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# Effect of Waon therapy on oxidative stress in chronic heart failure

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## Abstract

**Background:** A previous report by our team showed that Waon therapy, using a far infrared-ray dry sauna at 60°C, improves cardiac and vascular function in patients with chronic heart failure (CHF). The purpose of the present study was to clarify the effect of Waon therapy on oxidative stress in CHF patients and investigate its mechanism by animal experiments.

**Methods and results:** Forty patients with CHF were divided into control (n=20) and Waon therapy (n=20) groups. All patients received standard optimal medications for CHF. Waon therapy group was

treated with Waon therapy daily for 4 weeks. After 4 weeks of Waon therapy, concentrations of hydroperoxide and brain natriuretic peptide (BNP) decreased significantly (hydroperoxide,  $422 \pm 116$  to  $327 \pm 88$  U.CARR,  $P < 0.001$ ; BNP,  $402 \pm 221$  to  $225 \pm 137$  pg/ml,  $P < 0.001$ ), and the nitric oxide metabolites increased ( $71.2 \pm 35.4$  to  $92.0 \pm 40.5$  mmol/L,  $P < 0.05$ ). In contrast, none of these variables changed over the 4-week interval in the control group. Furthermore, animal experiments were performed using TO-2 cardiomyopathic hamsters. On immunohistochemistry, cardiac expression of 4-hydroxy-2-nonenal, a marker of oxidative stress, was decreased in the 4-week Waon therapy compared to untreated hamsters. On Western blotting, cardiac expressions of heat shock protein (HSP) 27, manganese superoxide dismutase and HSP32, which reduce oxidative stress, were significantly upregulated in the 4-week Waon therapy compared to untreated hamsters.

**Conclusions:** Waon therapy decreases oxidative stress in patients and hamsters with heart failure.

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