for AR had some similarity between the studies, where the first athletes performed a continuous trot for 10 minutes at moderate intensity with another 20 minutes of PR, as a result there was a blood lactate removal of 68.4% after 30 minutes of the protocol. The second study was also carried out with the athletes in a race with 80% of the critical speed there was a removal of blood lactate of 47.62% after 10 minutes of the protocol.

The studies did not show any evidence about the ineffectiveness of passive recovery, using it only in comparison with other recovery methods. The study by Lopes, *et al.* [22] had a sample of 10 participants, soccer players in the junior category between 15 and 20 years old and they were divided into two groups, the test and the control. The aim of the study was to observe the effect of sports massage on the removal of lactate after physical exercise, the training protocol was elaborated by the club's physical trainer. The study concludes that at the end of the protocol there was no significant difference between the two groups, however during the intervention the test group 18.7% faster in removal compared to the control group, so when there is no possibility of using other protocols, due to short recovery periods, massage can be alternative.

This study is important for soccer professionals because shows that the literature presents which type of recovery is most efficient

te, so this provides guidance for professionals in the area for which type of recovery to use in soccer, which is increasingly increasing the amount of games per season, being necessary to be used more efficient methods player's recovery. As limitation of the study, we had the small number of studies related to the area, so we cannot know if these studies were well conducted or not, there were few studies with professional teams, as they play more in the results studies could have been different.

Conclusion

Activer recovery was more effective when compared to cryotherapy and passive recovery. Sports massage has not had significant results, but when recovery periods are short and other methods are not possible, it can be used.

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