PERCEIVED MUSCLE SORENESS IS IMPROVED BY POST EXERCISE COMPRESSION GARMENTS: A CRITICALLY APPRAISED TOPIC

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CLINICAL SCENARIO

Muscle soreness is a recurrent complication among athletes of all activity levels. This issue can lead to reduced performance and lack of success on the field. One of the most common interventions used by clinicians to address this dilemma includes compression devices. The effects of compression devices on muscle soreness are currently unknown.

METHODS

Search Strategy:
Terms Used to Guide Search Strategy (PICO)
Patient: Athlete OR Adult
Intervention: Compression Garment OR Clothing
Comparison: No Intervention
Outcome: Muscle Soreness
Compression AND Garment AND (Creatine Kinase) AND (Muscle Soreness)

Sources of Evidence Searched:
- PubMed @ Duquesne
- CNHA!
- PEDro Database
- SportDiscus
- MedLine
- Other resources found through review of reference lists and hand search

Inclusion and Exclusion Criteria:
Inclusion
- Studies measuring muscle soreness by evaluating the values of creatine kinase in the athletes
- Studies with running or sprinting as the exhaustive exercise
- Level 3 or higher
- Studies done on humans only
- Studies limited to the last 10 years (2005-2015)
- Limited to the English language
- Athletes above the age of 18

Exclusion Criteria
- Studies with resistive training

RESULTS

The studies reviewed were identified as the “best” evidence and met the inclusion criteria (Table 1). None of the four articles meeting the inclusion criteria revealed significant improvements regarding muscle damage based on small effect sizes from all articles. However, there were significant improvements in perceived muscle soreness for subjects wearing compression garments.

DISCUSSION AND CONCLUSIONS

Our study involved the evaluation of high quality evidence to determine the effectiveness of compression garments as a recovery tool in athletes participating in sports where running is involved. The main hypothesis was that the athletes would experience a reduction in muscle soreness with the use of a compressive garment in the post-exhaustive phase. While the evidence does not support the idea that compression garments positively impact physiologic markers associated with muscle soreness, the evidence does support significant reductions in perceived muscle soreness.

The significant results are as follows:
- Running athletes believed they were not as sore when wearing the compression garments 24 hours after workouts
- Running athletes perceived less soreness after applying garments rather than generating a physiologic reduction in muscle soreness
- No significant change in performance measures in the experimental groups as compared to the control groups in three of the studies
- Garments did not have an effect on the blood markers for muscle damage, including creatine kinase levels.
- The interventions investigated in the study are as follows:
  - Three of the four studies utilized lower limb compression garments or tight garments, which one study used a full body compression garment.
  - Outcomes: Muscle Soreness

Compression AND Garment AND (Creatine Kinase) AND (Muscle Soreness)

Our findings reveal that compression garments can be used to generate a perceived reduction in muscle soreness following activity. While compression garments may aid with perceived muscle soreness, the research revealed that compression garments do not significantly impact biomarkers of muscle soreness. Although a reduction in perceived muscle soreness may result in improved athletic performance, more research is necessary to address muscle soreness at the cellular level.

Based on our findings, compression garments can be used to generate a perceived reduction in muscle soreness following activity. While compression garments may aid with perceived muscle soreness, the research revealed that compression garments do not significantly impact biomarkers of muscle soreness. Although a reduction in perceived muscle soreness may result in improved athletic performance, more research is necessary to address muscle soreness at the cellular level.

