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Enhancing Respiratory Health: Inhaled Synbiotic Administration

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Respiratory diseases, including asthma, chronic obstructive pulmonary disease (COPD), cystic fibrosis, various infections, and allergic conditions, pose significant global health challenges, increasing the demand for effective and sustainable treatment options. Studies have demonstrated that patients with respiratory disorders have distinct lung microbiome compositions compared to healthy individuals. Examples of microorganisms that show increased prevalence in these patients include *Chlamydia pneumoniae*, *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Aspergillus fumigatus*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*, which are associated with persistent wheezing, as well as immune and inflammatory responses (1-3).

Dysregulation of microbiota in these individuals often coexists with chronic gastrointestinal tract diseases. This may result from disruptions in gut microbiome composition caused by antibiotics, diet, and lifestyle factors, highlighting a significant bidirectional relationship between the lung and gut, known as the gut-lung axis (2, 4). Consequently, the use of probiotics, prebiotics, and synbiotics is being explored as a potential intervention to improve the quality of life for patients with respiratory conditions.

Dietary probiotics are live microorganisms that confer health benefits when administered in adequate amounts (2, 4). Prebiotics are non-digestible food substances that can be selectively fermented by the host microbiota, resulting in specific changes in the composition and/or activity of the gut microflora (4, 5). Most prebiotics are carbohydrates, such as oligosaccharides, characterized by their resistance to stomach acidity, lack of gastrointestinal absorption, ability to be fermented, and selective stimulation of intestinal bacteria growth and/or activity (5). Synbiotics, a combination of probiotics and prebiotics, are defined as "a mixture of live microorganisms and substrates selectively utilized by host microorganisms that confer health benefits to the host" (6, 7).

Synbiotics were initially and extensively administered orally, showing effects on both gastrointestinal and respiratory diseases. More recently, direct application of synbiotics to the respiratory system, particularly through dry powder inhalers, has emerged as a promising approach to enhance the pulmonary microflora. Direct lung administration could improve the lung microbiome, acting as a first line of defense against foreign pathogens (2).

In conclusion, synbiotic treatment shows potential in reducing pulmonary exacerbations and decreasing the need for additional antibiotic treatments by inhibiting the pathogenic activity of harmful bacteria (1). A variety of probiotics may be beneficial for this purpose, including *Bifidobacterium lactis*, *Bifidobacterium breve*, *Bifidobacterium longum*, *Bacillus clausii*, *Enterococcus faecalis*, *Lactobacillus casei*, *Lactobacillus rhamnosus*, *Lactobacillus acidophilus*, *Lactobacillus plantarum*, *Lactobacillus gasseri*, *Lactobacillus fermentum*, *Lactobacillus bulgaricus*, and *Streptococcus thermophilus* (1, 2, 7-10). However, further research is essential to explore their clinical efficacy and potential applications in treating various respiratory disorders.

Footnotes

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