

Study on the Effect of Warm-Up on DOMS

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(Received 20 April 2014 – Accepted & Published 07 May 2014)

Abstract

Delayed onset muscle soreness refers to the skeletal muscle pain when individual engage in exercise to which they are unaccustomed. It is associated with connective and contractile tissue micro trauma, resulting from high-tension generated during the eccentric phase of a movement. Delayed Onset of Muscle Soreness (DOMS) is a frequent problem after unaccustomed exercise. No universally accepted treatment exists for this. Warm-up is often recommended for this condition but uncertainty exists about its effectiveness. Does the subject benefits more from a 10 minute warm-up which reduces effect of delayed onset of muscle soreness over a 3 days following eccentric exercise? To determine the effect of warm-up on DOMS physically active male and female subjects (n=32) in age group 18-25 were included after they met inclusion criteria. Participants were randomly to one group warm-up, control. The soreness and pain measured in all groups. Result of this study suggest that the warm up has very good result on DOMS.

Key words:-Soreness, pain, range of motion, warm-up.

INTRODUCTION

DOMS refer to the skeletal muscle pain when individual engage in exercise to which they are unaccustomed. The exact mechanism responsible for DOMS is not completely understood a number of theories have been proposed in attempt to explain the underlying mechanism responsible for DOMS. These theories include the following: lactic acid, muscle spasm, connective tissue and muscle damage, enzyme efflux and inflammation although loss of intracellular Ca^{++} homeostasis could play a primary role. It is associated with connective tissue micro trauma, resulting from high tension generated during the eccentric phase of a movement. The intensity of soreness increases during the first 24hr, peaks at 24-48hrs and subsides within 5-7 days post exercise. The cardinal sign and symptoms of DOMS are:-loss of movement (due to muscle shortening or pain), swelling, decreased muscular performance and pain, which becomes particularly apparent during movement or palpation.

Eccentric exercise results in injury to cell membrane, setting off an inflammatory response that leads to prostaglandin and leukotriene synthesis. Prostaglandin E₂ directly causes the sensation of pain by sensitizing type III & IV pain afferents to the effects of chemical stimuli; whereas leukotriene increase vascular permeability and attract neutrophils to the site of damage. The respiratory burst of the neutrophils generates free radicals, which can exacerbate damage to the cell membrane. Swelling results from the movement of cells and fluid from the blood stream into the interstitial space with inflammation and can contribute to the sensation of pain.

Despite limited scientific evidence supporting their effectiveness, warm up routines prior to exercise are a well accepted practice. The majority of the effects of warm up have been attributed to temperature-related mechanisms (e.g. decreased stiffness, increased nerve-conduction rate, altered force-velocity relationship, Increased anaerobic energy provision and increased thermoregulatory strain), although non-temperature related mechanisms have also been proposed (e.g. Effects of academia, elevation of baseline oxygen consumption (VO_2) and increased post activation potentiating). It has also been hypothesized that warm up may have

number of psychological effects (e.g. increased preparedness). Connolly et. al (2003) suggested treatment for these symptoms are numerous and include herbal remedies, pharmaceutical and nutritional supplement. Among others Cryotherapy, message and electro therapeutic modalities like TENS, U.S etc are widely used by physical therapist working in the sport medicine setting.

Statement of Question

Does the subject benefits more from a 10 minute warm up which reduces effect of delayed onset muscle soreness over 3days following eccentric exercise?

Hypothesis

Experimental Hypothesis

10 minute warm up performed immediately prior to unaccustomed eccentric exercise reduces DOMS.

Null Hypothesis

10 minute warm up prior to unaccustomed eccentric exercises in reducing DOMS.

Purpose and Objective of the Study

The aim of study is to find out which protocol is most effective to prevent DOMS. Also, the major objective of this research is to find out the effect of warmup on DOMS.

Significance of Study

Sporting and non-sporting performances like (i.e. routine daily activities) are impaired if the individual participating is sore or injured .Thus any practice that limits the extent of damage and/or speeds up the recovery process would be of great interest and practical value to the athletic population, as well as the general public. As a result, DOMS research serves to benefit a wide audience. Information elicited from this study provides active individuals with valuable information concerning the role of warm up and cool down in managing and treating the clinical signs associated with DOMS.

