The Effect of Contrast Temperature Water Therapy on Blood Lactic Acid clearance of male students of Mazandaran University of Science and Technology after exhausting activity

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Abstract

The purpose of this research was the considering of the effect of Contrast Temperature Water Therapy on Blood Lactic Acid clearance of male students of Mazandaran University of Science and Technology after exhausting activity. In this semi-experimental study, 30 male students were randomly chosen and classified between two groups with 15 members, in a design with control group and experimental group, before and two hours after CTWT (experimental group) the Bruce test on treadmill was done. The measurement of blood Lactic Acid was done by Lactometer, before and after Bruce tests, and also immediately after CTWT. And then in both groups the results of each test was compared with another test. After that the results between two groups were compared. To analyze the data, the Kolmogorov-Smirnov test, pair T test, and match T test were used in meaning level $\alpha \leq 0.05$ for statistical analyze. To summarize, the following findings have been obtained: 1. CTWT reduced the concentration of blood Lactic Acid after exhausting performance significantly; 2. Two hours after recovery, the effect of CTWT on Lactic Acid concentration did not differ from the passive recovery method effect significantly; 3. CTWT did not also have any significant effect on the Lactic Acid accumulation in next exhausting performance; 4. CTWT did not have any significant effect on fluctuations of blood Lactic Acid in next exhausting performance. It is believed that CTWT facilitates recovery by blood circulation, vaso-pumping, hydrostatic pressure due to immersion, relieving of metabolic waste, and central nervous system stimulation.

Keywords: Contrast Temperature Water Therapy, exhausting performance, Lactic Acid clearance

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**Introduction**

Generally, the purpose of exercise and physical education is persuading body and enforcing it to be under the pressure in training and we should know that ideal accordance of body is not only based on the pressure of training, but also on the recession to the primal state after training. Unsuitable recession after one session exercise can result undesirable function for the next session, and finally over training is the result of undesirable recoveries that are repeated and very long and also tire the person. On the other hand effective physiological recovery helps reforming the vacated reservoirs of energy. Lifting the injured texture and removing the aggregated metabolites, and reducing tiredness causes the extreme effect of training.

In recent years, recovery interventions between repeated bouts of exhaustive exercise have become a major focus in the field of sports science.

A lot of researchers consider the high levels of lactic acid in blood circulation, as the responsible for creating disorder in recession to the primary state, so that they are looking for the methods to excrete lactic acid very fast.

Nowadays, different methods like massage, water therapy, oxygen therapy, hyperbaric and acupuncture are increasingly used to precipitate the process of recession to the primary state. In water therapy, four methods of cold therapy, heat therapy, soaking in water and contrast temperature water therapy, alternatively, are used to improve recovery.

In first 3 methods, temperature is immobile, while in contrast temperature water therapy, soaking in water with different temperature is alternatively used.

These passive strategies present the advantage to result in a greater amount of muscle glycogen resynthesize than active strategies (as active recovery) over the same duration. Compression garments and water immersion (including hot, cold and contrast water) are the examples of passive strategies often studied and reviewed.

This method is well-known recently and is used to help faster recovery by many players in different fields.

It is shown that active recovery increased the ability of being metabolism of lactate, keep the strength of a person and also it has an effective effect on the psychological recovery by relaxation.

On the other hand, contrast temperature water therapy has an effect that is similar to the effect of active recovery.

On removing the lactate of blood.

Hot water immersion (>36°C) has contraindications and cold water immersion (<15°C) is assumed to be more beneficial in treatment of exercise-induced muscle damage following unaccustomed or eccentric, than between repeated high-intensity exercises.

For example, Vaile et al says that, there is not any scientific and technical documentation about the potential effects and the mechanisms of the effects of this method.

Although, it appears that using this method as a recovery strategy is not baneful and this method has the possible advantage for next function, but we should consider that used protocols in researches are different with each other according to the duration of water therapy, duration of soaking in each environment, starting and ending the protocols of contrast temperature water therapy and also the degree of used water based on the deep of soaking. That it can be the probable cause which is antithesis in this field.

Thus, based on the differences in research results, it appears that doing this research can help the coaches and athletes of lactic acid fields to plan better exercise and training schedule based on the fast and complete recovery principles.

The purpose of this research is to investigate the aggregation of lactic acid in blood at the end of over weary actions and density variation of lactic acid in these actions, and also to study the effect of this method in the physical recover on the density of lactic acid created after training.
Materials and methods

Statistical society of this research was a number of male students that volunteered for this research. Among them, 30 people were chosen randomly and then divided into 2 groups randomly and then divided into 2 groups and in each group there were 15 people (group 1: alternative contrast temperature water therapy (tentative), group 2: control group). The tools for measuring is including the lactometer system (the brand lactate scout) for measuring the lactate in blood, band winch by the model Tuntury 880 was made in Finland for performing Bruce test, thermometer by the model testo-925 was made for controlling the temperature of water and scale for measuring weight the model Sochnle was made in Germany for measuring the weight of examined features.

