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Probiotic supplementation improves colonic wall morphology and gut microbiota community in a murine model of colitis

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Inflammatory bowel diseases (IBD) are chronic relapsing-remitting gastrointestinal disorders associated with altered intestinal permeability, which causes a degeneration of the intestinal wall[1]. The treatments for IBD have insufficient therapeutic efficacy; however, studies identified that disease progression appears to be improved by a probiotic- supplemented diet[2]. The potential health-promoting properties of *Pediococcus acidilactici* 46A (*Pa*) were evaluated by an orally 10 days supplementation of the bacterial strain (1×10^8 CFU daily) on a murine model of Dextran-sulfate sodium (DSS)-induced colitis[3], by 7 days administration of DSS (2.5% w/v).

Progression of colitis was monitored after DSS administration. The gut microbiota community was evaluated using Illumina sequencing. Morphological and immunochemical analyses were performed on the proximal and the distal colon to assess disease severity score, neurodegeneration of myenteric plexus, pro-inflammatory cytokines expression, and oxidative stress status.

Pa supplementation reduced the disease activity index score while not affecting weight loss. The group receiving *Pa* exhibited higher microbiota biodiversity than the group receiving only DSS. Furthermore, bacterial co-occurrence network analyses revealed that *Pa* maintained favourable inter-species interactions, indicative of a more resilient and balanced microbial community.

The crypts architecture alteration, goblet cells depletion, and pro-inflammatory microenvironment were ameliorated in the *Pa*-supplemented mice compared to the DSS group. *Pa* ameliorates DSS-induced dysfunction of the colonic barrier by enhancing mucin 2 (MUC2) and zonula occludens-1 (ZO-1) expression. Moreover, in the *Pa*-supplemented mice was appreciated the stability of the neuronal network, evaluated by HuC/D pan-neuronal, nitrergic, and cholinergic markers.

These results showed the protective effects of specific bacterial strain to maintain colonic mucosal integrity, emphasizing the potential applications in the management of inflammation-related diseases.

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References

1) Tse, C.S.; Hunt, M.G.; Brown, L.A.; Lewis, J.D. Inflammatory Bowel Diseases-related Disability: Risk Factors, Outcomes, and Interventions. Inflamm Bowel Dis. 2024, 30, 501-507.
2) Haneishi, Y.; Furuya, Y.; Hasegawa, M.; Picarelli, A.; Rossi, M.; Miyamoto, J. Inflammatory Bowel Diseases and Gut Microbiota. Int J Mol Sci. 2023, 24, 3817.
3) Katsandegwaza, B.; Horsnell, W.; Smith, K. Inflammatory Bowel Disease: A Review of Pre-Clinical Murine Models of Human Disease. Int J Mol Sci. 2022, 19, 934.