Sample Size

A sample of healthy athlete's volunteers (male and female) of age 18-25 years participated in the study. All the subjects were informed about the nature, purpose, and possible risk involved in the study and an informed written consent was taken from them prior to participation. Subjects were randomly assigned into 2 experimental groups A, B, on the basis of inclusion and exclusion criteria.

Source of Subjects

All subjects are taken from the Hamdard University. And they are the students of physiotherapy and occupational therapy stream.

Method of Selecting Subjects

Inclusion Criteria

Age group: 18-25

Sex: Male and Female

Exclusion Criteria

1. If they were experiencing delayed onset muscle soreness already.
2. Subject with congenital abnormality.
3. Patients under medication (muscle relaxants).
4. Patient having any orthopedic and neurological disorder.
5. If any question of PAR-Q is yes than excluded.
6. Noncompliance with testing procedure.
7. Impaired sensitivity to pain.
8. Internal or external appliances in the hip, knee, and ankle.
9. Acute trauma or inflammation, bleeding disorder, infection, severe ischemia or poor thermo regulation.

Study Design

Pre Test and Post Test Design

Measuring Tools and Equipment

Treadmill, VAS scale, Force transducer, Universal Goniometer

Variables

Dependent Variables

Soreness, Pain, Range of motion

Independent Variable

Treadmill walking

PROCEDURE

Space and Location

All Athletes were recruited from Majeedia Hospital, Jamia Hamdard, New Delhi 62.

Step by step process of data collection

On first day subject will be explained about the nature and procedure of study and will be given demonstration of procedure. They will be told about any possible threats to training and also the method of overcoming harmful possibilities that will ensure their safety. All the possible doubts will be cleared on the same day. The willing participants will be required to sign informed consent form. The assessment will be done and who will be found suitable on the basis of inclusion and exclusion criteria will be included in the study.

Protocol for different group

Healthy adults were allocated randomly to one of the four groups

Group A- A Warm up group only

Group B- Normal group only

Initially, all participants rested in a seated position for 10 minutes. Subsequently, participant in the two warm up groups performed 10 minute warm up. Participants in the two groups that did not warm up remained resting for a further 10 minutes. Then all participants performed 30 minutes for eccentric exercise to induce muscle soreness. Participants were instructed to refrain from strenuous physical activities for three days after the exercise in this study.

Muscle soreness in the gastrocnemius muscle of the right leg was assessed 10 minutes after the exercise and then at 24 hr intervals over the three days following the exercise. The exercise was designed to induce muscle soreness in the gastrocnemius muscle of the right leg and involved walking backwards downhill on a treadmill inclined at 13 degree and the speed was 2.2km per hr, for 30 minutes at 35 steps per minutes, leading with right leg. Participants were instructed to take large backward steps with the right leg and to strike the treadmill with the toe of the right foot and with the right knee extended. This protocol induces muscle soreness in most people.

Both warm up and control group exercise consist of walking forward uphill on a gentle inclined treadmill (3 degree inclination) for 10 minutes at 4.5 km/hr walking at this speed and on average rate of approximately 3.1 to 3.4 metabolic equivalent.

The data analysis was done by using SPSS (version 15) software system. Anova was used to find differences in Demographic data of subjects. Between group analysis of variables done by Post Hoc test. Within group analysis of variables done by Mauchly's test of Sphericity. The prior alpha level $P < 0.05$ was set as significance for all comparison.

RESULTS

A group of subjects were recruited for the study. Each subject completed the measurements of soreness, pain, Dorsi flexion, planter flexion range of motion in warm up,