One day before test, there was a session for completing the knowledge of examined things with maximum test of Bruce on the band winch and contrast temperature water therapy (1 minute sitting in cold water for 4 times) and registering the data that was related to the age, length and weight. It was asked the examined people to avoid the sever training before 24 hours before the test. Because of the limited number of band winch for Bruce test and because each person in two Bruce test should attend by time duration of 2 hours after each other, it should be considered that all the things for examinations should be investigated in the same circumstances and at least in the same time and day, so at first, the cases for examination of 2 groups (tentative and control), were divided randomly into 3 people were in the lab at 8:00 am, as they were hungry and did not eat breakfast and at first, their blood sample is taken from their fore finger, so they could measure the extent of lactic acid in their blood. Then, after 15 minutes limbering. They were rested for the standard 7 stages Bruce test in the band winch (although the degree of the environment was 23 °C and the humidity was 48 percent and it was according to the suggested amounts that were 20°C to 23°C and its humidity was 50 percent). In this test, examined case is on the band winch by 10 percent gradient and 1.7 mile/hour velocity and walks, and after each 3 minutes activity, the pressure is increased automatically by increasing the gradient and velocity of band winch until the case cannot continue (In this time duration, the heartbeat of case was controlled to be as the extent of heartbeat which is estimated by the formula age-220). As soon as the test finished, second blood sample was taken and the extent of lactic acid in blood was measured and registered bye lactometer.

In the next stage, at first, each case needed 8 minutes for recession to the first stage, but if the case pertained to and it was from the tentative group, it attended in the contrast temperature water therapy protocol. At the end of 8th minute, lactic acid of cases in each group was measured again. Then, all the cases were inactive to complete the 2 hour duration, and then, the second maximum test was done on the band winch, before and immediately after the second test band winch. Before and immediately after the second test, the density of lactic acid in blood was measured and registered as the same way.

Based on statistics, descriptive statistics is investigated for presenting the data related to the calculated dependent variables and the condition of normality in dispensing the data by Kolmogorov-Smirnoff test is studied. Meaningful differences of pre-test and post-test of dependent variables in each test (removing the post training of lactic acid, aggregation of lactic acid at the end and the variation in the density of lactic acid). At first in control group and then in tentative group is investigated by t-test, in the next stage, pre-test and post-test of 2 groups and the extent of variation from pre-test to post-test of 2 groups are compared by independent t-test, in all cases, the extent of 5 percent is determined as the zero value, and in meaningful cases, the smallest meaningful extent, is calculated and reported.

Results

In this research, these findings are presented:
Contrast temperature water therapy reduced the density of lactic acid in blood meaningfully after activity.

After 2 hours recession to the primary state. The effect of contrast temperature water therapy did not differ meaningfully with the effect of inactive recovery on the density of lactic acid in blood. Water therapy did not affect meaningfully on the aggregation of lactic acid in the next activity of Bruce.
Alternative contrast temperature water therapy did not effect on the variation of lactic acid in blood during the activity.

**Table 3 - The results of lactic acid two groups in two tests**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Experimental</th>
<th>Control</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before the first test</td>
<td>2.05±0.245</td>
<td>1.72±0.126</td>
<td>-1.347</td>
<td>0.182</td>
</tr>
<tr>
<td>Before the second test</td>
<td>2.62±0.656</td>
<td>2.427±0.76</td>
<td>1.087</td>
<td>0.362</td>
</tr>
<tr>
<td>After first test</td>
<td>11.132±2.315</td>
<td>11.882±3.521</td>
<td>0.674</td>
<td>0.492</td>
</tr>
<tr>
<td>After second test</td>
<td>10.24±2.334</td>
<td>10.7±2.269</td>
<td>0.667</td>
<td>0.498</td>
</tr>
</tbody>
</table>

**Table 4 - Changes in lactic acid groups results in the maximum test**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Experimental</th>
<th>Control</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes first test</td>
<td>9.082±0.647</td>
<td>10.002±0.496</td>
<td>0.566</td>
<td>0.121</td>
</tr>
<tr>
<td>Changes second test</td>
<td>7.570±0.534</td>
<td>8.172±0.639</td>
<td>0.679</td>
<td>0.182</td>
</tr>
</tbody>
</table>

**Discussion**

In this research, it was appeared that alternative contrast temperature water therapy, meaningfully reduced the density of lactic acid in blood after maximum activity, in other words, it causes that the removing of lactic acid gets faster after activity. It believes that alternative contrast temperature water therapy, makes the recovery easier and gets faster by creating the blood circulation, removing the metabolically redundancy, and persuading the central neural system.

