The effect of repeated bouts of eccentric exercise on some of the biochemical markers of delayed onset muscle soreness

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Abstract

Objectives: The purpose of study was to the investigate the effect of repeated bouts of eccentric muscle exercise on some of biochemical markers (Total cholesterol and Creatine Kinase ) of delayed onset muscle soreness.

Methods: thirty college males (with mean age of 21.2±3.8 years, body mass Index of 22.5±1.4 Kg) were selected and divided into two groups randomly. Both groups performed five sets (10 repetitions per set) of the eccentric contractions, at 85% of one repetition maximum (1- RM), the experimental group repeated this exercise 48h later. Creatine Kinase and Total cholesterol were recorded before and after 24, 48, 72, and 96(hr) after eccentric contractions.

Results: The repeated bout of eccentric exercise does not show any effects on cholesterol, Creatine kinase values in the experimental group(p>0.05).

Conclusion: The results of this study suggest that the repeated bout of eccentric exercise produces an adaptation such that the muscle is more resistant to damage from a subsequent bout of exercise.

Keywords: Eccentric exercise, Delayed onset muscle soreness, Total cholesterol and Creatine Kinase.

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Introduction

Participation in unaccustomed, eccentrically biased exercise often results in ultra structural damage to skeletal muscle (Friden & Lieber 2001; Paul et al. 1989; Friden et al. 1983). Symptoms of this exercise-induced muscle damage (EIMD) include elevated muscle proteins in the blood, delayed-onset muscle soreness, swelling, a decreased range of motion, and impairment of proprioceptive function and neuromuscular control (for a review, see Byrne et al. 2004). However, perhaps the greatest consequence to sports performers is the immediate and long-lasting reduction in strength and power commonly observed followed by muscle-damaging exercise. Traditionally, such observations have demonstrated significant reductions in isometric force generating capability (Byrne & Eston 2002a,b; Sayers & Clarkson 2001; Clarkson et al. 1992; Cleak & Eston 1992a). However, the relevance of such observations to sports performers is questionable; as such static movements rarely occur during athletic competition. Moreover, evidence that type II muscle fibers are more susceptible to EIMD (Brockett et al. 2001) would make the investigation of more dynamic movements warranted. Several studies have consistently shown that EIMD reduces peak torque produced on an isokinetic dynamometer. However, results regarding whether there is any significant difference between performance losses at different angular movement velocities have been equivocal, with some studies reporting greater strength loss at higher (Eston et al. 1996; Golden & Dudley 1992; Friden et al. 1983) or lower (Michaut et al. 2002; Deschenes et al. 2000; Gibala et al. 1995) angular movement velocities, while others reporting no difference (Byrne et al. 2001; Sherman et al. 1984). Although these measurements involve the use of a dynamic muscle action, the validity of these measurements are questionable when considering that angular velocity for knee flexion can be up to 975 deg.s–1 during activities such as sprinting (Baltzopoulos & Gleeson 2008), a velocity approximately twice as high as the amount which can be measured through the use of isokinetic dynamometry. Accordingly, the effects of EIMD on measurements more closely associated with sporting performance requiring a rapid generate of force have been sought on.

One of the consequences of the exercises is the delayed onset muscle soreness .Delayed muscle soreness causes pain, swelling, decreased range of motion and functional strength reduction (Dipasqualeetal. 2011). Eccentric contractions can cause muscle pain. To reduce muscle pain induced by eccentric contractions of the lower angular movement can be used in practice, which is not possible for most sports; Also, due to reduced fitness in the off-season, athletes, in order to do pre-season preparation, need to repeat the same exercise intensity and continuously within a few days, and this has caused a lot of athletes and ordinary people to continue to practice while having muscle soreness. It is very important to prevent such damage. Since these injuries are inevitable, providing a treatment to help relieve the discomfort, injury and disability, and fast return of the individual to exercise is very important (Moradi et al., 2002). Warm up before exercise, cool down and stretch afterwards as guidelines for the prevention of delayed onset muscle soreness have been introduced (Kazunori Nosaka et al., 2000).

