



# Thermal Therapy And The Effects Of Hot And Cold On Blood Lactate After An Isotonic Exercise

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## Abstract

**INTRODUCTION:** Delayed-Onset Muscle Soreness (DOMS) describes a phenomenon of muscle pain or soreness that frequently occurs as a result of strenuous physical activity. DOMS occurs especially during the first few days after such activity. Because DOMS results in functional loss and related activity restriction, prevention and treatment are both important factors to recreational and competitive athletes, and to anyone who participates in vigorous exercises and activities of daily living. Lactic acid and its accumulation was once thought to be a major cause of DOMS, however this is not the case. Research suggested that blood lactate returns to resting levels within one hour of exercise even after extremely intense bouts of work. Thus the goal of this study was to determine the effects of two 10 minute thermal therapy between hot and cold, after an isotonic exercise, and the effect on blood lactate within a 30 minute interval.

**PURPOSE:** The purpose of this study was to evaluate the effects of hot and cold therapy on blood lactate after an isotonic exercise.

**METHODS:** Five males (ages: 25.80±2.77yrs, weights: 160±1.14 lbs., heights: 68.40±9.35 in.) of the UTA Kinesiology department, volunteered to participate in this study. Each subject met in the laboratory to take an initial blood lactate as a baseline. Their fingers, on the right-hand, were cleaned with alcohol and then pricked with a blood lancet to obtain a drop of blood. A capillary tube attached to a reflation applicator collected the sample of blood from their fingers. The blood sample was then placed on a strip of paper inside the analyzer. The participants were then walked up to the gym and asked to do seated calf raises with only the right leg, on a weight that was 20 percent of each participant's 1 RM (weight: 83.75±24.90 lbs.), until exhausted (reps: 52±18.91). After the exercise, a second blood lactate was taken. Then randomly each participant had either a cold (-4±1.4 °F) or hot (165±2.5 °F) pack wrapped around the right calf for 10 minutes. A final blood lactate was taken right afterwards. Heart rate and RPE were also taken and recorded with blood lactate. Each participant was asked to come back a week later to do the exact experiment again but with the treatment that was not given the week before.

**RESULTS:** Tests of *within-subjects effects* results indicated that there were no significant differences in any of the results obtained; RPE between baseline (6±0) pre therapy (9.1±2.46), and post therapy (6.4±0.89;  $p=0.016$ ), between heat (6.93±0.60) and cold (7.4±1.46;  $p=0.374$ ), between baseline, pre therapy, post therapy of heat and cold ( $p=0.645$ ). There were also no significant differences between HR baseline (83.6±4.67 bpm), pre therapy (94.9±4.62 bpm), and post therapy (83.5±4.43 bpm;  $p=0.00$ ), between heat (88.4±5.01 bpm) and cold (86.27±3.34 bpm;  $p=0.208$ ), between baseline, pre therapy, post therapy of heat and cold ( $p=0.084$ ). Blood lactate (BLa) show no significant results during each testing; BLa between baseline (2.9±0.42 mmol/L), pre therapy (4.8±0.57 mmol/L), and post therapy (4.0±0.35 mmol/L;  $p=0.001$ ), between heat (3.76±0.28 mmol/L) and cold (4.07±0.55 mmol/L;  $p=0.394$ ), between baseline, pre therapy, post therapy of heat and cold ( $p=0.508$ ).

**CONCLUSION:** The results of this study indicate that cold and heat therapy showed no significant effect on blood lactate, RPE, and heart rate following muscle contraction to exhaustion.

## Purpose

The purpose of this study was to evaluate the effects of hot and cold therapy on blood lactate after an isotonic exercise.

## Methods

**Instruments**

- Samsung Freezer (-4°F) (-4±1.4 °F)
- Emerson microwave 900 watts (1 min and 30 sec. Each side) (165±2.5 °F)
- ThermiPaq Therapeutic Hot & Cold Pad
- Accusport Lactate Analyzer
- Insta Read Thermometer
- Accusport Lactate Analyzer
- Alcohol wipes
- Blood Lancet
- Bandages
- Capillary Tub.

