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THE EFFECTS OF ELECTROSTIMULATION ON POST-EXERCISE MUSCLE RECOVERY: A SYSTEMATIC REVIEW

Tiago Costa Esteves
Faculdade Inspirar, Belém, Pará
http://lattes.cnpq.br/1129943526806064

Jean de Souza da Silva Junior
Universidade Paulista, Belém, Pará
http://lattes.cnpq.br/3076472734393699

Cleomar Ribeiro de Oliveira
Universidade da Amazônia, Belém, Pará
http://lattes.cnpq.br/3565268549128699

Monique Fernanda Peres
Universidade Paulista, Belém, Pará
http://lattes.cnpq.br/4434361109251641

Leandro Lopes Rodrigues
Universidade Paulista, Belém, Pará
http://lattes.cnpq.br/5893335275880154

João Sérgio de Sousa Oliveira
Universidade do Estado do Pará, Belém, Pará
http://lattes.cnpq.br/0926756122867180

Laércio Brehner Gemaque do Couto
Universidade da Amazônia, Belém, Pará
http://lattes.cnpq.br/7852580196821893

Abstract: The objective of this review was to determine the effects of electrostimulation on muscle recovery after exercise. Materials and Methods: A systematic search strategy was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for reporting systematic reviews, studies were identified by searching electronic databases, no language limits were applied and foreign documents were translated. Databases searched were: MEDLINE (Pubmed), PEDro (Physiotherapy Evidence Database), and Cochrane-clinical trials, up to October 2018, using the following search terms to search all trial registries and databases: electrostimulation; electro-stimulation; recovery; after exercise; and post-exercise. Criteria for inclusion in the analysis required the studies to be clinical trials, participants to be healthy humans, to exercise before the intervention, to use electrical stimulation for recovery, and to be assessed for muscle recovery. Result: fifteen studies met the eligibility criteria and were included for the review. Conclusion: From the results obtained in this systematic review, it can be concluded that electrostimulation alone is not effective when used for muscle recovery.
Keywords: Recovery, exercise, electrostimulation, fatigue.

INTRODUCTION

Neuromuscular electrostimulation (NMES) is a method widely used in muscle recovery, which is part of one of the resources of electrotherapy used in the restoration of motor and sensory functions, this type of current generates electrical pulses and are not polarized, however, it produces muscle contraction. aiding your recovery. These are currents where the frequency varies according to the therapist's prescription and their modulations are symmetrical and asymmetrical (FONSECA, 2014).

Post-exercise muscle recovery consists of restoring the body's systems to their basal condition, bringing balance and preventing the possible installation of injuries and, in this sense, it becomes an important aspect within any area, so a program is necessary. of muscle recovery within any modality of activity, promoting adequate physical conditioning for them and thus improving their performance (PASTRE et al, 2009).

After the practice of exercise in which strenuous use of strength is made, the body reacts with manifestations of tiredness and discomfort as a result of the exercise, and with this they suffer manifestations that limit their range of motion caused by muscle edema, these manifestations directly interfere with performance. activities, so it is necessary to use resources that will act quickly in their muscle recovery. (SOUZA et al, 2010).

So, the purpose of electrostimulation is to present the purpose of improving performance, trying to bring about an immediate effect, in an attempt to accelerate musculoskeletal regeneration, reduce pain, edema, and the recovery time of these so that they can enter their activities in the shortest period of time possible, thus bringing benefits to you and to the team responsible for your physical conditioning, within a treatment protocol. Therefore, the objective of this review was to determine the effects of electrostimulation on muscle recovery after exercise (CAPUTO et al, 2013).

MATERIALS AND METHODS

A systematic search strategy was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for reporting systematic reviews.

INFORMATION SOURCES

Studies were identified by searching electronic databases, no language limits were applied, and foreign documents were translated. The databases searched were: MEDLINE (Pubmed), PEDro (Physiotherapy Evidence Database), and Cochrane-clinical trials, up to October 2018.

RESEARCH

The following terms were used to search all clinical trial registries and databases: electrostimulation; electro-stimulation; recovery; after exercise; and post-exercise.

SELECTION CRITERIA

Studies that are in accordance with the theme and objectives proposed by it, without restriction to any year of publication or original language, in addition to requiring that: the studies were randomized clinical trials or not, participants were healthy humans, performed exercises before the intervention, used electrostimulation for recovery and were evaluated for muscle recovery. No restrictions were imposed regarding the age group of the participants, sex, type or level of exercise, we obtained the search results according to figure 1 below.

