

Lactobacillus Salivarius Modulates Intestinal and Liver Functions in Poultry: From Gut Health to Hepatic Lipid Metabolism

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Abstract

The rising demand for antibiotic-free poultry production necessitates the development of effective probiotic alternatives that concurrently promote gut health and address metabolic disorders, such as fatty liver syndrome. This study explored the probiotic efficacy of *Lactobacillus salivarius* SNK-6, a strain derived from chickens, in modulating intestinal barrier function and hepatic lipid metabolism. In vitro analyses revealed that SNK-6 exhibits significant tolerance to acidic and bile salt conditions, possesses adhesive capabilities, and demonstrates antimicrobial activity against key poultry pathogens (e.g., *E. coli*, *Salmonella*) through the production of organic acids and bacteriocins. In vivo feeding trials indicated that SNK-6 enhances villus height and the villus-to-crypt ratio in the jejunum and ileum, upregulates tight junction protein expression, and alters the gut microbiota by increasing *Lactobacillus* populations while suppressing *E. coli*, thereby reducing diarrhea in pigeons. Notably, SNK-6 mitigated hepatic oxidative stress and lipid accumulation, decreased serum levels of AST, ALT, and triglycerides, and activated the miR-130a-5p/MBOAT2 and AMPK pathways in a non-alcoholic fatty liver disease model. Mechanistically, extracellular vesicles derived from SNK-6 (LsEVs) were internalized by hepatocytes, leading to the promotion of autophagy through the upregulation of Beclin-1 and LC3II/LC3I. Additionally, these vesicles restored the expression of intestinal claudin-1 and modulated the gut microbiota by increasing the abundance of *Lachnospira* and *Faecalibacterium*. Safety evaluations demonstrated the absence of mutagenicity, hemolytic activity, and reproductive toxicity. These findings underscore the potential of *L. salivarius* SNK-6 as an effective probiotic for sustainable poultry production, enhancing both intestinal integrity and liver health, with its extracellular vesicles playing a critical role in the communication between the gut and liver axis.

Keywords

Lactobacillus Salivarius, Gut-liver Axis, Poultry, Fatty Liver, Extracellular Vesicles, Autophagy