ThermiPaq Therapeutic Hot & Cold Pad:  
 • Reusable hot/cold therapy wrap  
 • Moldable clay, cord-free operation  
 • Latex free

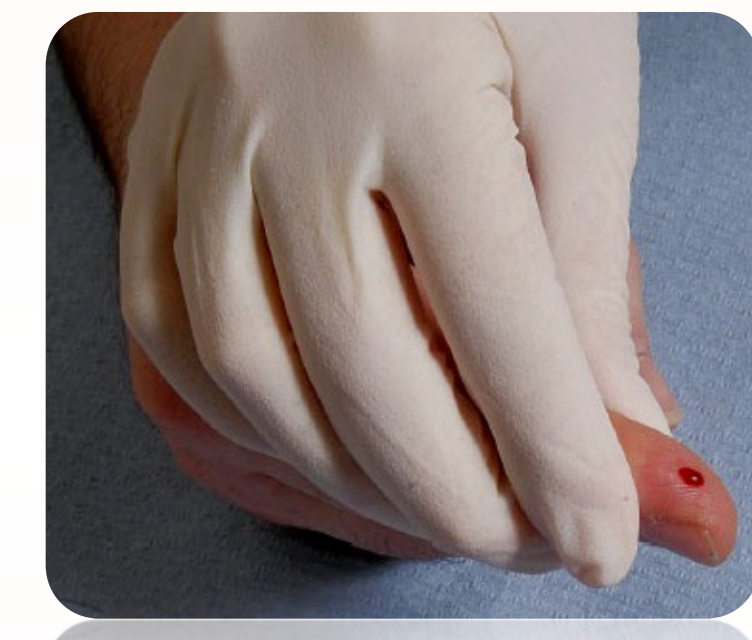
## Methods (cont'd)

### Participants

- ✓ 6 males
  - 5 were left as part of the data
  - 1 was removed due to his blood lactate increasing during the entire testing.
- ✓ Ages: 25.80±2.77yrs
- ✓ Weights: 160±1.14 lbs.
- ✓ Heights: 68.40±9.35 in.
- ✓ Participants are members of the UTA Kinesiology department
- ✓ All participants signed an informed consent document (ICD).

### Procedure

- ✓ Baseline
  - Attachment of HR monitor
  - Initial blood lactate (right hand), RPE, and HR
- ✓ Pre Therapy
  - Subjects performed seated calf raises with only the right leg
  - Weight was set on 20 percent of each participant's 1 RM (weight: 83.75±24.90 lbs.)
  - Until exhausted (reps: 52±18.91)
  - Within 5 minutes of performing exercise a 2<sup>nd</sup> blood lactate, HR and RPE was taken.
- ✓ Post Therapy
  - Heat Therapy
  - Cold Therapy
  - 10 minutes
  - 3<sup>rd</sup> blood lactate, HR, and RPE
- ✓ Same procedure was done ~ a week later.



### Data Analysis

- ✓ IBM SPSS v19.0
- ✓ Within-within 3 x 2 repeated measures ANOVAs
  - Time (Baseline, Pre Therapy, and Post Therapy) x Temp (Cold and Hot)
- ✓ Alpha was set a priori at  $p \leq 0.05$ .

