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Ameliorative Effect of Egg Shell Membrane on Inflammatory Bowel Disease Delineated By Multi-Omics Approach

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One of the natural byproducts of egg processing is the eggshell membrane (ESM), which is usually discarded as an industrial waste. We have previously reported that dietary intake of ESM counters injury and fibrosis of the liver using a CCl_4-induced rat cirrhosis model. Since an anti-inflammatory effect of ESM had been reported we then hypothesized that consumption of ESM powder could prevent inflammatory bowel diseases (IBD). ESM attenuated lipopolysaccharide-induced inflammatory cytokine production and promoted the Caco-2 cell proliferation by up-regulating growth factors *in vitro*. In mice, IBD was induced by administration of dextran sodium sulfate (DSS). Consumption of ESM powder significantly suppressed the disease activity index and colon shortening. Such an effect was also observed in a spontaneous IBD model (IL-10 KO mice).These effects were associated with significant ameliorations of gene expressions of inflammatory mediators, intestinal epithelial cell proliferation, restitution-related factors and antimicrobial peptides. Multifaceted integrated omics analyses revealed improved levels of energy metabolism-related genes, proteins and metabolites. Concomitantly, cecal metagenomic information established an essential role of ESM in improving dysbiosis characterized by increasing the diversity of bacteria and decreasing absolute numbers of pathogenic bacteria such as *Enterobacteriaceae* and *E. coli*, as well as in the regulation of the expansion of Th17 cells by suppressing the overgrowth of segmented filamentous bacteria. Such modulations have functional effects on the host; i.e., repairing the epithelium, regulating energy requirements and eventually alleviating mucosal inflammation. These findings are first insights into ESM's modulation of microbiota and IBD suppression, providing new perspectives on the prevention/treatment of IBD.

Biography:

Dr. Hisanori Kato is a Project Professor of The University of Tokyo. Dr. Kato received his PhD from the University of Tokyo in 1990. He has been at the current position since 2017. Dr. Kato is the Secretary General of Federation of Asian Nutrition Societies (FANS) and is the Chair of the Organizing Committee of the 22nd International Congress of Nutrition (ICN2021). He is also the President-Elect of Asia-Pacific Nutrigenomics and Nutrigenetics Organization. He is the president of the Japanese Society for Amino Acid Sciences, the vice-president of Japan Society of Nutrition and Food Science, and a member of Science Council of Japan.