



Lactobacillus paracasei GMNL-32, *Lactobacillus reuteri* GMNL-89 and *L. reuteri* GMNL-263 ameliorate hepatic injuries in lupus-prone mice

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Abstract

Probiotics are known to regulate host immunity by interacting with systemic and mucosal immune cells as well as intestinal epithelial cells. Supplementation with certain probiotics has been reported to be effective against various disorders, including immune-related diseases. However, little is known about the effectiveness of *Lactobacillus paracasei* GMNL-32 (GMNL-32), *Lactobacillus reuteri* GMNL-89 (GMNL-89) and *L. reuteri* GMNL-263 (GMNL-263) in the management of autoimmune diseases, especially systemic lupus erythematosus (SLE). NZB/W F1 mice, which are a lupus-prone animal model, were orally gavaged with GMNL-32, GMNL-89 or GMNL-263 to investigate the effects of these *Lactobacillus* strains on liver injuries in NZB/W F1 mice. The results thus obtained reveal that supplementary GMNL-32, GMNL-89 or GMNL-263 in NZB/W F1 mice ameliorates hepatic apoptosis and inflammatory indicators, such as matrix metalloproteinase-9 activity and C-reactive protein and inducible nitric oxide synthase expressions. In addition, supplementation with GMNL-32, GMNL-89 or GMNL-263 in NZB/W F1 mice reduced the expressions of hepatic IL-1 β , IL-6 and TNF- α proteins by suppressing the mitogen-activated protein kinase and NF- κ B signalling pathways. These findings, presented here for the first time, reveal that GMNL-32, GMNL-89 and GMNL-263 mitigate hepatic inflammation and apoptosis in lupus-prone mice and may support an alternative remedy for liver disorders in cases of SLE.

Key words: Probiotics; *Lactobacillus paracasei* GMNL-32; *Lactobacillus reuteri* GMNL-89; *Lactobacillus reuteri* GMNL-263; Systemic lupus erythematosus; Liver disorders

Probiotics or probiotic bacteria generally refer to live micro-organisms pre-existing in human bodies that are beneficial to intestinal tract health, or micro-organisms administered from external sources that favour any aspect of human health^(1,2). Various food products that are made from probiotics are regarded as functional foods^(3,4). Lactobacilli are being widely used in the development of novel bio-therapeutic probiotic

formulations for managing various diseases. Indeed, the effects of probiotics on various diseases have been widely studied in both animal experiments and human clinical trials^(5–8). Evidence has demonstrated that *Lactobacillus casei* Shirota differentially the inflammatory cytokine responses of macrophages and T cells in either Peyer's patches or the spleen⁽⁹⁾. A recent study indicated that *Lactobacillus jensenii* TL2937 can interact with intestinal

Abbreviations: CRP, C-reactive protein; ERK, extracellular signal-regulated kinase; GMNL-32, *Lactobacillus paracasei* GMNL-32; GMNL-89, *Lactobacillus reuteri* GMNL-89; GMNL-263, *Lactobacillus reuteri* GMNL-263; IKK, I κ B kinase; iNOS, inducible nitric oxide synthase; JNK, c-Jun N-terminal kinase; MAPK, mitogen-activated protein kinase; MMP, matrix metalloproteinase; SLE, systemic lupus erythematosus; TUNEL, terminal deoxynucleotidyl transferase dUTP nick end labelling.

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