DATA ANALYSIS

The evaluation of the eligibility of the studies was carried out by two researchers: (CO and JS) in a standardized and independent way, discrepancies were resolved by consensus between them, and when there was a continuation of discrepancy, a third independent reviewer (RL) was available to resolve.

DATA COLLECTION PROCESS

We developed a data extraction sheet where one review author extracted the following data from the included studies and the second author verified the extracted data. Differences were resolved by discussion between the two review authors; if no agreement could be reached, the third reviewer had ownership to decide. We did not contact any authors for more information. The doubts held in each study were taken out through the data displayed by graph in the studies.

DATA LIST

Information was extracted from each included study on: (1) characteristics of study participants (including whether they were professional or recreational athletes) and study inclusion and exclusion criteria; (2) type of intervention (including electrostimulation modes, duration, number of sessions; versus placebo, no method, or versus another type of modality for post-exercise muscle recovery); (3) type of outcome (including benefit or risk to participants).

RISK OF BIAS

To verify the risk of bias of the eligible studies, the Cochrane risk of bias tool was used.

SUMMARY MEASURES

Qualitative analyzes were carried out through the results obtained through a selected study, taking into account all the forms and protocols used in each of them.

RESULTS

The risk of bias analysis demonstrated a high risk of bias for blinding procedures. Blinding of participants has been described in few studies. Personnel blinding has also been described in only a few studies. Blindness of outcome raters was found in only one study. A low risk of reporting bias and other bias could be observed throughout

