INTERNATIONAL GRADUATE COLLOQUIUM

i-SPEAK 2025

SPORTS AND PHYSICAL EXERCISE ASSEMBLY OF KNOWLEDGE SHARING

COLLOQUIUM PROCEEDINGS

EXTENDED ABSTRACT

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COMPARATIVE ANALYSIS OF COLD AND HOT WATER THERAPIES ON AGILITY AND POWER METRICS IN COLLEGIATE FUTSAL ATHLETES

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Keywords: Cold-water therapy, Hot-water therapy, Muscle performance, Futsal players, Recovery strategies

I. Introduction

This study investigates the effects of cold-water therapy (CWT) and hot-water therapy (HWT) on muscle performance in UiTM Negeri Sembilan futsal players. By evaluating their influence on agility and power, the research seeks to clarify the long-term effects of CWT and HWT on muscle contractile properties, contributing to strategies for optimizing athletic performance [1].

II. Methods

This study used quasi - experimental design involved 10 male UiTM Negeri Sembilan futsal players aged 18–25 years, meeting strict eligibility criteria. Cold-water therapy (15°C, 15 min) [2] and hot-water therapy (38–40°C, 15 minutes) [3] were administered. Data were collected before treatment, immediately after treatment, and 72 hours post-treatment. Muscle performance was assessed using agility T-tests [4] and broad jump measurements [5]. Participants had no lower limb injuries in the past six months.

III. Results and Discussion

A. Outcome on Agility & Power

The data in Table I show significant effects on agility (p = 0.006, η^2 = 0.042) and power (p<0.001, η^2 = 0.050) across the two time points, indicating that both CWT and HWT interventions influenced these outcomes.

TABLE I
Inferential Effects of Cold-Water and Hot-Water Therapy on Agility and Power

Effect	p	η^2
Agility	0.006	0.042
Power	<0.001	0.050

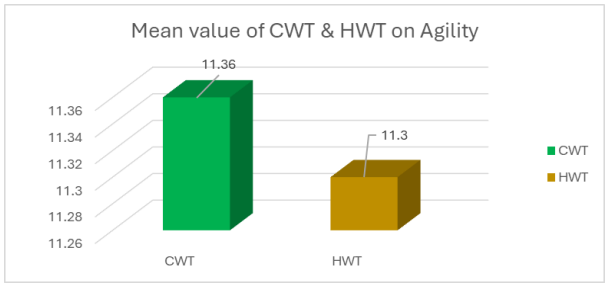

Fig. 1 Mean value of CWT and HWT on Agility

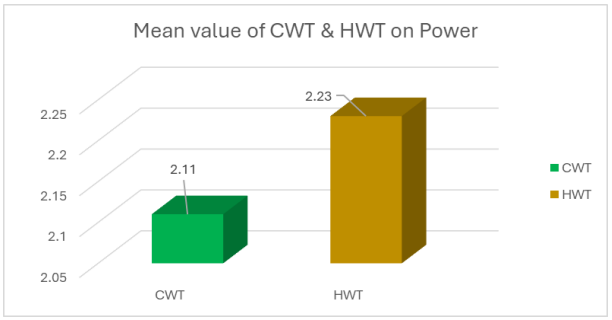

Fig. 2 Mean value of CWT and HWT on Power

Figure 1 illustrates changes in each treatment, showing a decline over two time series. The mean (M) values indicate that CWT resulted in the highest agility score at 11.36, while HWT had a score of 11.3. Figure 2 illustrates changes in each treatment, showing an increase over two time series. The mean values indicate that HWT resulted in the highest power score at 2.23, while CWT had a score of 2.11.

B. CWT and HWT on Agility

Cold-water therapy significantly enhanced agility performance in futsal players, as evidenced by a main effect (F = 9.72, p = 0.006). The moderate effect size (η^2 = 0.101) indicates a meaningful impact of cold-water immersion on agility. However, participant feedback revealed no perceived difference in agility between treatments (F = 0.348, p = 0.348), suggesting both therapies were similarly effective in agility recovery.

Hot-water therapy also had a significant effect on agility performance (F = 26.84, p<0.001) with a large effect size (η^2 = 0.292). However, its effects did not differ significantly

from those of cold-water therapy, indicating that both treatments contribute similarly to agility recovery.

C. CWT and HWT on Power

Broad jump performance significantly improved after cold-water therapy (F = 26.84, p<0.001) with a large effect size (η^2 = 0.292), suggesting its effectiveness in enhancing lower-body power recovery. The interaction effect (F = 7.78, p = 0.012) indicates that power gains increased over time, underscoring its potential as a post-exercise recovery strategy.

Hot-water therapy did not significantly improve broad jump performance (F = 2.37, p = 0.141), with a small effect size (η^2 = 0.050), indicating minimal impact on power recovery. These findings suggest that while hot-water therapy supports agility recovery, it may be less effective than cold-water therapy in enhancing power performance.

D. Comparison CWT & HWT

Cold-water therapy demonstrated greater improvements in both agility and broad jump performance. While both therapies were effective, no significant differences were observed, indicating comparable efficacy in improving muscle performance.

IV. Discussions

This study found that CWT and HWT both produced significant improvements in agility and power among UiTM Negeri Sembilan futsal players, with no discernible difference in effectiveness between the two interventions. These results, supported by evidence that CWT reduces muscle stiffness and fatigue and that HWT enhances circulation and muscle relaxation, underscore the suitability of both methods as effective recovery strategies. Consequently, practitioners can employ either CWT or HWT to optimize athletic performance in futsal.

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