Table 1 - Characteristics of Included Studies

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<td>11 rugby players with a mean ± 10 years: age 20.3 ± 1.0 years, height 176.3 ± 5.8 cm and weight 75.4 ± 6.3 kg. All participants maintained a regulated diet.</td>
<td>10 male, 6 hierarchical criterion trials and physically fit with a (SD) age 22 ± 1.3 years, height 185.2 ± 6.5 cm, and body mass 84.65 ± 3.90 kg utilized for this study. All had regulated diet and fitted CG.</td>
<td>22 trained male rugby union players (mean ± SD): age 20 ± 2.1 years, body mass 86 ± 8.8 kg. Every participant had at least 5 years rugby training and same level.</td>
<td>24 subjects (female = 7, male = 31). CG Group: age 47.7 ± 10.8, height 177.8 ± 10.2 cm. Non-CG Group: age 43.1 ± 10.5, height 175.3 ± 7.0 cm.</td>
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<td>Interventions Investigated</td>
<td>Testing session with and without lower body CG during and 24h post-exercise. Participants performed a warm-up of 5 min. Blood was drawn to measure creatine kinase (CK) pre-, 2h and 24h post-exercise. Participants performed a 20 m sprints.</td>
<td>3 types of CGs were utilized to compare results. Participants were involved in a warm-up routine, 3400m runs, stretching, and a 4 x 40m throwing routine. They were tested on distance and accuracy throwing and then performed 30 min sprint exercises.</td>
<td>Participants completed a submaximal lactate profile and a maximal exercise test on a treadmill. Subjects performed a 6.26 km run outside. Assessed perceived exertion and maximal voluntary isometric contraction (MVIC) and CK.</td>
<td>A full leg-length CG was utilized. Each participant completed a series of exercise circuits simulating a game of rugby followed 24 hours later by a 40 m repeated sprint test (10 sprints at 10-s intervals second) and a 3 x 40 m run.</td>
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<td>Outcomes Measured</td>
<td>Peak twitch force of quadriceps, hamstrings, and knee extensors. CK values and perceived muscle soreness.</td>
<td>Sprint times, RPE, perceived muscle soreness for arms and legs, Analysis of [La2], pH, sO2 and pO2, and CK levels.</td>
<td>Perceived muscle soreness measured 0-5, fatiguing levels, and CK activity determined through the study.</td>
<td>Perceived muscle soreness, MVIC of knee extensors, CK and C-RP were assessed before, during and, after 24-72h after.</td>
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<td>Main Findings</td>
<td>A moderate ES (P = 0.08; d = 0.62) was evident for reduced muscle soreness (2h post-exercise (5.1 ± 6.3 vs. 3.7 ± 3.15) and low 24h post-exercise (2.81 ± 3.0 vs. 4.9 ± 1.4; P = 0.01; d = 0.1). No significant differences in C-reactive protein (C-RP) or CRP (P = .30).</td>
<td>No significant difference (p=0.05 small ES) in CGs for 10m and 20m sprints. There was no significant difference utilizing one garment on another. Control group had a higher rating of muscle soreness in arms and legs (p=0.05 and large ES). CK levels were lower in the experimental groups 24h after exercise than the control group.</td>
<td>Sprint times were improved with CG recovery. Differences in fatigue % (compression 7.2 ± 6.7, placebo 8.69 ± 3.21, effect size 0.50, p=0.005; rating moderate) was better with CG as well. CK activity was similar in both the CG and placebo groups. Participants with CGs during recovery had a less severe case of DOMS (42.49%, 90% CI: 26.0 to 177.2, E(5) = 0.04).</td>
<td>Muscle soreness exhibited a significant time by group effect (F(6, 39) = 3.08, p = 0.001) and a significant group effect (F(1, 22) = 4.46, p = 0.046), with those in the CG group experiencing reduced muscle soreness. CK was elevated at 24h and 48h after exercise (692.1 ± 625.6 and 1022.3 ± 1439/1 in compression and sham groups).</td>
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REFERENCES


Figure 1: Lower Extremity Compression Garment

For an abstract of this poster, please visit dgu.athletetraining.duquesne.edu
Exercise Induced Asthma (EIA) is prevalent throughout all levels of sports and if not properly identified can be fatal. There is no standard protocol for preventative warmups for athletes with EIA. Proper warmups can help to reduce the incidence of an exercised induced bronchospasm (EIB). Current position statements for preventative warmups in athletes with EIA espouse a slow, progression of activity to optimize preventative benefits. However, consensus in the literature upon which level of warmup intensity is the most effective in preventing an EIB remains elusive.

The purpose of this critically appraised topic (CAT) was to determine if performing high intensity interval warmups versus continuous moderate intensity warmups before activity reduce the incidence rate and severity of an asthma attack in athletes. 