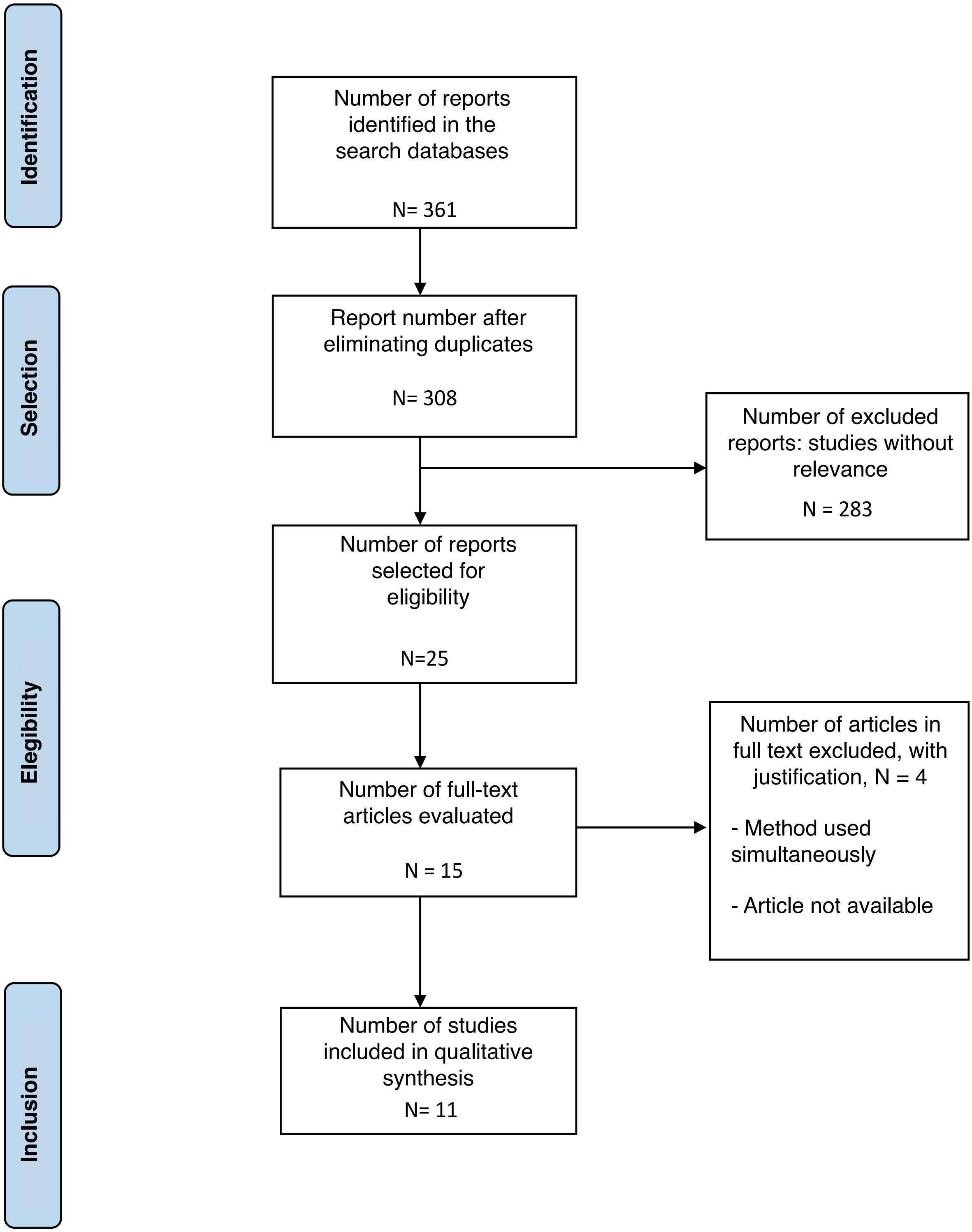

Figure 1: Flowchart describing the systematic review procedure.

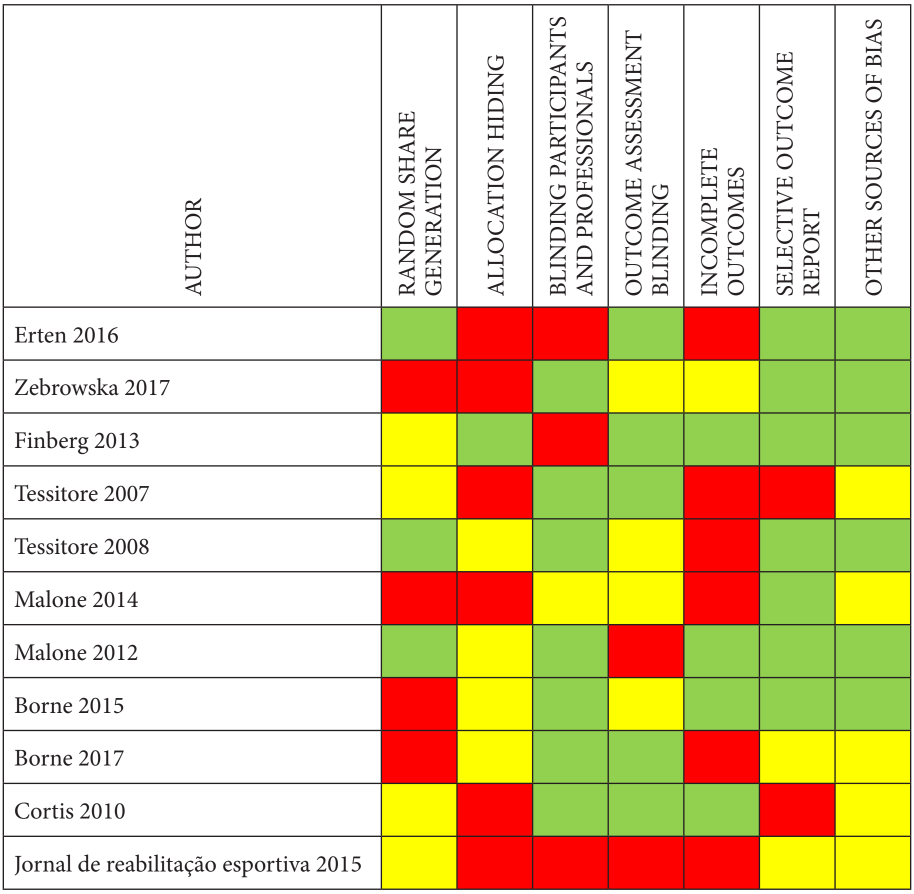

Figure 2 - Risk of bias for each study included.

