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Case Study
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An Overview of Intestinal Ecology affected by the Fermentation of Marine Polysaccharides by Gut Microbiota

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Abstract

The intestine microbiota that resides in the mammalian gut performs a crucial function in host health, nutrition, metabolic and immune homeostasis. As symbiotic bacteria, these microorganisms rely on the whole on non-digestible fibers and polysaccharides as electricity sources. Dietary polysaccharides that attain the distal intestine are fermented with the aid of intestine microbiota and for this reason exert a critical have an effect on intestinal ecology. Marine polysaccharides include a category of dietary fibers that are broadly used in meals and pharmaceutical industries. In this regard, insights into fermentation of marine polysaccharides and its results on intestinal ecology are of crucial significance for perception the really useful results of these glycans. Here, in this review, to supply a forget about of cutting-edge advances and facilitate future research in this field, we describe and summarize updated findings on how marine polysaccharides are metabolized by means of intestine microbiota and what consequences these polysaccharides have on intestinal ecology.

Keywords: Intestinal ecology; Gut microbiota; Marine polysaccharides; Fermentation; Metabolites; Microbial interactions

Introduction

The intricate ecosystem within the human gastrointestinal tract, governed by a myriad of microbial inhabitants, plays a pivotal role in maintaining overall health and well-being. Among these inhabitants, gut microbiota have emerged as key orchestrators, influencing various physiological processes, nutrient metabolism, and immune responses [1]. The fermentation of dietary substrates by these microbes not only sustains their own growth but also produces a plethora of metabolites that profoundly shape the local intestinal environment and exert systemic effects on the host. In recent years, there has been a growing interest in understanding how marine polysaccharides, abundant in the diet of coastal populations and increasingly recognized for their health-promoting properties, interact with the gut microbiota and influence intestinal ecology [2]. Marine polysaccharides encompass a diverse array of complex carbohydrates derived from seaweeds, algae, and other marine sources, exhibiting structural diversity and biochemical characteristics distinct from terrestrial plant polysaccharides. This overview aims to delve into the intricate interplay between gut microbiota and marine polysaccharides, shedding light on the mechanisms by which these polymers are fermented and metabolized within the intestinal milieu [3]. By elucidating the impact of marine polysaccharide fermentation on the composition, function, and diversity of gut microbial communities, as well as the resulting metabolic outcomes and host responses, we can gain valuable insights into their potential therapeutic applications and dietary implications for human health [4]. Through a comprehensive examination of current research findings and emerging trends in this field, this overview seeks to provide a holistic understanding of how the fermentation of marine polysaccharides by gut microbiota influences intestinal ecology and contributes to the intricate balance between microbial symbiosis and host physiology [5].

Future Directions

Elucidating specific interactions: Further research should aim to unravel the specific interactions between different types of marine polysaccharides and distinct microbial taxa within the gut microbiota. Understanding how these interactions modulate microbial composition and metabolic activity can provide valuable insights into designing targeted interventions for promoting gut health.

Exploring metabolic signatures: Investigating the metabolic signatures associated with the fermentation of marine polysaccharides by gut microbiota holds promise for identifying novel biomarkers of gut health and metabolic function. Metabolomic studies can elucidate the diverse array of metabolites produced during polysaccharide fermentation and their downstream effects on host physiology.

Impact on host-microbe crosstalk: Future studies should focus on elucidating the intricate crosstalk between marine polysaccharide fermentation products, gut microbiota, and host immune cells and epithelial cells. Understanding how these interactions influence immune regulation, barrier function, and inflammatory pathways can offer new avenues for therapeutic interventions in conditions such as inflammatory bowel disease and metabolic disorders.

Utilization in functional foods: Exploiting the health-promoting properties of marine polysaccharides through the development of functional foods and dietary supplements represents a promising avenue for translational research. Formulating products enriched with specific polysaccharides known to modulate gut microbiota composition and activity could offer targeted solutions for promoting gut health and preventing disease.

Impact of environmental factors: Investigating the impact of environmental factors, such as diet, lifestyle, and geographical location, on the fermentation of marine polysaccharides by gut microbiota can

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provide valuable insights into personalized nutrition and microbiome-targeted interventions. Understanding how individual variations in microbiota composition influence responses to marine polysaccharides can inform personalized dietary recommendations.

Clinical applications and therapeutic potential: Clinical trials are warranted to assess the therapeutic potential of marine polysaccharides in managing gastrointestinal disorders, metabolic syndrome, and other health conditions associated with dysbiosis. Rigorous clinical studies are needed to validate the efficacy, safety, and optimal dosing of marine polysaccharide-based interventions in diverse patient populations.

Integration of multi-omics approaches: Integrating multi-omics approaches, including metagenomics, metatranscriptomics, and metaproteomics, can provide a comprehensive understanding of the dynamic interplay between marine polysaccharides, gut microbiota, and host physiology. By combining insights from different omics layers, researchers can uncover complex microbial-host interactions and identify potential therapeutic targets.

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Conflict of Interest

None

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