

## HEMODYNAMIC RESPONSES TO SAUNA, SHOWER AND ICE WATER IMMERSION

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Winter swimmers enjoy ice water immersions in natural waters 2 to 3 times a week throughout the winter season. Some of them alternate the ice water immersions with the sauna, some do not<sup>1</sup>.

Nine healthy<sup>2</sup> male volunteer winter swimmers were invited to the experiments designed to simulate actual sauna bathing and winter swimming practices<sup>1</sup>: A: sauna and ice water immersion: B: sauna and shower: C: sauna and rest at room temperature: D: ice water immersion only. The exposures were repeated.

The subjects were weighed before and after the experiments. Hb and Hcr were determined from blood samples drawn before and after the combination of exposures, and after the recovery period. The changes in plasma volumes (PV) were calculated<sup>3</sup>. The heart rates were continually recorded<sup>4</sup>. The blood pressures were determined from sitting subjects six times in each experiment. The Friedman's two-way analysis of variance by ranks<sup>5</sup> was employed for statistical evaluation.

The mean sweating in the sauna experiment A was 417 g, in B 437 g and in C 544 g. However, in A and B the mean PVs decreased to about 92 % from the initial, but only to about 95 % in C. So, the amount of excreted sweat alone should not be considered as an indicator of PV changes. The type of bathing combinations influences the reduction of plasma volume.

In A, B and C the systolic pressure (SAP) remained at the initial level and in D the SAP increased ( $P < 0.01$ ). In A and B the diastolic pressure (DAP) decreased ( $P < 0.01$ ) and remained at the reduced level throughout the experiments, in C the DAP increased to initial levels during cooling at room temperature, and in D the DAP increased slightly ( $P < 0.05$ ). The differences between A, B and C vs D were significant ( $P < 0.01$ ).

The rate pressure product (RPP)<sup>6</sup> shows that the combinations of the sauna and ice water immersion and the sauna and cool shower increase the cardiac oxygen requirements the most ( $P < 0.05$ ). The ice water immersions alone (experiment D) do not increase the cardiac oxygen demand, but do raise the blood pressure. The alternation of heat and cold seems to stress the heart the most, even suggesting a disturbance of the cutaneous circulation resulting from this type of bathing.

<sup>1</sup> Kauppinen, K., Urponen, H. (1988) *Arct Med Res* 47:4-12.

<sup>2</sup> Kauppinen, K., Vuori, I. (1988) *Arct Med Res* 47:71-82.

<sup>3</sup> Dill, D.B., Costill, D.L. (1974) *J Appl Physiol* 37:247-8.

<sup>4</sup> Brengelmann, G.L., Johnson, J.M., Hong, P.A. (1979) *J Appl Physiol* 47:638-42.

<sup>5</sup> Siegel, S. (1956) *Nonparametric Statistics for Behavioral Science*. McGraw-Hill Book Co., Inc. New York.