Search Strategy: Terms Used in Search Strategy (PICO)
- Patient: athletes with exercise induced asthma
- Intervention: warm up OR preparation
- Comparison: none
- Outcomes: reduce chance of EIB during activity

Sources of Evidence searched:
- PubMed & Duquesne
- CINAHL
- ProQuest
- Hand Search through previously reviewed articles for topic of question

Inclusion and Exclusion Criteria: Studies that were included examined differences in warm up procedure for athletes with EIA, were of a level 2 evidence or higher, of the English language, and limited to humans. Articles excluded were those that focused on pharmacological differences in EIA preventions.

RESULTS

Four relevant studies[1,3,4,5] were located and one study was found but not included because it focused on the pharmacological differences in EIB prevention. The following studies were identified as the “best” evidence and selected for inclusion in the CAT (Table 1). The reasons for selecting these studies were based on the different effects of warmup procedures in athletes with EIA and they were graded with at least level 2 evidence or higher.

DISCUSSION AND CONCLUSIONS

Our purpose for this critically appraised topic was to determine a proper warmup protocol for athletes with EIA. We believed that a high-intensity warmup would be most effective at reducing incidence and severity of an EIB. All four of our studies showed a decrease in the incidence rate and severity of EIB in athletes with EIA. De Bishop et al showed that participants that completed a long run and experienced a decrease in breathing capacity were more likely to experience a bronchoconstriction versus participants that completed an interval warmup. McKinzie et al showed that those who performed a high-intensity interval warmup experienced a period of bronchodilation compared to the control group. Mickleborough et al determined that high-intensity interval warmups improve pulmonary function to decrease the stress on the athletes’ lungs from exercise. Schnall et al concluded that short runs caused bronchodilation to aid in prevention of an EIB and further stressed the importance of a warmup protocol for asthmatics. In athletics, EIA is generally ignored unless an athlete begins experiencing an EIB. Instead of being proactive, athletic trainers and coaches instead deal with EIB once it presents itself. Previously, it was unknown how to effectively prevent athletes from experiencing EIB. The National Athletic Trainers Association suggests the use of a warmup procedure to reduce the incidence of EIB without further explanation on the type of warmup to use.

Also, the article explains in detail the procedure for how to treat an athlete experiencing an EIB but it does not go into detail on how to prevent these EIBs from occurring. This reflects the general attitude toward athletes with EIA such that they are often overlooked until it becomes an emergency situation. Athletic trainers need to educate themselves on the proper procedures for aiding in the prevention of EIB. Another problem is that the line of communication between coaching staff and medical staff has not been opened in order to create an understanding for the importance of a proper warmup technique for athletes with EIA. Therefore, clinicians need to relay this information to the coaches because the warmup procedures are generally the responsibility of the coaches. Current and common warmup procedures consist of moderate intensity for extended periods of time. As found in the studies, this type of warmup is not effective in preventing EIB. Based on the findings from the studies, it can be concluded that a high-intensity warmup is needed to aid in prevention of an EIB. To summarize the type of high-intensity warmups used, we suggest completing five to ten 30-second sprints with one to two minutes rest in between sprints, depending on how the athlete responds. The athletes can complete one or two sets with a recommended 5-minute break in between sets. If coaches prefer athletes to participate in a group warmup, the asthmatic athletes should complete this high-intensity warmup prior to the group workout. It is imperative to aid asthmatic athletes in preventing the occurrence of an EIB and one way to accomplish this is to complete this type of high-intensity warmup regardless of activity the athlete will engage in.

CONCLUSION

For athletes with exercise induced asthma, it is recommended that athletes complete a warmup protocol that includes high-intensity exercises since this will enable increased physical activity with less risk of EIB.

REFERENCES
The EFFECT of SERUM-ELECTROLYTE LEVELS on EXERCISE ASSOCIATED MUSCLE CRAMPS: A CRITICALLY APPRAISED TOPIC

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INTRODUCTION
- Exercise Associate Muscle Cramps (EAMC) can be defined as a painful involuntary contraction of skeletal muscle that occurs during or immediately after exercise.
- EAMC is a common problem in active individuals. As clinicians, it is our responsibility to prevent EAMCs from occurring.
- A variety of techniques have been used to prevent EAMC before, during, and after exercise.
- Of these interventions, hydration is a popular strategy in alleviating EAMC.