In addition, these methods of treatment in order to reduce the signs and symptoms of delayed onset muscle soreness have been used. Medications due to their side effects and the possibility of getting their doping agents cannot be an appropriate treatment (J.B. Rodenburg et al., 1994). Non-drug treatments including massage, ice massage, and ultrasound waves, repeated this practice cause subcutaneous nerve stimulation (Divakara kedlaya, 2001; G.Howatson,D et al, 2005; Kasonuri Nosaka., 1995).
But since the main cause and mechanism of this phenomenon are not known exactly, the results of the application of different methods can be different (Michelle A, et al., 2002). Repeating this exercise as a method of treatment has been studied on delayed onset muscle soreness. The researchers repeated the research on the effects of exercise and have come to the conclusion that the effect of repeated eccentric exercise is similar to the first, markers of muscle damage, primarily due to reduced exercise. Repeating the same exercise the researchers concluded that in the first 3 days, due to a series of adaptations in muscle, injury does not cause deterioration of muscle function (Kasonuri Nosaka et al., 1995; Moradi, 2002). According to studies and eyewitness accounts, team and individual sportsmen in our country, have to practice at least 3 times a week. As the muscle after 48 hours of rest, is not completely returned to the initial state it is not yet clear whether the exercise or performance will decrease in such a situation.

Methods

A survey of 600 male college students in the general physical education course was selected from the second semester of 86-85. Sample questionnaire of the 30 eligible subjects were randomly assigned to the control group (n=15, mean age 20/8 ± 5/2 years, height 1/74± 0/53cm and mean weight of 62/29± 7/1kg) and the experimental group (n = 15, mean age 21/7 ± 1/9years, height 1/65 ± 0/5 cm, and mean weight 61/7 ± 3/9 kg group).

In the present study delayed onset muscle pain free weights (dumbbells) were used. Because, eccentric contractions may cause delayed muscle aches, lifting the second phase, which involves reducing weight with the non-dominant hand was used (Kasonuri Nosaka., 1995).

In order to become familiar with the test and the 1RM, subjects were recruited through questionnaires 48 hours before the start of the performance were invited to the Physical Education School Hall. During their meeting, they start to warm up for 5minutes.

After warming up, the estimated 1RM, with 3 to 5 people, the maximum concentric contraction was in the non-dominant hand (Shahbazpour, N., 2004). 48 hours after the test, measurements were performed in the period between 8 pm to 11 pm. Subjects initially completed questionnaire and consent form.

Questions were as follows: Participants should not experience neurological, muscle, heart and brain disease, and the history of the non-dominant upper limb fractures were included. During the six months prior to the study, the non-dominant upper extremity weight training Companies had drug injection and during the 10 days prior to study, by the onset of analgesic or pain or discomfort in the non-dominant upper limbs did not. They did not have high- fat meal, especially during the protocol and the night before each workout had to begin. Height, weight, and blood samples for determination of creatine kinase and total cholesterol levels were measured.

For the measurement of Creatine Kinase and total cholesterol levels, 5 ml of venous blood radius (antecubital) was performed by an expert. Blood samples of 5 minutes at room temperature were immediately centrifuged. When the serum was separated, it was stored at - 20°C for subsequent analysis. All measurements were performed by one person. The subjects sat on a chair and performed 50 eccentric contractions of 85% 1RM for 5 sets of 10 repetitions. Each set includes 10 contract that lowers a person's weight in 3 seconds and at least 2 seconds to reach the next contraction without weights placed in full flexion (Kasonuri Nosaka., 1995). One minute rest was given between each set. The experimental protocol was repeated at 48 hours only. All measurements except contusion, immediately before and after exercise once a day for the first 4 days of the experimental and control groups were used. Contusion, before exercise, 24, 48, 72 and 96 hours after the first two groups were measured.
Result

There was no difference between total cholesterol levels in both control and experimental groups at 24, 48, 72 and 96 hours after first part of eccentric exercise. Table 1

Table 1 –Comparison of the total cholesterol levels (T-test)