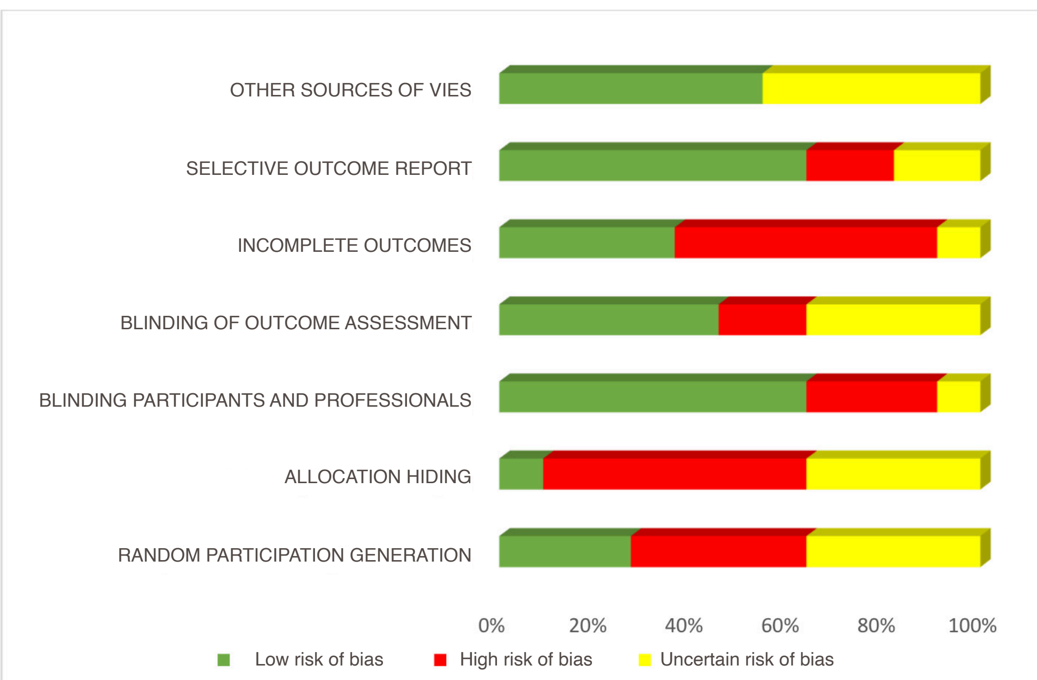

Figure 3 - Risk of bias in summary for all included studies.

the studies. Full details of the bias analysis risk for all individual studies can be seen in Figures 2 and 3.

RESULTS

The MEDLINE (PUBMED), Pedro, and Cocrhane-clinical trials data search provided a total of 361 studies for the search, after adjusting for 308 duplicates, of these, 283 articles were discarded after reading the abstracts as they did not fit the eligibility criteria, a total of 11 studies involving 15 trials were included for the review.

STUDY CHARACTERISTICS

Methods: All eleven studies finally selected for review were randomized and non-randomized clinical trials published in English. The maximum duration of the intervention was 30 minutes of continuous electrostimulation for more than one study. All studies used some form of exercise before the interventions, thus comparing them or even joining methods to seek a better result for muscle recovery.

PARTICIPANTS

The included studies involved 243 participants of both sexes of varying mean age. The main inclusion criteria required were that the participants were adults (age 18 years or older), and that they had not suffered recent injuries, in all of them there was no selection because they were professionals or not, only that they were willing to fulfill the exercise protocol, recovery and analyzes imposed for each study, follows the summary of studies included in the review according to table 1.

DISCUSSION

Overall, the evidence is not sufficient to determine the effectiveness of electrostimulation for muscle recovery. The studies included for analysis did not show strength of evidence in the comparison or even individually to establish a protocol in which it can be followed to improve the recovery of individuals, however it is worth mentioning that among the subjective analyses, two studies were effective, however , the questioning was done only once after the application of the electrostimulation protocol. Randomized studies did not evaluate enough patients or did not follow them up for a sufficient period to allow a definitive assessment, another limitation of these articles was the low variation in exercise protocols, exercise-induced muscle injury protocols varied in relation to sprint protocols and endurance, where exercise on a cycle ergometer was the most seen, only Borne et al. (2015), Tessitore et al. (2007) and Tessitore et al. (2008) used the exercise actually practiced by the participants in real time and conditions in which they are used to doing it. There was also a wide variation in relation to the device and modulations used in the protocols, with everything in our point of view what may have contributed to the non-efficacy of the method, was the time and the number of sessions carried out for this, we did not identify a predominance by body area chosen for the tests, although most chose to perform the procedures in the lower limbs taking into account the chosen exercise.