## Results

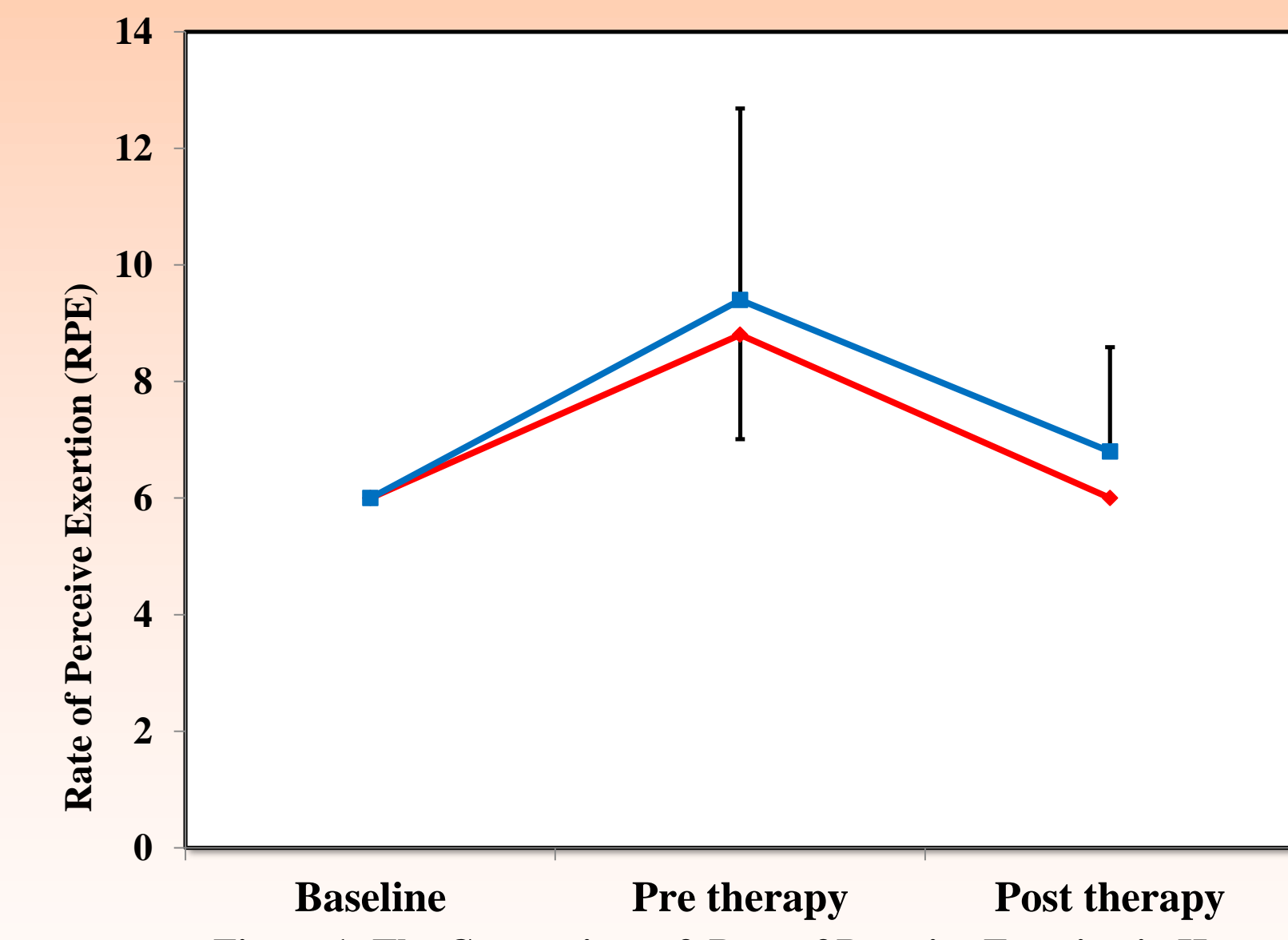


Figure 1: The Comparison of Rate of Perceive Exertion in Heat and Cold During Baseline, Pre Therapy, and Post Therapy.

	Baseline	Pre Therapy	Post Therapy	Temp
Hot	6±0.00	8.8±1.79	6±0.00	6.93±0.60
Cold	6±0.00	9.4±3.29	6.8±1.79	7.4±1.46
Time	6±0.00	9.1±2.46	6.4±0.89	

Table 1: Rate of Perceive Exertion: Time vs. Time ( $p=0.016$ ), Temp vs. Temp ( $p=0.374$ ), Time vs. Temp ( $p=0.645$ )

