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Western-style diet, calcium supplementation and liver health: Gut microbial and metabolomic signature

Statement of the Problem: The Western-style diet (WSD) is strongly linked with the growing epidemic of obesity and is associated with numerous chronic age-related ailments. In the liver, specifically, non-alcoholic fatty liver disease (NAFLD) is a result. The goal of this work was to determine if dietary calcium supplementation could protect mice fed a WSD from NAFLD, including its down-stream consequences (i.e., liver fibrosis, formation of pre-cirrhotic regenerative nodules and premalignant/malignant liver tumors).

Methods: Male C56BL/6 mice were maintained for 18-months on a WSD containing dietary calcium at either 0.41gm/Kg or 5.25gm/Kg. Livers were evaluated for steatosis, inflammation, hepatocyte degeneration, fibrosis and necrosis. A metabolomic approach was used to evaluate bile acid composition and other metabolites in bile samples, comparing mice on the WSD with and without calcium supplementation. Cecal and stool microbial communities in mice on the un-supplemented and calcium-supplemented WSD were compared using *16S rRNA* gene Illumina sequencing.

Results: Steatosis was observed in most animals, irrespective of dietary calcium level. In contrast, liver inflammation and ballooning degeneration fibrosis, necrosis and incidence of regenerative hyperplastic nodules were less prevalent in mice receiving calcium. Bile acid levels were significantly higher in WSD-fed mice without calcium supplementation than in those with supplementation. Microbial populations were distinctly different on the two diets. Calcium-supplemented mice had more microbial diversity and this reflected the increased levels of several species associated with reduced inflammation and enhanced gastrointestinal barrier function. Of interest, species associated with obesity were more highly represented in mice on the un-supplemented diet, even though mice on both diets had equal weight gain over the course of study.

Conclusion: Dietary calcium supplementation can reduce NAFLD-related consequences in the context of a high-fat diet. Alterations in metabolomic profile and gut microbial populations may contribute to this effect.

Biography

James Varani has completed his PhD in Microbiology and is a Professor in the Department of Pathology at the University of Michigan. His research interest is epithelial biology and he has focused his studies on gastrointestinal health, and especially on the prevention of chronic diseases with dietary intervention.

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