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A STUDY TO FIND THE EFFECT OF PRECOOLING WITH ICE TOWEL IN HIGH INTENSITY SHORT TERM CYCLING PERFORMANCE

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ABSTRACT

This study aims to found the effect of pre cooling in high intensity short term cycling performance to the male. Further the study found when comparing pre test and post test parameters for work rate, RPM and distance, it shows statistically significant result at P<0.05. Heart rate is statistically not significant at P>0.05. The undertaken experimental study indicate that precooling provides a small but significant performance enhancement for elite cyclist performing high intensity short term exercise requiring a mix of aerobic and anaerobic energy supply.

KEYWORDS: Precooling, Cycle Ergometer, RPM, Heart Rate, Ice Towel.

INTRODUCTION

Allegations are flying thick and fast these days over the rampant use of performance enhancers by Indian sportsmen and women. Many athletes use a variety of pharamcologic agents in the belief that a specific drug will enhance skill, strength and endurance. I have gone through many literatures and planned to do a small experimental study in the precooling procedures. In addition cold exposure increases the level of circulating catecholamines¹ which may prove beneficial to high intensity exercise performance. The purpose of this experiment is to measure the effect of precooling (Ice towel) on a “60 min cycling trail”. It was hypothesized that mean power output¹ during the performance test would be improved after precooling. Previous research has indicated that lowering body temperature before exercise (precooling) can be beneficial to endurance performance² in the heat environment. No research has been reported on the effect of precooling with ‘Icetowel’³ for shorter more intense events. This is probably because of the minor role thermoregulation⁴ plays during these type of events
Materials and methodology
Type: Experimental study.
Design: Same subject Design.
Sampling: Simple random sampling.
Sample size: 20 cyclists
Study Setup: Madha college of Physiotherapy, PG research lab, Kundrathur.

Outcome measures:
Work rate (Kcal), Heart rate (bpm), Rate of pedaling per minute (RPM), Distance (Kms)

Inclusion Criteria
Cyclist between age of 15 – 25
Male cyclist
Weight 60 - 75 kg
Height 150 - 180 cm

Exclusion Criteria
No specific history of recent injury.
Cyclist with tightness of muscle and fascia
Cyclist with ROM deficit
Cyclist with specific cause for the symptoms like discogenic, structural, neurological and infectious causes. Cyclist with hypertension, cardio and respiratory problems

Materials used for the study
Weighing machine with height measurement scale
Thermo cool flask
Precooling bucket
Terry towels
Lab Thermometer
Sphygmomanometer & stethoscope
Crushed ice
Assessment chart
Paper & Pencil
Materials used for the study

Procedure

All the players and the coaches were explained about the programme, objective and significance of the study. After all the subjects randomly selected then the informed consent obtained from them, followed by the approval of ethical committee in Madha medical college Hospital and research center. Subjects were required to attend three testing session, each of which was separated by 10 days. Initially subjects were engaged in familiarisation session followed by either Non precooling or precooling session. The order of these last two sessions were randomized so as to avoid any order effect. They were asked to refrain from any vigorous exercise for 24 hours before undergoing any of the testing session and to avoid any food, drinks, cigarettes or caffeinated products during the two hours before the start of the testing sessions.
Testing Protocol:
Six one minute all out sprints at 10 minutes interval on three session. In each session Non Precooling and Precooling procedures separated by minimum of three days.

Precooling procedure

Ice towel used as the method of precooling before each performance test. Cyclist performed a normal warm-up (10 min) which commenced 10 min after precooling both thighs with ice towel for 10 min. Warm up includes calisthenics, running (or) jogging and static stretching (3 min). Immediately after warm up before performance test cyclist stretched for three minutes then were seated on bicycle.

Mechanism of cycling

After they were seated on the bicycle with back rest arranged at 75° angle, with head in neutral, hands on pulse sensor hip and knee flexed 90° and foot placed in pedal covered by strap.

Instruction to player
Riding Instruction
Subjects were instructed not to see the monitor and pedaling with symmetrical forces in both legs. This same procedure followed for all the same subjects.

Weaning
After the completion of testing protocol subjects were instructed to undergone relaxation.
Non precooling procedure

Subjects were instructed to warm up 10 minutes including calisthenics, static stretching and running (or) jogging slowly. Immediately after warm-up and before performance test cyclist stretched for 3 min then were seated with back rest arranged at 75º angle.