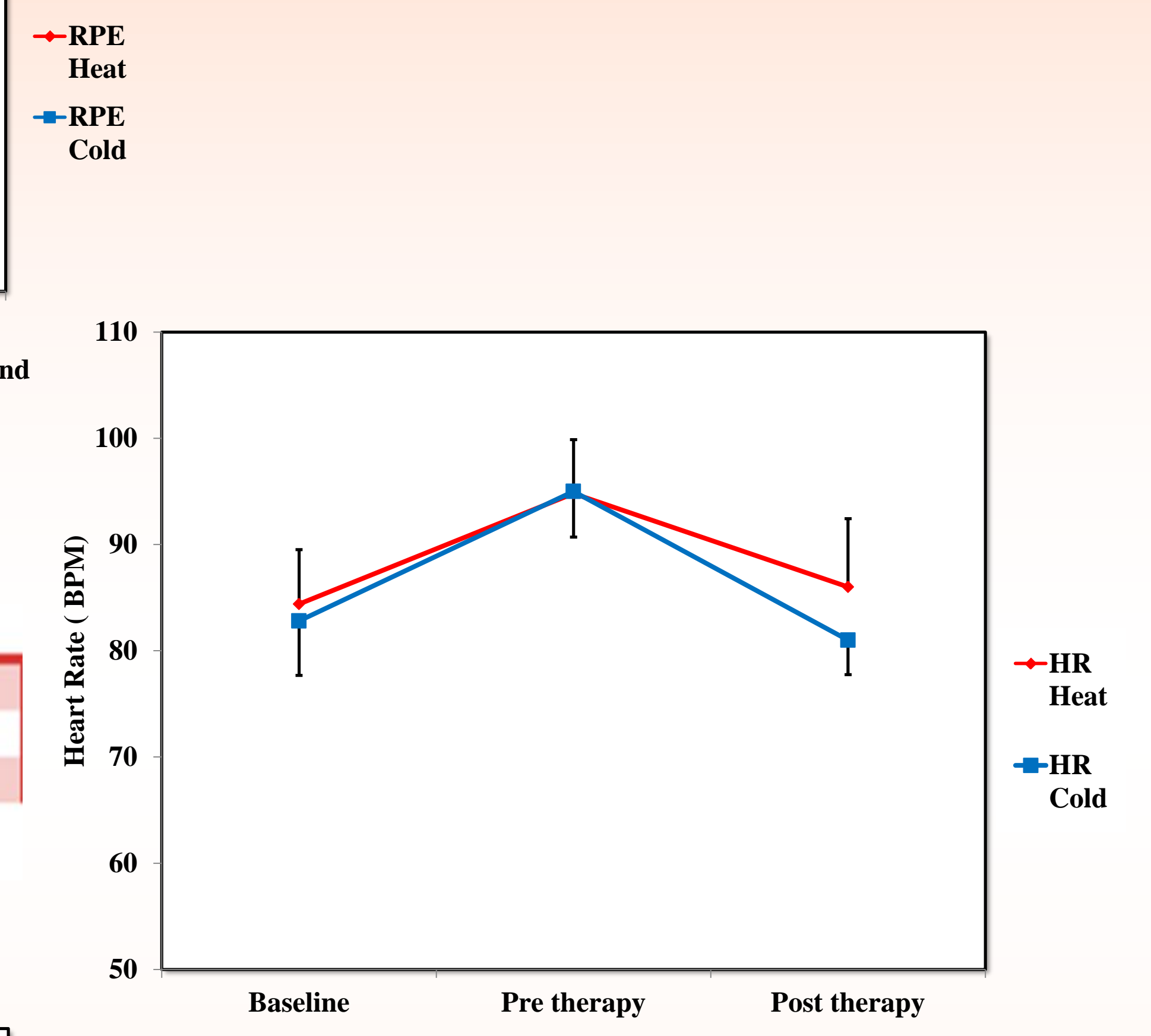


Figure 2: The Comparison of Heart Rate in Heat and Cold During Baseline, Pre Therapy, and Post Therapy.

	Baseline	Pre Therapy	Post Therapy	Temp
Hot	84.4±5.13	94.8±5.07	86±6.44	88.4±5.01 bpm
Cold	82.8±5.12	95±4.30	81±3.24	86.27±3.34 bpm
Time	83.6±4.67 bpm	94.9±4.62 bpm	83.5±4.43 bpm	

Table 2: Heart Rate: Time vs. Time ( $p=0.00$ ), Temp vs. Temp ( $p=0.208$ ), Time vs. Temp ( $p=0.084$ )