CLINICAL QUESTION
What is the role of serum-electrolyte levels on exercise associated muscle cramps?

METHODS
Search Strategy: Patient/ Client Group: athletes OR active individual Intervention: Serum Electrolyte Comparison: no intervention AND control Outcome: exercise associated muscular cramps AND prevention
Sources of Evidence Searched: - PubMed @ Duquesne - CINAHL - Cochrane Library - PEDro Database - Additional resources obtained via review of reference lists and hand search

Inclusion and Exclusion Criteria: Inclusion criteria included level of evidence 2 or higher, limited to endurance athletes in English language articles published. Exclusion criteria included active individuals not participating in endurance events, examination of hydration status without quantification of serum electrolyte levels or use of a control group.

RESULTS
Three studies were identified and categorized as shown in Table 1 (based on Levels of Evidence, Centre for Evidence Based Medicine). Additional studies were located but not included in this CAT because they failed to meet the inclusion criteria of our search.

DISCUSSION AND CONCLUSIONS
It is a popular belief that EAMC are related to dehydration or changes in hydration level. Therefore, a popular treatment for EAMC is adequate hydration and replenishing serum electrolyte levels. The purpose of this CAT was to determine if EAMC are related to hydration levels or change in serum electrolyte levels.

All three studies reviewed in this CAT indicated that there is very limited evidence to support the use of hydration to alleviate lower extremity EAMC in active individuals. Two of the three studies observed EAMC in triathletes while the remaining study observed EAMC in an ultra-distance road race.

What are the main findings of this study?

The three studies assessed in this CAT measured pre- and post-race weights, serum electrolyte levels and severity of the cramps. The data collected showed no significant changes in participant weight nor serum electrolyte levels. These findings suggest that EAMC are not affected by hydration levels or serum electrolyte imbalances. The use of electrolyte in rehydrating beverages does not result in decrease incidence of EAMC.

Electromyography (EMG) activity of the lower extremity cramping muscle was measured in the Sulzer article. The EMG data was compared to a non-cramping upper extremity muscle on the same participant. Sulzer found that the EMG activity of cramping muscle was significantly increased compared with a non-cramping muscle. This finding supports the theory that EAMC may be caused in part by neuromuscular activity possibly associated with muscle fatigue.

Clinical Importance:
- Changes in hydration status and serum electrolyte levels do not impact EAMC in endurance individuals.
- Independent risk factors for EAMC include history of muscle cramping and prolonged exercise at a relatively higher intensity.

Table 1 - Characteristics of Included Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Level of Evidence</th>
<th>Outcome Measures</th>
<th>Participants</th>
<th>Interventions</th>
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<tbody>
<tr>
<td>Schwellnus et al (2004)</td>
<td>Level 2b</td>
<td>Serum Electrolyte Concentration via pre and post race blood samples</td>
<td>72 runners participating in an ultradistance race: 45 had a history of cramping, 27 had no history of cramping</td>
<td>Pre and post race blood samples</td>
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<tr>
<td>Schwellnus et al (2006)</td>
<td>Level 3</td>
<td>Serum Electrolyte Concentration via pre and post race blood samples</td>
<td>22 from the 27 runners with no history of cramping formed the control group, 23 from the 45 runners with cramping formed the cramp group</td>
<td>Serum Electrolyte Concentration via pre and post race blood samples</td>
</tr>
</tbody>
</table>

CONCLUSIONS
The study of this result show that EAMC are associated with a history of muscle cramping and an overall faster race time during the Ironman triathlon. Magnitude exercise at a relatively higher intensity compared with training is therefore associated with the development of EAMC in triathletes. The main finding of this study was that two independent risk factors for the development of EAMC inIronman triathletes were a history of muscle cramping and an overall faster race time during the Ironman triathlon. This study supports that muscle fatigue is an important predictor for development of EAMC.

REFERENCE

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