<table>
<thead>
<tr>
<th>Time</th>
<th>T test</th>
<th>Significant Level (P = 0/05)</th>
<th>Difference of mean</th>
<th>Degree of freedom</th>
</tr>
</thead>
<tbody>
<tr>
<td>After workout</td>
<td>0.124</td>
<td>.902</td>
<td>-0.73</td>
<td>28</td>
</tr>
<tr>
<td>24h</td>
<td>2.007</td>
<td>0.54</td>
<td>10.53</td>
<td>28</td>
</tr>
<tr>
<td>48h</td>
<td>1.755</td>
<td>0.90</td>
<td>5.00</td>
<td>28</td>
</tr>
<tr>
<td>72h</td>
<td>-1.09</td>
<td>0.28</td>
<td>-4.87</td>
<td>28</td>
</tr>
<tr>
<td>96h</td>
<td>-0.081</td>
<td>0.42</td>
<td>-3.27</td>
<td>28</td>
</tr>
</tbody>
</table>

There was no difference between experimental and control groups in Creatine Kinase levels at 24, 48, 72 and 96 hours after eccentric exercise. Table 2

Table2 –Comparison of the creatine kinase levels (T-test)

<table>
<thead>
<tr>
<th>Time</th>
<th>T test</th>
<th>Significant Level (P = 0/05)</th>
<th>Difference of mean</th>
<th>Degree of freedom</th>
</tr>
</thead>
<tbody>
<tr>
<td>After workout</td>
<td>.231</td>
<td>.819</td>
<td>2.80</td>
<td>28</td>
</tr>
<tr>
<td>24h</td>
<td>-.572</td>
<td>.570</td>
<td>-2.31</td>
<td>28</td>
</tr>
<tr>
<td>48h</td>
<td>0.520</td>
<td>0.060</td>
<td>4.407</td>
<td>28</td>
</tr>
<tr>
<td>72h</td>
<td>-1.830</td>
<td>.078</td>
<td>-4.528</td>
<td>28</td>
</tr>
<tr>
<td>96h</td>
<td>1.281</td>
<td>.211</td>
<td>3.113</td>
<td>28</td>
</tr>
</tbody>
</table>

Discussion

There was not a significant difference in total cholesterol levels between experimental and control groups although total cholesterol levels in both groups decreased immediately after exercise, and then increased 48 hours after it occurred. After 24 hours of training in total, the cholesterol level decreased and then increased again. A notable finding in this study is that the total cholesterol decreased immediately after 72 hours of the first training. Increased levels of total cholesterol are major causes of cardiovascular disease. Although it seems to develop endurance, cardiovascular exercise, is effective in lowering cholesterol, but conflicting evidence about the relationship between lipid levels strengthening and muscle strength are found. The findings of some researchers in the field are consistent with the reduction of cholesterol in total after eccentric muscle activity (R. Chan, M et al, 2012; Shahbazpour N, 2004). In fact that this cholesterol may constitute 13% of the muscle cell membrane structures, the reason for this is that the decrease in total cholesterol in the present study reconstituted damaged cell membranes. This applies to acute reductions in total cholesterol and can include loss of plasma proteins that leak is due to inflation. Because there are no significant differences between control and experimental groups in total cholesterol levels after repeated practice, similar exercises in the first two days of practice groups, probably on the level of total cholesterol is not harmful and is shows consistency. Significant differences between control and experimental groups were on retaining kinase levels. Creatine kinase increased after exercise in both groups increased to 96 hours continuously.
Some researchers found elevated levels of creatine kinase after eccentric exercise which the result is consistent with (Priscill M. et al, 1991; N. stupka, 2001; Michelle A, et al, 2002; Lewis P et al, 2011).

Although there was no significant difference between the two groups, but higher creatine kinase level is controlled at 24, 48, 72, and 96 hours after exercise. Eccentric exercise exists in relation to changes in individual creatine kinase differences. To some people eccentric exercise is excessive and to some people there is not too much of a reduction in the level of creatine kinase after eccentric exercise. This could be due to the eccentric exercise group with a higher percentage of weight than done. Increase in creatine kinase levels after eccentric exercise, may be the reason for muscle cell membrane rupture (Sarco lema) and because there is no significant difference between groups, these results suggest that repeated practice during contusion injury should be more. Thus, this intervention should be made with caution, because there is no high correlation between levels of serum creatine kinase content and no tissue damage.

The results of this study indicate that repeated eccentric exercise muscle recovery before damage causes deleterious effects on serum cholesterol levels of creatine kinase and muscle will not happen. The results confirm that there is consistency in eccentric training on muscle by repeating for the first 48 hours.

Acknowledgment

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induced injuries to contractile


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