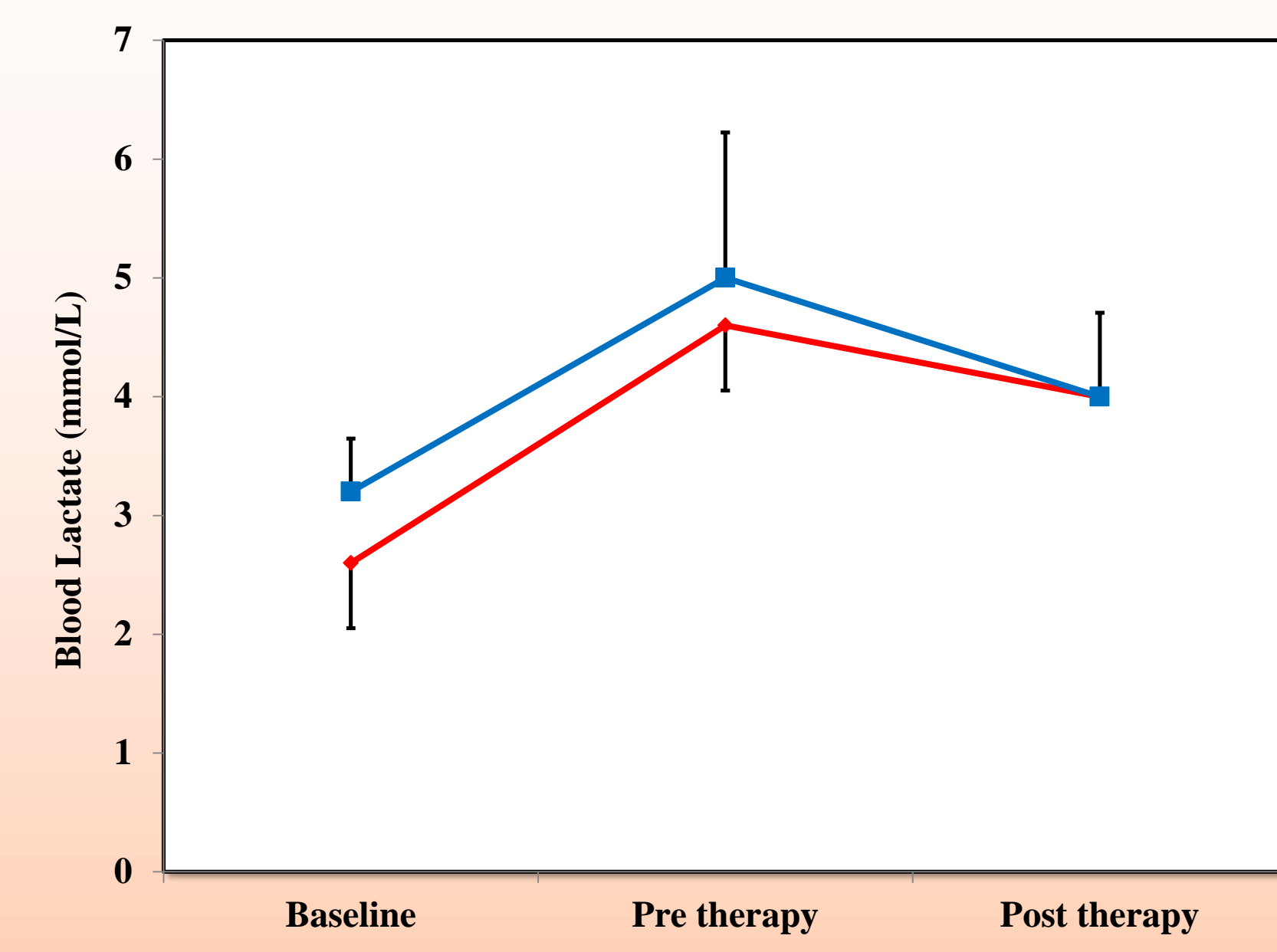


Figure 3: The Comparison of Blood Lactate in Heat and Cold During Baseline, Pre Therapy, and Post Therapy.

	Baseline	Pre Therapy	Post Therapy	Temp
Hot	2.6±0.55	4.6±0.55	4.0±0.00	3.76±0.28 mmol/L
Cold	3.2±0.45	5.0±1.23	4.0±0.71	4.07±0.55 mmol/L
Time	2.9±0.42 mmol/L	4.8±0.57 mmol/L	4.0±0.35 mmol/L	

Table 3: Blood Lactate: Time vs. Time ( $p=0.001$ ), Temp vs. Temp ( $p=0.394$ ), Time vs. Temp ( $p=0.508$ )

## Conclusions

- ✓ Tests of *Within-within subjects effects* results indicated that there were no significant differences in any of the results obtained.
- ✓ Based on the results of this study, recreational and competitive athletes, and anyone else who participates in vigorous exercises and experiences functional loss and related activity restriction, it appears that only TIME will decrease the symptoms of DOMS.