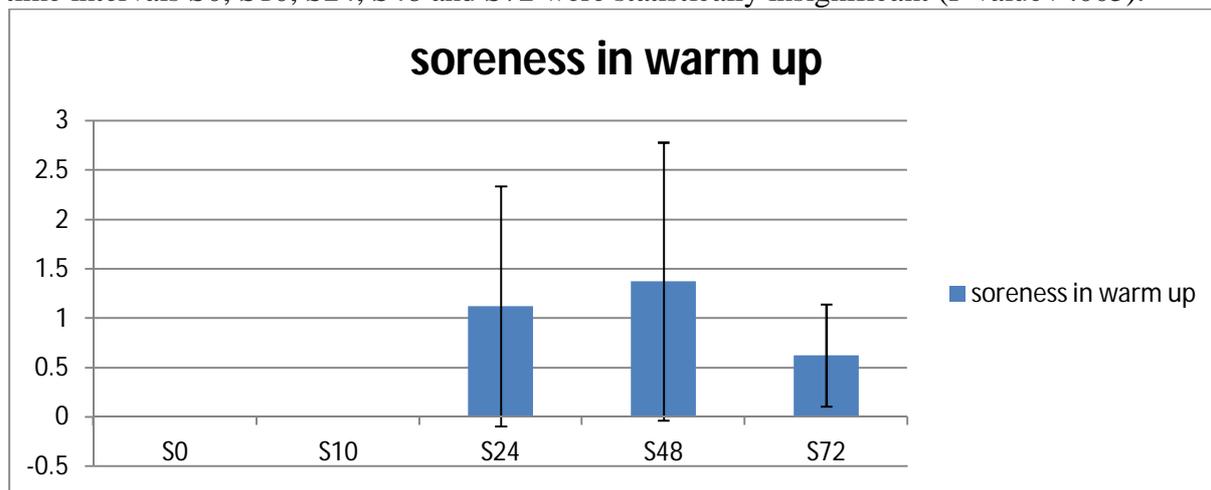
cool down, both warm up and control group. There were no missed measurements in either group. Soreness measurements were measured by treadmill, pain by Vas scale, range of motion by universal goniometer.

The soreness, pain, range of motion were compared between groups by using post Hoc test and Mauchly's test used to compare values with in groups.

Within Group Analysis

Soreness in Warm up Group

The analyses revealed that the soreness compared with in warm up group at different time intervals S0, S10, S24, S48 and S72 were statistically insignificant (P value >.005).



Graph 5.1 within group analysis of soreness in warm up group.

Within group analysis

In this present study soreness values at different time intervals S0, S10, S24, 48, S72 in warm up and control group were statistically insignificant.(P value>0.05). But in control group when soreness compared at S0-S48 and S10- S48 were statistically significant. (P value < 0.05).

The analysis confirms the induction of DOMS in the selected muscle group. The increased discomfort, decreased ROM of DF indicates that DOMS was successfully induced. Eccentric exercise successfully produced the symptoms of delayed onset muscle soreness. One of the possible causes the muscle damage may be due to disruption of the z-band. Clarkson and Sayers in 1999 in their study stated that during the eccentric muscle contractions there are fewer motor units, thus fewer muscle fibres, activated. This may lead to an increase in tension taken through the cross bridges of the muscle fibre resulting in disruption of the z-band causing streaming.

Another previous study by Clarkson and Kazunori³⁷ reveals that soreness appears 24 hours after exercise and peaks at 2-3 days of post exercise. Soreness slowly dissipates and does not fully subside until 8-10 days of exercise. The probable reason could be this of my result.

In this present study pain values at different time intervals P0-24, P0-P48, P10-P24,P24-P48,P24-P72 and P48-P72 in warm up, and control group were statistically significant.(P value<0.05).

Previous study by Newham³⁰ stated that when subjects perform eccentric exercise they are aware of muscle fatigue but are completely pain free for approximately 8h. The first discomfort is usually a feeling on movement which increases over the following one or two days. The affected muscle often feel swollen, are tender to palpation and, in severe cases

there may be an arching, pain at rest. All discomfort has usually disappeared by four or five days.

Our study results having significant difference only after 10min reading because pain present at least after 8 hours.

Comparison of pain between groups

In this present study pain compared in warm up, cool down, warm up and control group, there were a significant difference between groups. As we compare warm up group with control group, pain statically less significantly produced in warm group that was most apparent at 24, 48 and 72 hours.

Limitations

1. Due to lack of funds study cannot carried on large number of populations.
2. Blinding was not done during study.
3. Large sample size would have brought in more clarity in observed trends.

Suggestions

1. Generalized of results can be increased by compare with female subjects.
2. Study can be carried on a large sample size for better credibility of results.

CONCLUSION

To conclude our study that there is a strong significant difference between soreness, pain, range of motion at all time intervals. The results of study have important implication of using a warm up procedure to reduce pain and soreness. In conclusion, warm-up performed immediately prior to unaccustomed eccentric exercise produces small reductions in delayed onset muscle soreness. It opens up a board area for further studies.

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