Investigator set up the time in 60 s. with minimal resistance and all parameters in zero and instruction given to the cyclist when he has to start and stop pedaling. Beep sound indicated the completion of countdown and the measures have taken immediately after the beep sound. This procedure continued for 6 trials each with 10 minute interval.

DATA ANALYSIS:
To find out the effectiveness of pre cooling from pre-test to post-test, in I, II, III sessions paired t-test was adopted.

TABLE: I
Statistical comparision of work rate between pre test (Non pre cooling) and Post test (Pre cooling) in I, II & III Session

<table>
<thead>
<tr>
<th>Session</th>
<th>Pre test mean</th>
<th>sd</th>
<th>Post test mean</th>
<th>sd</th>
<th>Paired t test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>9.7130</td>
<td>1.9873</td>
<td>12.580</td>
<td>2.554</td>
<td>5.840</td>
<td>0.000</td>
</tr>
<tr>
<td>II</td>
<td>11.4650</td>
<td>1.4887</td>
<td>12.585</td>
<td>1.687</td>
<td>2.612</td>
<td>0.017</td>
</tr>
<tr>
<td>III</td>
<td>11.198</td>
<td>0.723</td>
<td>12.075</td>
<td>0.998</td>
<td>2.910</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Graph 1
TABLE: II
Statistical comparison of heart rate between pre test (Non pre cooling) and Post test (Pre cooling) in I, II & III Sessions

<table>
<thead>
<tr>
<th>Heart rate</th>
<th>Pre test mean</th>
<th>sd</th>
<th>Post test mean</th>
<th>sd</th>
<th>Paired t test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session I</td>
<td>122</td>
<td>6.85</td>
<td>124</td>
<td>7.55</td>
<td>1.389</td>
<td>0.181</td>
</tr>
<tr>
<td>Session II</td>
<td>125</td>
<td>11.60</td>
<td>127</td>
<td>6.62</td>
<td>1.155</td>
<td>0.262</td>
</tr>
<tr>
<td>Session III</td>
<td>132</td>
<td>10.45</td>
<td>133</td>
<td>5.18</td>
<td>0.772</td>
<td>0.449</td>
</tr>
</tbody>
</table>

Graph-2

TABLE: III
Statistical comparison of rate of pedaling per minute between pre test (Non pre cooling) and Post test (Pre cooling) in I, II & III Sessions

<table>
<thead>
<tr>
<th>Rate of pedaling per minute (RPM)</th>
<th>Pre test mean</th>
<th>sd</th>
<th>Post test mean</th>
<th>sd</th>
<th>Paired t test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session I</td>
<td>114</td>
<td>22.41</td>
<td>133</td>
<td>25.75</td>
<td>2.961</td>
<td>0.008</td>
</tr>
<tr>
<td>Session II</td>
<td>131</td>
<td>23.39</td>
<td>148</td>
<td>20.20</td>
<td>2.523</td>
<td>0.021</td>
</tr>
<tr>
<td>Session III</td>
<td>128</td>
<td>12.84</td>
<td>136</td>
<td>8.56</td>
<td>2.641</td>
<td>0.016</td>
</tr>
</tbody>
</table>
Graph-3

![Bar chart showing rate of pedaling per minute for three sessions](chart1)

**TABLE: IV**
Statistical comparision of distance between pre test (Non pre cooling) and Post test (Pre cooling) in I, II & III Sessions.

<table>
<thead>
<tr>
<th>Distance</th>
<th>Pre test mean</th>
<th>sd</th>
<th>Post test mean</th>
<th>sd</th>
<th>Paired t test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session I</td>
<td>0.949</td>
<td>2.333</td>
<td>1.0940</td>
<td>0.2571</td>
<td>2.191</td>
<td>0.041</td>
</tr>
<tr>
<td>Session II</td>
<td>1.04</td>
<td>0.3936</td>
<td>1.334</td>
<td>0.335</td>
<td>2.887</td>
<td>0.009</td>
</tr>
<tr>
<td>Session III</td>
<td>0.943</td>
<td>0.234</td>
<td>0.816</td>
<td>0.132</td>
<td>2.094</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Graph-4

