

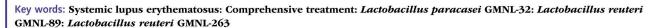
Effects of oral *Lactobacillus* administration on antioxidant activities and CD4+CD25+forkhead box P3 (FoxP3)+ T cells in NZB/W F1 mice

Bor-Show Tzang^{1,2,3,4}, Chung-Hsien Liu⁵, Kuo-Ching Hsu¹, Yi-Hsing Chen^{6,7}, Chih-Yang Huang^{8,9,10}† and Tsai-Ching Hsu^{1,2,3}*

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Abstract

Systemic lupus erythematosus (SLE) is an autoimmune disease that is characterised by a dysregulation of the immune system, which causes inflammation responses, excessive oxidative stress and a reduction in the number of cluster of differentiation (CD)4+CD25+forkhead box P3 (FoxP3)+ T cells. Supplementation with certain *Lactobacillus* strains has been suggested to be beneficial in the comprehensive treatment of SLE. However, little is known about the effect and mechanism of certain *Lactobacillus* strains on SLE. To investigate the effects of *Lactobacillus* on SLE, NZB/W F1 mice were orally gavaged with *Lactobacillus paracasei* GMNL-32 (GMNL-32), *Lactobacillus reuteri* GMNL-89 (GMNL-89) and *L. reuteri* GMNL-263 (GMNL-263). Supplementation with GMNL-32, GMNL-89 and GMNL-263 significantly increased antioxidant activity, reduced IL-6 and TNF- α levels and significantly decreased the toll-like receptors/myeloid differentiation primary response gene 88 signalling in NZB/W F1 mice. Notably, supplementation with GMNL-263, but not GMNL-32 and GMNL-89, in NZB/W F1 mice significantly increased the differentiation of CD4+CD25+FoxP3+ T cells. These findings reveal beneficial effects of GMNL-32, GMNL-89 and GMNL-263 on NZB/W F1 mice and suggest that these specific *Lactobacillus* strains can be used as part of a comprehensive treatment of SLE patients.



Various studies have shown that elevated oxidative stress and decreased antioxidant activities are critical in the pathogenesis of systemic lupus erythematosus (SLE)⁽¹⁻³⁾. Excessive oxidative stress damages lipids, proteins and DNA^(4,5), and elicits autoantibodies in SLE patients, such as antibodies against oxidatively modified DNA and LDL^(6,7). Cytokines are also known to play direct roles in the disease pathogenesis of SLE⁽⁸⁾. SLE is

characterised by a dysregulation of the immune system, which causes inflammation in multiple organs with diverse clinical manifestations (9). Levels of IL-6 and TNF- α in serum are elevated in both lupus animal models and SLE patients. Studies of multiple animal SLE models have identified the critical role of the IL-6 pathway in SLE (10–13). Indeed, evidence has correlated serum IL-6 level with disease activity or anti-double stranded

Abbreviations: DPPH, 1,1-diphenyl-2-picryl-hydrazyl; FoxP3, forkhead box P3; GMNL-32, *Lactobacillus paracasei* GMNL-32; GMNL-89, *Lactobacillus reuteri* GMNL-89; GMNL-89; GMNL-263, *Lactobacillus reuteri* GMNL-263; MDA, malondialdehyde; MyD88, myeloid differentiation primary response gene 88; PI3K, phosphoinositide 3-kinase; SLE, systemic lupus erythematosus; TLR, toll-like receptor.

* Corresponding author: Dr T.-C. Hsu, fax +886 4 2324 8172, email htc@csmu.edu.tw \dagger Equal contribution as corresponding author.



¹Institute of Biochemistry, Microbiology and Immunology, Chung Shan Medical University, Taichung 402, Taiwan, ROC

²Immunology Research Center, Chung Shan Medical University, Taichung 402, Taiwan, ROC

³Clinical Laboratory, Chung Shan Medical University Hospital, Taichung 402, Taiwan, ROC

⁴Department of Biochemistry, School of Medicine, Chung Shan Medical University, Taichung 402, Taiwan, ROC

⁵Department of Obstetrics and Gynecology, Chung Shan Medical University and Chung Shan Medical University Hospital, Taichung 402, Taiwan, ROC

 $^{^6}$ Research and Development Department, GenMont Biotech Incorporation, Tainan 741, Taiwan, ROC

⁷Institute of Biomedical Science and RongHsing Research Center for Translational Medicine, National Chung-Hsing University, Taichung 402, Taiwan, ROC

⁸Graduate Institute of Basic Medical Science, China Medical University, Taichung 404, Taiwan, ROC

⁹Graduate Institute of Chinese Medical Science, China Medical University, Taichung 404, Taiwan, ROC

¹⁰Department of Health and Nutrition Biotechnology, Asia University, Taichung 413, Taiwan, ROC