

# PRACTICAL PRECOOLING TECHNIQUE IN OCCUPATIONAL SETTINGS

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## 1. INTRODUCTION

Precooling (i.e., removal of heat from the body immediately prior to exercise) is a popular strategy for improving exercise performance in hot conditions. Immersion in water is the procedures most commonly used to precool in sports activities. However, the supply of a large volume of water and ice in all occupational settings is not always possible, or practical. We recently reported that fanning (4.5 m/s) and spraying water over the body for 30 min before walking reduced thermal strain while wearing impermeable protective suits (Tokizawa et al. 2014). Because the effects were less than those of conductive cooling, we here tried to investigate more effective conductive and evaporative cooling procedure by changing the velocity of the fan and exposure time (Study 1). In addition, we examined the effectiveness of hands and foot water immersion and wearing a cool-vest as alternative precooling method on heat strain while wearing protective clothing (Study 2).

## 2. METHODS

### 2.1 Study 1

Eight males engaged in five cooling trials: 2 m/s, 4 m/s, and 8 m/s fan velocity for 30 min and 15- and 45-min fan exposure time in 4 m/s fan velocity. They sat with their anterior surface closest to two tandem fans at 28°C with 40% relative humidity. The water was sprayed continuously from a sprayer over the volunteers' entire anterior body during fanning.

### 2.2 Study 2

Eight males engaged in 60 min of walking at a moderate speed (2.5 km/h) in a hot environment (37°C, 50%relative humidity). Before walking, they immersed hands and foot in water at 18C and wore a cool-vest (PCM) for 30 min. The water was wiped off and the vest was put off, then they wore protective clothing and a full-face gas mask.

## 3. RESULTS

### 3.1 Study 1

In all trials, esophageal temperature showed the lowest at an hour after the end of the cooling. The decreases were not different among three fan velocities ( $0.4 \pm 0.1^{\circ}\text{C}$ ,  $0.5 \pm 0.1^{\circ}\text{C}$  and  $0.5 \pm$

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0.1°C in 2 m/s, 4 m/s, and 8 m/s, respectively).

In 4 m/s fan velocity, 45-min fan exposure exhibited greater hypothermia than 30-min fan exposure ( $0.6 \pm 0.1^\circ\text{C}$ ,  $p < 0.05$ ), whereas in 15-min fan exposure, the decrease was less ( $0.3 \pm 0.1^\circ\text{C}$ ).

### 3.2 Study 2

Rectal temperature increased by  $1.1 \pm 0.1^\circ\text{C}$  at the end of the walking in the control trial (without the precooling). The precooling inhibited the increases ( $0.6 \pm 0.1^\circ\text{C}$ ,  $p < 0.05$ ). In addition, sweat rate, heart rate, and thermal and fatigue perceptions were significantly lower in the precooling than in the control trial.

## 4. CONCLUSION

Convective and evaporative cooling may need longer exposure times to decrease core temperature regardless of fan airflow velocity. In the other hand, peripheral water immersion and cool-vest could be an alternative precool method reducing heat strains.

## 5. REFERENCE

Tokizawa, K., 2014: Fan-precooling effect on heat strain while wearing protective clothing. *Int. J. Biometeorol.*, DOI: 10.1007/s00484-014-0794-8.