Ｐ２．Deep-sea water promotes mitochondrial biogenesis and function in vitro and in vivo.

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Recent studies showed that deficiencies of essential minerals including Mg, Ca, and K, and trace minerals including Se, Zn, and V, have implications for the development, prevention, and treatment of several chronic diseases including obesity and type 2 diabetes. Mitochondrial dysfunction is recognized as a core feature of these diseases. Emerging evidence also suggests that defects in mitochondrial biogenesis, number, morphology, fusion, and fission, contribute to the development and progression of metabolic diseases. Our previous studies revealed that balanced deep-sea water (BDSW), which is composed of desalinated water enriched with Mg and Ca, has potential as a treatment for diabetes and obesity. In this study, to determine whether BDSW regulates mitochondrial biogenesis and function, we investigated its effects on mitochondrial DNA (mtDNA) content, mitochondrial enzyme activity, expression of key transcription factors and mitochondria-specific genes, phosphorylation of signaling molecules associated with mitochondrial biogenesis, and mitochondrial function in C2C12 myotubes and 3T3-L1 preadipocytes. BDSW increased mitochondrial biogenesis in a time and dose-dependent manner. Quantitative real-time PCR revealed that BDSW enhances gene expression of PGC-1α, NRF1, and TFAM for mitochondrial transcription. Upregulation of these genes was supported by increased mitochondria staining, CS activity, CytC oxidase activity, and AMPK phosphorylation. Moreover, drinking BDSW remarkably improved mtDNA content in the muscles of HFD-induced obese mice. Taken together, these results suggest that the stimulatory effect of BDSW on mitochondrial biogenesis and function may provide further insights into the regulatory mechanism of BDSW-induced anti-diabetic and anti-obesity action.

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