

Revolutionising the Treatment of Respiratory Tract Diseases

EXPLORING THE BENEFITS OF LACTOBACILLI

Harnessing the potential of beneficial bacteria can lead the way in revolutionising the approach to addressing respiratory tract conditions. A thorough comprehension of these advantageous characteristics is essential for the development of precise strategies focused on modulating upper respiratory tract (URT) bacteria to prevent or treat symptoms.

This article delves into the promising realm of respiratory microbiome research and the potential it holds for transforming respiratory health.

THE EPHEMERAL EFFICACY OF ANTIBIOTICS

Once hailed as the panacea for infectious ailments, antibiotics have witnessed a gradual decline in their effectiveness. While potent against pathogenic bacteria, they often disrupt the fragile balance of the microbiome, potentially resulting in an array of complications. Compounding this issue is the looming threat of antibiotic resistance, a prospect that necessitates a long-term, sustainable solution.

LACTOBACILLI: A PATH TO SUSTAINABLE RESPIRATORY HEALTH

Lactobacilli are considered pivotal beneficial species within the human body, animals, and fermented food environments due to, among others, their antimicrobial and immunomodulatory capabilities. Their importance for the human body is best studied for the gastrointestinal tract and they are often considered probiotics or “live organisms, which, when administered in adequate amounts, confer a health benefit to the host”. However, the importance of these lactobacilli in other human body environments, including the respiratory tract (RT), hasn't been widely studied.

Nevertheless, research indicates that lactobacilli have significant potential in improving respiratory health.

Specific strains of lactobacilli for instance appear to exhibit differential prevalence and abundance between healthy individuals and those afflicted by chronic rhinosinusitis. This observation suggests a potential advantageous role for these lactobacilli within the respiratory tract.

LACTICASEIBACILLUS CASEI AMBR2

Among the beneficial lactobacilli strains, *L. casei* AMBR2 was isolated from the healthy respiratory tract and stands out for its remarkable attributes. Significantly, *L. casei* AMBR2 is perfectly fit to reside in the upper respiratory tract's unique conditions, characterised

by high airflow and oxidative stress. Despite the swift clearance mechanisms involving cilia in the nasal passages, this strain demonstrates strong adhesion to respiratory epithelial cells due to the presence of unique fimbriae structures, preventing rapid removal. Furthermore, this lactic acid bacterium exhibits potent antimicrobial activity against common respiratory bacterial and viral pathogens. In addition, it strengthens the nasal epithelial barrier and boosts the immune system. These promising characteristics position *L. casei* AMBR2 as a compelling treatment option for modulating the respiratory tract microbiome (microbial communities).

OPTIMISING PROBIOTIC DELIVERY

Current probiotic administrations typically involve oral ingestion, which

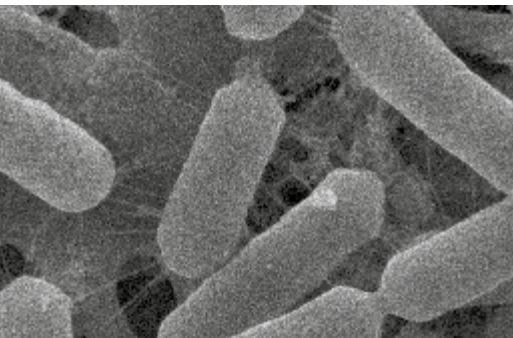
A better understanding of both the upper and lower respiratory tract microbiome also paves the way for microbiome therapy in persons with cystic fibrosis.



MY PULMONARY RESEARCH

PRODUCT DEVELOPMENT

does not facilitate direct interaction with the respiratory system. Test cases have indicated that the best approach is to directly administer the bacteria to the respiratory system through, for instance, throat sprays, nasal administration or tablets specifically manufactured to target the airways. Current challenges include ensuring bacterial stability under diverse conditions to locally target the airways and transitioning the research findings to clinical trials.



Scanning electron microscopy of respiratory tract isolate *L. casei* AMBR2 cell surface shows long, spike-like fimbriae

PEDIATRIC CARE FOR CYSTIC FIBROSIS

The research team of prof. Irina Spacova (UA) and prof. Lebeer (UA), in collaboration with prof. Stijn Verhulst (UA/UZA) and prof. Kim Van Hoorenbeeck (UA/UZA), is also exploring the potential of microbiome therapy tailored to the respiratory system of persons with cystic fibrosis (CF). *L. casei* AMBR2 also shows important protective features against common CF pathogens. Their research is primarily focused on young pediatric patients. Microbiome therapy may be valuable in early preventive stages of the diseases, as add-on for current therapies such as modulator therapy, which improves the function of the faulty protein, but is often only possible from a certain age.

MEDICAL LANDSCAPE

Nasal and throat sprays featuring carefully selected bacterial strain(s) based on in-depth scientific insight in de mode-of-action, are now being developed and tested. These novel sprays will target specific respiratory conditions, with nebulised lactobacilli

offering potential prevention or relief for individuals with certain respiratory conditions. However, the process to bring these therapies to market is intricate, with similar complexities as traditional drug development. It entails extensive design and development of the drug substance and drug product, industrialization through the careful set-up of a manufacturing line, all in line with the highest quality standards and new regulations. Clinical studies, securing funding, and collaborative research lie ahead.

CONCLUSION

*The exploration of lactobacilli and their potential in respiratory health conditions presents promising avenues for addressing Ear, Nose, and Throat (ENT) conditions. We have highlighted their unique attributes, including specific strains with the potential to enhance respiratory well-being. While antibiotics face challenges, the emerging field of microbiome therapy holds promise, with *L. casei* AMBR2 as one of the lead candidate strains. To locally target the airways, different formulations can be explored to deliver the bacteria where they can immediately enforce the host microbiome. Additionally, considerations for younger patients with cystic fibrosis have been discussed. The journey toward bringing lactobacilli therapies to market, is a path we are dedicated to following allowing us to ultimately relieve the suffering of a world of patients affected by respiratory ailments.*



 University of Antwerp

About dr. Ilke De Boeck

Ilke De Boeck has completed her studies of Bioscience Engineering in Cell- and Gene Biotechnology with a minor in Applications for Human Health Engineering at the KU Leuven in 2014. She started her PhD at the University of Antwerp in the LebeerLab, entitled 'Study of the upper respiratory tract microbiota and the potential of probiotics in the management of chronic rhinosinusitis', in collaboration with the ear, nose and throat department of the Antwerp University Hospital, led by prof. Olivier Vanderveken. Currently, she works as a postdoctoral researcher (FWO junior postdoc grant) in the LebeerLab with a main focus on the research line on the potential of probiotics for the respiratory tract. She is also the coordinator of the clinical trials and biobank of the lab.

ABOUT EU.RECA

The European Respiratory Cluster Antwerp provides a knowledge platform that focuses on the lung as a crucial part of the body, the healthy functioning of this vital organ and combating lung disease. There are many developments in the respiratory sector; the prevalence of lung disorders is increasing, but there is also a tremendous drive to get new treatments on the market.

As a catalyst for innovation, we bring promising start-ups into contact with leading companies, pharma with product designers, academics with entrepreneurs, and investors with patients. That is why our approach is based on interaction. Our extensive network will ensure a top-quality pool of participants; our workshops and symposia will encourage in-depth dialogue.

eu.reca facilitates innovation in the respiratory sector by providing innovation and business support for late-stage researchers, start- and scale-ups.

Visit www.eureca.world for more respiratory-related research insights from within our network, business services and events.

eu.reca fuels discussions by sharing point of views, research insights and innovations focused on respiratory health. Got something to share or interested to support? Reach out via info@eureca.world.