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Illuminating the Microbial Dark Matter in Fermented Foods and Gut: Unlocking Insights for Cardiometabolic Health and Biotherapeutics

Invited Talk

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Abstract

We stand at an extraordinary inflection point in human health research: the convergence of ancient dietary wisdom and cutting–edge microbiome science. For millennia, fermented foods have been the cornerstone of human health and longevity across cultures, yet the mechanistic brilliance of how these foods dialogue with our microbial partners remains largely unexplored. The emerging tragedy of modern cardiometabolic disease lies in dysbiosis: the silencing of gut microbial diversity and the disappearance of keystone metabolic functions. Growing evidence demonstrates that atherosclerosis is not merely a vascular disease—it is fundamentally a disease of microbial dysregulation, where the loss of protective commensals and the proliferation of pathobionts ignite chronic inflammation, increase intestinal permeability, and accelerate the accumulation of atherogenic metabolites. Yet herein lies a profound opportunity: if dysbiosis drives disease, then targeted microbiota remodeling through fermented foods offers a preventive and therapeutic frontier.

This talk sheds light on the "microbial dark matter" that inhabits fermented foods and our gut ecosystems, unveiling transformative evidence that demonstrates how traditional fermented foods could serve as microbiome–targeted therapeutics. While traditional dietary habits of consuming fermented foods (Mediterranean, Japanese Washoku) are established for improving gut health and promoting a healthy lifestyle, the biologically rich fermented foods of Northeast India remain scientifically underexplored despite their potential to restore eubiosis and mitigate cardiometabolic disease. The presentation will focus on recent scientific findings from our preclinical investigations examining the health implications of long–term dietary intake of Indian traditional fermented foods on gut microbiota–immunomodulation and their cardioprotective potential. Through rigorous scientific investigation, our work reveals the mechanisms by which these foods reprogram the gut ecosystem and exert their cardioprotective effects (restoring eubiosis, promoting balance of cardio–protective and cardio–detrimental metabolites, amplifying short–chain fatty acid production, fortifying intestinal barrier integrity, dampening inflammatory signaling and endotoxemia, and suppressing atherogenic lesion formation).

The implications are far–reaching: traditional fermented foods represent a scalable, accessible, and culturally resonant intervention for preventing and managing cardiometabolic diseases.

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This work challenges the field to reconceptualize preventive medicine through the lens of microbiota–targeted nutrition, positioning traditional fermented foods not as folklore, but as evidence–based biotherapeutics.

Keywords: Fermented food microbiome, gut microbiome, dysbiosis, cardiometabolic disease, microbiota–targeted therapeutics

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