The Effects of Preheating and Precooling on Isokinetic Hamstring Strength in Division II Collegiate Male Sprinters

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INTRODUCTION

A variety of heating and cooling modalities are used in sports-based settings as rehabilitating tools. There is research on their practical use in rehabilitating sports related injury, but there has been little exploration of their effects on sports performance when used prior to maximal-effort isokinetic exercises. The purpose of this study was to determine the effects of direct hamstring precooling and preheating on peak torque measurements during maximal isokinetic hamstring testing on the Biodex.

METHODS

The study included six male division II collegiate short and long sprinters (100-400m) (Age 20 ± 1.25 years, height 180 ± 5.6 cm, and body mass 74 ± 8.96 kg) who were in-season and had no prior experience with the Biodex. Subjects completed a crossover design under all three conditions one week apart at the same time on the same day of the week. The sessions began with a 10-minute acclimatization period sitting at room temperature (23°C), before beginning their randomly selected treatment. Preheating consisted of a moist heat pack (69°C) wrapped in a cover (~5 towel layers), and precooling consisted of an ice bag (1000mL), wrapped in a singular moist towel (0°C), both treatments were applied directly to the middle hamstrings for 20 minutes. Testing consisted of 3 sets of 3 maximal isokinetic knee extension and flexion repetitions at 180 degrees per second with 30 seconds of rest between sets to measure peak torque during knee flexion.

Figure a. The Biodex was fitted for each participant so that the rotation axis of the dynamometer was lined up with the lateral epicondyle of the dominate legs femur. The leg attachment was adjusted so that the bottom of the ankle pad was at the participants superior border of the medial malleolus. Additionally, straps were attached to the trunk, hip, and dominant thigh to reduce compensatory movements.

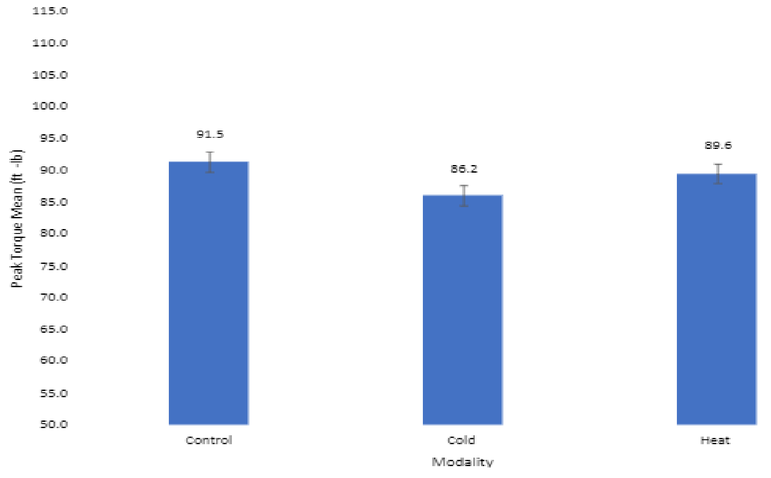

Figure 1. Group average peak torque calculated from absolute peak torque from each modality session from each subject.

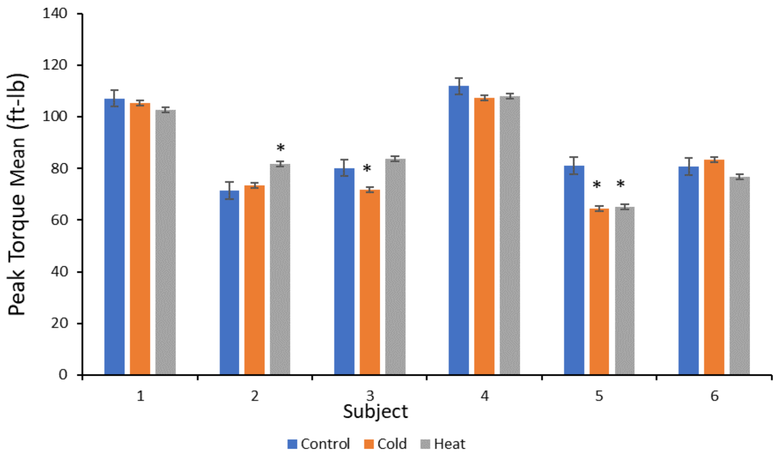

Figure 2. Average peak torque calculated from peak torque values of each trial (set) from the different modality sessions for each subject. "*" indicates a statistically significant difference from the control (P=0.035) for subject 2. (P=0.047) for subject 3. (P=0.015) and (P=0.007) for subject 5.

RESULTS

Whole group peak torque analysis did not demonstrate statistically significant difference (P<0.05) between any of the modalities (P=0.087 Cold vs. Control, P=0.693 Heat vs. Control, P=0.440 Cold vs. Heat). Group means (± SD) were 91.5 ft-lbs. (± 16.9) (Control), 86.2 ft-lbs. (± 17.3) (Cold), and 89.6 ft-lbs. (± 15.9) (Heat). Individual analysis produced statistically significant difference (P<0.05) for five conditions between four of the six subjects, with varying patterns.

DISCUSSION

Other research investigating peak isokinetic torque has included measurements at various angular joint velocities, finding differing results at angular velocities less than 180deg/s (Cetin et al., 2008; Alexander and Rhodes, 2020). Specific to the current study population, it may be beneficial to perform a biomechanical analysis of their sport specific movements and determine a knee flexion range in degrees per second and use this as the base for the testing protocols. Additionally, different treatment applications such as whirlpool heating/cooling could be used to illicit deeper thermic effects. Future research could explore a combination of these changes to the treatment or testing protocols.

CONCLUSIONS

Preheating and precooling can produce significant differences in isokinetic strength of knee flexion measured by peak torque at 180deg/s, but these differences tend to be individualized and vary in respect to temperature.

REFRENCES

Alexander, J., & Rhodes, D. (2020). Temporal patterns of knee-extensor isokinetic torque strength in male and female athletes following comparison of anterior thigh and knee cooling over a rewarming period. *Journal of Sports Rehabilitation*, 29, 723-729.

Cetin, N., Aytar, A., Atalay, A., & Akman, M. N. (2008). Comparing hot pack, short-wave diathermy, ultrasound, and TENS on isokinetic strength, pain, and functional status of women with osteoarthritic knees. *American Journal of Physical Medicine and Rehabilitation*, 87, 443-451.