Abstract

Irritable bowel syndrome (IBS) is a highly prevalent and chronic functional gastrointestinal disorder characterized by abdominal pain, bloating, and altered bowel habits. The underlying pathophysiology of IBS is multifactorial, involving gut–brain axis dysregulation, intestinal barrier dysfunction, and imbalances in the gut microbiota. Current therapeutic approaches primarily aim to alleviate symptoms often yielding inconsistent outcomes, highlighting the need for better interventions. Photobiomodulation (PBM) therapy, which involves the application of specific wavelengths of light to modulate cellular activity, has emerged as a promising non-invasive strategy for IBS. PBM primarily targets mitochondrial function, enhancing adenosine triphosphate production, reducing oxidative stress, and promoting cellular repair and resilience. These effects collectively contribute to reduced inflammation, improved gut barrier integrity, and modulation of the neural and immune pathways relevant to IBS. Recent evidence suggests that PBM favorably influence the gut microbiome composition and function and reduce neuroinflammation, both considered key contributors to IBS symptomatology. This review critically examines preclinical and clinical evidence supporting the use of PBM in the context of IBS, exploring its mechanisms of action and therapeutic potential. By addressing multiple pathophysiological targets, PBM represents a novel and potentially transformative approach for managing IBS, particularly in patients unresponsive to conventional therapies.
Keywords: Irritable bowel syndrome; Photobiomodulation therapy; Metabolism; Gastrointestinal microbiome; Light therapy

INTRODUCTION

Photobiomodulation (PBM) is a non-invasive therapeutic technique that utilizes low-level light energy—typically in the red and near-infrared (NIR) spectrum—to modulate cellular function and promote tissue repair []. Since its inception, PBM has been widely studied for its therapeutic potential across a range of conditions, including musculoskeletal injuries, neurodegenerative disorders, wound healing, and inflammatory diseases []. In recent years, growing interest has emerged in exploring PBM's application in gastrointestinal (GI) conditions, particularly irritable bowel syndrome (IBS).

IBS is a common functional GI disorder characterized by recurrent

abdominal pain, bloating, and altered bowel habits, including diarrhea, constipation, or a combination of both []. Although the exact pathophysiology of IBS remains unclear, it is thought to involve multiple interrelated factors such as abnormal gut motility, visceral hypersensitivity, disruptions in the gut–brain axis, immune dysregulation, and microbial imbalance []. Although the exact pathophysiology of IBS remains unclear, it is thought to involve multiple interrelated factors such as abnormal gut motility, visceral hypersensitivity, disruptions in the gut–brain axis, immune dysregulation, and microbial imbalance [,]. This therapeutic gap has spurred interest in alternative, mechanism-based interventions.

PBM represents a promising candidate for IBS management due to its ability to modulate key cellular and molecular processes. Its anti-inflammatory, antioxidant, and tissue-reparative effects have been well documented, suggesting a potential role in mitigating the chronic inflammation and oxidative stress frequently observed in IBS patients []. Furthermore, PBM's capacity to influence neural signaling and gut microbiota composition introduces additional pathways through which it may exert therapeutic effects on IBS symptoms. In this will explore the underlying mechanisms of PBM and evaluate emerging evidence supporting its application in the treatment of IBS.