Thesis Abstract

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Title of Thesis:				
Multilateral understanding of hot springs by omics-based approaches				
Summary of Thesis:				
Hot springs are unique natural environments that have been used for recreational and/or				
therapeutic purposes (balneotherapy) since ancient times in various countries, especially,				
Japan. Japanese hot spring therapy, called "touji", is world-renowned. Multilateral and				
comprehensive scientific study of hot springs and their benefits could contribute to making				
Japan a tourism-oriented country. As a first step, microbes living in hot springs and their				
genes were analyzed to understand the hot spring mircobiome. We detected 27 novel				
microorganisms and type-specific tRNA degradation. Hot spring water (HSW) consumption				
is one of the methods of balneotherapy. It has been reported that consumption of hydrogen				
carbonate- or sulfur-containing water may be prevent and/or improve type 2 diabetes.				
However, since the molecular mechanisms underlying the effects of balneotherapy have				
not been well elucidated, the physiological effects of HSW consumption were evaluated				
using omics-based approaches. In the HSW consumption periods, serum glycoalbumin				
levels, a glycemic control index, were significantly decreased. Metabolome analysis				
showed that concentrations of 19 blood metabolites including 4 glycolysis-related				
metabolites and 3 amino acids were significantly changed in the HSW consumption periods				
as compared with the tap water consumption periods, suggesting that HSW consumption				
may induce glycolysis and proteolysis alteration. Additionally, 8 families of gut microbiota				
were significantly changed, out of which lean-associated bacteria was significantly				
increased. Moreover, experiment on murine models was also conducted and these models				
may be useful for screening to evaluate the effectiveness of HSW consumption. The				

current research provides beneficial information for future studies investigating the molecular basis of balneotherapy. Taken together, our findings provide new insights into the microbial ecosystems in hot springs and the molecular mechanisms underlying the effects of balneotherapy. These findings contribute to the understanding of hot springs and their effect in improving human health.

Keywords: Hot spring, Environmental microbes, Balneotherapy, Type 2 diabetes, Gut microbiota