4 The effect of body heat content on finger temperature during and after hand immersion in cold water

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The purpose of this study was to establish the relationship between finger temperature during and after hand immersion in 8^0C water and the level of body heat content. This abstract is based on results obtained from three male subjects, however, the results of an additional six subjects will be presented in the final paper. The subjects were fitted with B skin thermistor probes, two of which were attached at the pad of the middle finger ofeach hand. - Core temperature was measured using both a rectal and a tympanic probe. Body heat content was manipulated by affecting core and skin temperature independently. Skin temperature was controlled at two different levels (Sc, Sw) with average temperatures of 26.7 and 33.5°C, by adjusting ambient temperature in a climatic chamber and the amount of clothing worn by the subject. Tympanic temperatures were increased (Tw) or reduced (Tc) to an average of 37.1 and 36.3°C respectively, by drinking hot or cold fluids. There were four different combinations: ScTc, ScTw, SwTc and SwTw. Approximately 45 minutes were needed to allow body temperatures to stabilize at their new levels after entering the climatic chamber, including the ten minute ingestion period. With the subject sitting still, the right hand was immersed in an 8^0C stirred water bath for a half hour and then taken out to allow for physiological rewarming at ambient temperature. The following variables were calculated: 1) Cooling and rewarming response time (tc, tr); 2) the time needed to the first rise (TTR) in temperature after immersion as a result of cold induced vasodilation (CIVD); 3) the difference in temperature (dT) between the maximum of the first CIVD-wave and the lowest initial level; 4) the number of CIVD-waves (Nwaves) in the 30 minute immersion period; 5) the base- and recovery temperatures (Tb, Tr), indicating respectively the finger temperature prior to immersion and after rewarming; and 6) the lowest temperature recorded during immersion (Tmin). The following table outlines the results:

dependent variables

condition	Tb (°C)	tc (s)	TTR (s)	Tmin (°C)	dT (°C)	Nwaves (n.d.)	tr (s)	Tr (°C)
ScTc	17.3	2.5	23.7	8.3	0.2	0	4.3	15.8
ScTw	20.6	2.7	18.3	8.7	0.7	1	4.1	20.6
SwTc	33.3	2.8	16.1	9.1	1.8	1	5.7	33.5
SwTw	34.3	6.7	14.5	10.0	3.5	2	2.6	33.7

It is concluded that the temperature response of the hand during and after immersion in a cold water bath is largely dependent upon body heat content. The overall relationship is such that the higher the body heat content, the better the hands are protected against the negative effects of cold exposure. It is suggested that some of the'individual variation reported in the literature may be explained by differences in body heat content. If the relationship proves to be consistent it may well be incorporated in analytical models of thermoregulation.