

EFFECT OF CLOTHING ON COLD-INDUCED VASODILATATION (CIVD) RESPONSE AND SUBJECTIVE THERMAL LOADS DURING REPEATED FINGER COOLING

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In workers in cold environments such as refrigerated warehouses, food processing facilities and outdoors in cold weather, excessive cooling of fingers and toes have been frequently reported. In such cold work places, the workers are likely to handle frozen materials through cotton gloves or cold protective-gloves they wear, or touch a frozen fish or meat directly with their hands, or immerse their fingers in cold-water. In almost all cases, their fingers and hands are repeatedly and intermittently cooled, with rests and pauses in between. However, there have been so far only a few studies on the effects of repeated or intermittent peripheral cooling. The objective of this study was to investigate how repeated and intermittent finger cooling affects cold-induced vasodilatation (CIVD) response and finger pain and thermal sensations under different clothing conditions. Seven young men aged 23 to 24 years immersed their right index fingers in stirred water at 10°C for 10 minutes. This immersion procedure was repeated five times under ambient temperature of 20°C and relative humidity of 50%. Each cold-water immersion was followed by a 5-minute rest under the same climatic condition. This repeated cold-water immersion experiment was carried out on different days under three clothing conditions: light (pants, T-shirt, shorts and socks), medium (light clothing plus shirt and trousers) and heavy clothing (medium clothing plus jacket). Under the heavy clothing condition, marked CIVD response occurred and the CIVD reactivity did not significantly change upon repetition of cold-water immersion. The finger skin temperature during each post-immersion rest also tended to recover quickly to the pre-immersion level. Under the light clothing condition, however, the CIVD response weakened continuously upon repetition of immersion and the response in some subjects almost disappeared during the final immersion. The recovery rate of finger temperature during each post-immersion rest tended to decrease continuously upon repetition of immersion. Under every clothing condition, finger pain sensation rapidly increased during each immersion, but it completely disappeared during each post-immersion rest period. Finger cold sensation also rapidly increased during each immersion, but it was replaced by a warm or slightly warm sensation during each rest period. These subjective sensations during the immersion and post-immersion periods had no significant differences between clothing conditions. The present study suggests that light clothing in a cool environment may weaken CIVD reactivity during repeated finger cooling and delay the recovery of finger temperature during post-immersion rest periods. It also suggests that under such conditions, subjective judgments such as absence of finger pain and occurrence of warm sensations during post-immersion rest may not be reliable indicators of the risk of progressive finger cooling and frostbite formation.

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