On the other hand, it is claimed that creating alternative heat and cold, increases the removing of lactate, reduces the swelling after training and increases the blood circulation of tired muscle.

It is suggested that active recovery is more effective by average intensity (35 percent oxygen), in returning the density of lactate to relaxation levels, rather inactive recovery and active recovery with high intensity (65 percent oxygen).

In other words, using the active recovery, improves returning and recession to the primary state. The suggested theory regarding the increased recovery is the alternative muscular retraction on pumping-squeezing activity. Repeated mechanical squeezing with low intensity by muscles can increase the movement and removing of metabolites like lactate while retraction-relaxation and reduce the extent of liquid in cellule.

It is suggested that alternative contrast temperature water therapy can create this mechanism as active recovery, which is very energetic, and it does not spend energy for doing this. The results show that while recession to active primary state, removing lactate can be increased by active muscles while pumping. In many research literatures about alternative contrast temperature water therapy, it is said that this method is similar to vaso-pumping, because it is thought that alternative retraction and extension like muscular pump, improves recovery by increasing the blood circulation and removing the metabolites. Some of the researchers believe that, it is improbable that in this way, vaso-pump works as it can...
be effective. For example: It is said that while contrast therapy, each temperature alternative is generally 30 to 120 seconds and it is repeated for 2 to 5 times. So vaso-pump is created very fast and it happen 2 to 5 pumps during a period of 2 to 10 minutes, its frequency is very low (0.008 to 0/3 HZ), while in active recovery, like running slowly, muscular pumping is created in 2HZ and if vaso-pump is created in contrast therapy, the important effect is un probable.

If the temperature of deep texture does not change by soaking in hot and cold water, vaso-pumping just can happen under skin and temperature changing is needed for helping the recovery and removing redundancy materials in muscles by vaso-pumping, in deeper tissue fur there more, unlike vaso-pumping in deep tissue.

It is impossible that sudden soaking in cold water from a hot environment create vaso-retraction, because when body temperature is high, like when it happens after extreme training and soaking in hot water, sudden soaking in cold water can cause stretching of the skin by creating a shock reaction.

There is no research to measure each kind of vaso-retraction and expansion which is created because of contrast temperature water therapy, so if a vaso-pumping is not created, there should be other justifications.

In contrast therapy, it is possible that the pressure of hyrostat which is the result of soaking, can justify removing the redundancy materials from the body. This force which is the pressure of water to the body while soaking, can cause replacing of the removing the redundancy materials from the body.

This force which is the pressure of water to the body while soaking can cause replacing of the liquids of body from the terminal organs to the central hole and it causes the increasing of siestas from the muscle, reducing of environment resistance and the increase of body ability for careening subsets.

The increase of central body according to the increase of soaking deep in water can be one of the possible causes of more removing of locate of contrast temperature water therapy.

Blood increases because of two reasons of Heamodilation and blood movement while soaking in water. Heamodilation is the result of the negative pressure of capillary in legs which moves the liquids from the space among tissues to the space of viso in legs.

Esfarjani et al studied on the plasma density changes while soaking in water to the neck. And they reported a meaningful reduction in the density of hemoglobin and hematocrit and the increase of plasma. Measured the liquid movement in viso while soaking in normal 34°C to 35°C water. The volume of plasma in blood increased and hematocrit and density of blood reduced.

This liquid movement increased the osmosis gradient in the cell-in the viso and it causes some parts in the cell such as metabolically redundancy, leave cells and the space among tissue to balance the osmosis.

Although these occasions are not investigated in this research, but it is possible that soaking can cause delivery of subseries by these activities and help the person by increasing his ability recover faster, so that the duration of coring reduces and he can increase removing of redundancy subseries.

Yeargin et al investigated the effect of contrast temperature water therapy on removing lactate and the repeated function among the soccer players. They found that density of lactate in each 3 groups of inactive recovery, soaking in cold water, soaking in hot and cold water, is the same while resting and after the first velocity test. On the other hand, the density of lactate acid after contrast temperature water therapy was meaningfully low comparing the inactive recovery. These finding are according to the finding of our investigation, too.

Morton investigated the effect of contrast temperature water therapy on the reduction of plasma lactate while recovery after hard aerobics, and found that the velocity of the reduction of density of plasma in 30 minutes recovery in tentative water therapy is meaningfully more than inactive recovery. He said that soaking in hot and cold water, is alternatively a valid
method for expedition of the reduction of density of plasma lactate while recovery after hard aerobics for male and female which is according to the presented research. Although, the findings of Coffey et al\textsuperscript{11} & Akkoyunlu et al\textsuperscript{17} which shows that the reduction of lactic acid in water therapy is not statistically meaningful comparing with the method of active an inactive, and it is not according to the result of our investigation.

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REFERENCES