![Bar chart showing distance for three sessions](chart2)
TABLE: V
Statistical comparison of Pre test and post test parameters.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pre test</th>
<th>Post test</th>
<th>Paired t test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work rate</td>
<td>10.79</td>
<td>12.41</td>
<td>7.748</td>
<td>0.000</td>
</tr>
<tr>
<td>Heart rate</td>
<td>126</td>
<td>128</td>
<td>2.022</td>
<td>0.057</td>
</tr>
<tr>
<td>RPM</td>
<td>124</td>
<td>139</td>
<td>3.988</td>
<td>0.001</td>
</tr>
<tr>
<td>Distance</td>
<td>0.977</td>
<td>1.08</td>
<td>2.839</td>
<td>0.010</td>
</tr>
</tbody>
</table>

Graph-5

Results
In this study when comparing pre test and post test parameters for work rate, RPM and distance, it shows statistically significant result at P<0.05. Heart rate is statistically not significant at P>0.05. An increase in central blood volume may be potentially beneficial to maximal exercise performance. Under conditions of maximal exercise, if a greater central blood volume leads to greater blood availability to the muscle, this would enhance oxygen delivery, resulting in a greater contribution of the aerobic system to energy supply for any given power output. It may also increase the clearance of metabolic by products, such as lactate from the muscle. Although our study did provide for a greater amount of maximal sprinting throughout the exercise protocol, the results show significant differences between the pre test and post test for work done and distance.
Discussion

Previous studies have indicated that precooling can be beneficial to endurance exercise, but this is the first study to report that precooling by using ice towel can enhance short term high intensity cycling performance. This decrease in heart rate has also been reported in previous precooling experiments. Although heart rate was not different in this study, during the performance test between pretest and Post test, more work was completed in the precooling condition and this may have masked any possible differences. In addition cold exposure increases the level of circulating catecholamines, which may prove beneficial to high intensity exercise performance. An increase in central blood volume may be potentially beneficial to maximal exercise performance. Under conditions of maximal exercise, if a greater central blood volume leads to greater blood availability to the muscle, this would enhance oxygen delivery, resulting in a greater contribution of the aerobic system to energy supply for any given power output. It may also increase the clearance of metabolic by products, such as lactate from the muscle. Although our study did provide for a greater amount of maximal sprinting throughout the exercise protocol, the results show significant differences between the pretest and post test for work done and distance. Harsh and Sleivert (2001) reported that rectal temperature was lowered by cold water immersion (for 30 min) before a 70 sec maximal cycle ergometer sprint. Therefore a significant decrease in core temperature may be necessary for precooling to improve exercise performance. Doherty, M (2003) most fitness assessment either use a constant load to exhaustion (exercise capacity test) or an “allout” effort (Performance test), includes peak power and peak cadence (RPM). In this study there is significant improvement in rate of pedaling in the precooling.

Conclusion

The undertaken experimental study indicate that precooling provides a small but significant performance enhancement for elite cyclist performing high intensity short term exercise requiring a mix of aerobic and anaerobic energy supply.

Further recommendations

- A similar study with large sample can be done.
- A similar Study can be done on female athlete.
A similar study comparing male and female athletes can be done.

A similar study can be done for various sports persons.

Limitations

- This is study is limited to elite cyclist.
- This study is limited to male cyclist only.
- The sample selected is small.
- The long term effect and study was not studied.

Bibliography

2. Carolyn Kisner Lynn, Allen colby (1996); Therapeutic Exercise Foundation and techniques: 4 - 111.
7. Sandra J. Shultz (2000); Assessment of Athletic Injuries.
16. Ramanathan NLA (1964); A new weighing system for mean surface temperature of the human body. J. Appl. Physiol. 19: 531 - 3
44. Gore CJ. Edward D.A. (1992); Australian fitness norms the Health Development Education.
49. Reitz D,Myer,JN,Durrant E,et al; Cryotherapy and sequential exercise bouts following rotherphy in concentric and eccentric strength in the quadriceps,28:320-4

www.jiarm.com
60 Kay D, Taaffee DR, Marino FE (1999); Whole body precooling and heat storage during self-paced cycling performance in warm humid conditions. Sport Sci. 17(2):937-44.
70 Wilson (2002); Thermoregulatory responses to sub maximal cycling following lowers body cooling in human.