Effect of Chronic Stress and Sleep Deprivation on Both Flow-Mediated Dilation in the Brachial Artery and the Intracellular Magnesium Level in Humans

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Summary

Background: Chronic mental and physical stress has been suggested to be a trigger for cardiovascular events. In addition, a reduction in levels of intracellular magnesium has been reported to cause vasoconstriction while enhancing platelet-dependent thrombosis.

Hypothesis: The purpose of this study was to investigate whether chronic stress affects endothelial function and intracellular magnesium levels in humans.

Methods: Flow-mediated dilation (endothelium-dependent vasodilation) and sublingual nitroglycerin-induced dilation (0.3 mg, endothelium-independent vasodilation) were measured in the brachial artery in 30 healthy male college students, aged 22 ± 1 years, using high-resolution ultrasound both before and immediately after a 4-week final term examination period. Erythrocyte magnesium concentration was measured simultaneously. All students had chronic sleep deprivation for 4 weeks, during which sleep lasted < 80% of that on ordinary days; in addition, the students were under great stress to pass the examination. This condition was considered to be chronic stress.

Results: Chronic stress decreased flow-mediated dilation and erythrocyte magnesium concentration (from 7.4 ± 3.0 to 3.7 ± 2.3%, p < 0.05; from 5.7 ± 0.4 to 5.5 ± 0.4 mg/ml, p < 0.05, respectively). The change in flow-mediated dilation correlated significantly with that of the erythrocyte magnesium concentration (r = 0.43, p < 0.05), but not with nitroglycerin-induced dilation.

Conclusions: Chronic stress was found to attenuate endothelial function, which may also be associated with a reduction in the intracellular magnesium level in humans.

Key words: chronic stress, sleep deprivation, endothelial function, magnesium

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