Effect of cobalamin on microbiota and metabolism alternation via an *in vitro* colonic simulation

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Abstract

Our research is to understand how cobalamin and analogues works as a modular to shape the structure of gut microbial communities, further to influence food digestion. Microorganisms are of importance in nearly all metabolic processes on every ecology, including food digestion, global carbon cycling, and soil stabilities. Gut microbiome is constructed by multi-species communities, where nutrients and signals are exchanged among members. In this study, an *in vitro* colonic simulation was introduced to evaluate effect of cobalamin on microbial digestion and its metabolism.

Vitamin VB12 (VB12) is the only vitamin that is produced exclusively by bacteria and archaea, yet is used by all domains of life. VB12 is energetically costly, requiring nearly 30 different enzymes for its synthesis , which likely explains why only a small fraction of prokaryotes have the genetic capacity to produce it. In natural microbial communities, the limited sources of VB12 made it a precious commodity. As such the availability of, and access to, VB12 has been suggested to impart a fundamental contribution, not only nutrition but also signal, to their spatial and functional organization.

We are exploring different forms of vitamin VB12 produced by microbes, how VB12 is used and shared in microbial communities and how the fundamental roles of VB12 is in bacterial metabolism. We have constructed a library of cobalamin including 10 different analogues. As their role as cofactors of enzymes that mediate methyl transfer reactions, isomerase rearrangements, and dehalogenation, we tried to examine bioactivity of analogue cofactors. A VB12 riboswitch library from different species

was constructed. Riboswitch is a 5'-untranslated leader sequences of a corresponding mRNAs, which regulates translation initiation and gene expression by binding a special molecular. In this study, we have achieved to figure out how analogues to affect expression of protein via riboswitch regulations, further to influence metabolism.

Brief Biography

Xuan Zhu (1982) is an associate professor from School of Food Science and Bio-engineering of Zhejiang Gongshang University. After his MSc. graduation in Food Science in 2007, he joined Eurofins as a microbiology section manager. From 2009 to 2013, he did his Ph.D. in Food Chemistry (Research on fermentation of vitamin B_{12} in soybean products by co-fermentation) at Hamburg University. In 2013, he joined Zhejiang Gongshang University to continue his academic career. Since 2016, he is an associate professor of Food Engineering. His research and teaching focus on fermentation (such as vitamin B group) and digestion via gut micro-ecology. The research is directed towards foods, feed, and by-products, thereby collecting a wide range of agricultural, aquatic and human being bacteria. The key approach in the research is the selecting, screening, identification, quantification, and functionality of bacteria and individual, closely related analogues within complex mixtures. He has published about 21 scientific papers, and obtained China Association for Instrumental Analysis Youth Award for Science and Technology (CAIA award) in 2015 and 1st Rank Scientific Award of Zhejiang Province in 2018.

Brief CV

Xuan Zhu, Ph.D.

Institute of Food Microbiology and Biotechnology, Hamburg University

Education:

B.S. Biology Engineering, Zhejiang Gongshang University, China, 2005

M.S. Food Science, Zhejiang University, China, 2007

Ph.D. Food Chemistry, Hamburg University, Germany, 2013

Professional Career:

2013-Present: Zhejiang Gongshang University, China, Associate Professor

Research Interests:

1. Microbial digestion and *in vitro* colonic simulation
2. Vitamin B group fermentation, evaluation, and processing
3. Polyols evaluation and processing

Selected publications

1. Xuan, B., Xiang, S., Chen, J., Shi, Y., Chen, Y., Wang, H., & Zhu, X*. (2018).Effect of Lactobacillus reuteri on vitamin B12 content and microbiotacomposition of furu fermentation. LWT.
2. Wang, H., Shou, Y., Zhu, X.*, Xu, Y., Shi, L., Xiang, S., Feng, X., Han, J. (2018) Stability of Vitamin B12 with the Protection of Whey Proteins and Their Effects on the GutMicrobiome, Food Chemistry.
3. Xu, Y, Zhu, X.*, et al. (2018) Cobalamin (Vitamin B12) Induced a Shift in MicrobialComposition and Metabolic Activity in an in vitro Colon Simulation. Front.Microbiol.
4. Xuan Zhu, Shasha Xiang, et al. (2018) Impact of Cyanocobalamin andMethylcobalamin on Inflammatory Bowel Disease and the Intestinal MicrobiotaComposition. J. Agric. Food Chem.
5. Yu, Y, Zhu, X*, et al. (2015) Enhancing the vitamin B12 production and growth of Propionibacterium freudenreichii in tofu wastewater via a light-induced vitamin B12 riboswitch. Appl Microbiol Biotechnol.
6. Gu, Q., Zhang, C, Song, D., Li, P., Zhu, X*. (2015) Enhancing vitamin B12 content in soy-yogurt by Lactobacillus reuteri. Int J Food Microbiol.
7. Zhu, X, et al. (2015) A riboswitch sensor to determine vitamin B12 in fermented foods. Food Chem.