Electrostimulation did not affect objective recovery variables such as lactate levels, CK levels or IL6 levels. However, significant differences can be observed favoring the performance evaluation, which was one of the variables in relation to the analysis obtained in the studies. Due to the high risk of bias according to the blinding procedures and the unclear selection bias, it is not certain that these results represent the actual effects of

Author/year	Status of training / sex / age.	Sample size. N=	Comparison of groups	Time for intervention/ Number of sessions	type of exercise	Outcome/ measurement of the post-exercise study
Erten et al/ 2016	Female volleyball players (age: 15,89 ± 0,33). male basketball players (age: 15,27 ± 0,46).	N=20 Exp. N =20 Cont. N =20	EE / MDC	1x 30min	treadmill running.	BL (<24H)
Zebrowska/2017	Ufc figthers (age: (27,5)	N= 80 Exp. = 20 Cont. 20	EE/ Lymphatic drainage	1x 20min	isometric strength	BL, CK (20 min 24h and 48h).
Finberg/2013	Moderately trained male athletes (age: 20 ±3)	N=10 Exp. N=10 Cont. N=10	EE/ Contrast water therapy	1x 30min	Simulated team game circuit	3 and 24h (IL-6) and (PCR).
Tessitore/2007	professional football players (age: 18,1 – 1,2)	N=12 Exp.N=12 Cont. N=12	Low intensity aerobic exercise / EE	1x 20min.	Normal football training.	Subjective evaluation.
Tessitore/2008	futsal players (age: 23- 2)	N= 10 Cont. N=10 Cont. N=10	Low-intensity aerobic exercise / rest / shallow water aerobics / EE	1X 20min	Futsal game	BL (5 min) Subjective analysis (rate of perceived exertion)
Sports rehabilitation journal /2015	Participants trained (age)	N=30 Exp. N=10 Cont. N=10	Immersion in cold water / EE	1X 24min.	Resistance exercises	PCR (IMMEDIATE, 24H AND 48H).
Malone/2014	Cyclists trained (age 28- 7)	N= 19 Exp. N= 19 Cont. N= 19	Active recovery/rest / EE	1x 30min	Pedal at full power	BL
Malone/2012	Healthy participants (age 21-38)	N=13 Exp. N=13 Cont. N=13	Passive recovery/ active recovery (pedaling) / EE.	1X30	cycle ergometer	BL(5, 10, 15, 20, 25, E 30min during the protocol).
Borne/2015	Canoístas trained (age 22- 3)	N=8 Exp. N=8 Cont. N= 8	EE low frequency / low frequency E + cooling vest/ active recovery + cooling vest.	1x 30min	canoeing race	BL (3, 15, e 30min)
Borne/2017	Trained high-intensity athletes.	N=33	Blood flow restriction/ rest/ placebo EE/ EE	1X30min	cycle ergometer	BL (7x during the protocol)
Cortis/2010	Active participants, age 21,9- 1,3)	N=8 Exp. N=8 Cont. N=8	Active in low intensity water / passive recovery / E	1X 20min	submaximal run	BL, hemoglobin saturation in muscles Subjective analysis (perceived effort).

MDC= compression stockings, Exp= experiment; com=control; DE= electrostimulation; BL=blood lactate; IL6=interleukin 6; CRP= C-reactive protein; min=minutes; CK = creatine kinase.

Table 1 - Summary of studies used for the analysis.

electrostimulation at this time. Furthermore, only two studies in a total of n = 18 volunteers represent this cited result. Future studies must consider their rating scales and use sensible and common scaling systems. The extraction of data from graphs implies a potential risk of under or overestimation of the individual effect of the treatment, it is worth emphasizing the importance of studies with at least a relevant number of participants, especially when more than two types of methods are compared or a combination of the same for the study, vary or even increase the number of objective analyzes to be carried out on each participant as these can be a strong point to obtain more reliability in a study of this type. They must also consider using more affordable electrostimulation equipment, as it may be more clinically relevant for a consultant to use these devices compared to devices from other types of muscle recovery modalities. I suggest a comparison between genders because in our analysis we did not obtain studies that differentiated results or even allocation to groups with different sexes.

CONCLUSION

From the results obtained in this systematic review, it can be concluded that electrostimulation alone is not effective when used for muscle recovery, whether in professional athletes or not, its combination with another modality can bring different results, however, if it is done Further studies are needed to compare, associate or improve their admission method in this regard. To summarize, it is worth mentioning that the objective of the present study was to analyze only the effectiveness or not of electrostimulation, without comparing or weighing any method used by the studies shown here, considering that other factors can influence the different characteristics for muscle recovery.

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