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Review Article

Probiotics to prevent acute respiratory infections in pediatric and adult populations

Alisson Camila Valladares Espinosa[1], Camila Brito Balanzategui[1], Albert Isaac Grijalva Velasco[2], Pierina Inés Cantos Márquez[2], Marilyn Paola León Cadena[3], Dario David Chicaiza Jácome[4], Carlos A. Chango Rodríguez[1]*, Galo D. Moreno Pineda[1]

[1]School of Medicine, UDLA University, Quito- Ecuador
[2]School of Medicine, Guayaquil University, Guayaquil- Ecuador
[3]School of Medicine, Escuela Superior Politécnica de Chimborazo University, Riobamba- Ecuador
[4]School of Medicine, Central University, Quito, Ecuador

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***Correspondence:**
Dr. Carlos A. Chango Rodríguez,
E-mail: carlosachangor@gmail.com

ABSTRACT

Respiratory tract diseases are among the most common infections of childhood and adolescence. Probiotics in recent years have been presented as a promise and prophylactic and curative alternative for various digestive, mental and respiratory pathologies. This is attributed to the great influence that the intestinal microbiota exerts on the immune system. Multiple studies indicate that an impact on the microbiota due to external or internal factors generates an alteration of the immune system. Among the uses that currently exist, they are used for the prevention and treatment of respiratory diseases in children, adolescents and adults. From the studies analysed, it is observed that *Lactobacillus casei* shows better results in the prevention of upper respiratory diseases than the rest of the probiotics in combination or alone, however the necessary administration time is unknown.

Keywords: Probiotics, Respiratory tract diseases, Microbiota

INTRODUCTION

Respiratory tract infections (RTIs) are conditions that commonly occur in pediatric patients. Globally, around 20% of deaths in children under 5 years of age are secondary to RTI, with pneumonia showing a high prevalence. Studies indicate that 25% of infants and 6% of children under 6 years of age experience RTIs. Respiratory tract infections are one of the main causes of the administration of antibiotics, in many cases unnecessary and causing high rates of bacterial resistance. Probiotics are small microorganisms that, when administered in adequate quantities, confer a certain benefit to the host.[1,2] Due to the high number of RTIs, multiple studies have been carried out on strategies that help prevent their development and appearance. Some show that probiotics decrease the duration and frequency of RTIs, while others indicate that they have no benefits.[3,4] It is thought that probiotics adhere to the intestinal mucosal lining, thus preventing infectious microorganisms from adhering and causing diseases. On the other hand, the mechanism at the level of the respiratory tract is not clear and there are even studies that mention that no significant changes were found. in cytokines after the use of probiotics for RTIs.[4] Respiratory tract diseases are common in Ecuador and other developing countries; malnutrition, low vaccination coverage, difficult access to a specialized health system, poverty, among other factors, play a fundamental role in the appearance of these diseases. They are a public health problem, generating a high cost to the health system due to the large number of patients that increase year after year, directly affecting the morbidity and mortality of each country.[5] Probiotics have been used to control the growth of potentially pathogenic bacteria, increase the number of beneficial bacteria, and restore lost metabolic activity.[6]

In 2011 a systemic review and meta-analysis of 10 randomized controlled trials involving 3451 participants was published, evaluating the use of probiotics to prevent RTIs in children and adults. The study found that probiotics were superior to placebo, reducing the number of RTI episodes and unnecessary antibiotic use. However, the meta-analysis did not evaluate the effect of the different colonies of the probiotics.[3] Respiratory tract infections can be caused by viruses, bacteria, and fungi. There is a symbiosis of highly pathogenic microorganisms with the usual microbiota that generates a benefit to the host. Multiple studies have shown that intestinal dysbiosis produces an alteration in the immune system and causes an increase in the risk of developing respiratory tract infections.[7,8]

The intake of probiotics can modify the intestinal microbiota and consequently generate a positive activation of the immune system. The effectiveness of its intake shows benefit in infectious processes such as: diarrhoea due to antibiotics, within the treatment of acute diarrhoea in children as well as necrotizing enterocolitis in preterm newborns. Its name is taken from its genus, spice and strain. Among the most studied we find *Lactobacillus, Bifidobacterium* and *Saccharomy cesboulardii*.

REVIEW

It is a descriptive-exploratory study type of bibliographic review. The literature search period is from 2014 to 2024 in electronic databases such as PUBMED, ELSEVIER, and Web of Science. The keywords used in the MesH search were; probiotics; respiratory tract diseases.

Search terms, level of evidence, summaries and keywords, exclusion criteria: not related to the topic, outside the year limit, not available; They will be classified by year, type of study and level of evidence. For eligibility, a critical reading is carried out, level of evidence, documents available for analysis and according to the topic. A total of 18 sources were obtained for analysis and synthesis. Among the main respiratory tract infections, we find rhinitis, tonsillitis, sinusitis, otitis media and pharyngitis. Its most frequent complications were fever, cough, sneezing, rhinorrhoea, headache, pneumonia and bronchitis. Studies carried out in pediatric and geriatric patients show that when probiotics are given in combination there is a significant reduction in the incidence of RTI or its complications. After the administration of probiotics, a decrease in the rates of respiratory tract infections is identified, especially in rhinitis, sinusitis and infections of the lung parenchyma.[9]

A randomized controlled trial carried out by Araujo et al shows that infants who were administered probiotics for 5 or 6 months have a lower rate of recurrence of RTI episodes, with a reduction in symptoms and duration of the disease. Skovbjerg et al indicates the use of probiotics for 10 days with a decrease in the RTI rate, while Rautava et al, administers them for a period of 10 to 12 months and indicates a marked reduction in the incidence of cases of otitis media in infants. Similarly et al use probiotics for two months in their study and show that there are fewer cases of RTI. Table I explains the reduction in ITR before and after the use of probiotics in a comparative manner.[10-12]

Mechanism of action of probiotics in respiratory tract infections

The vast majority of studies have been carried out in mice. Probiotics help maintain the integrity of the intestinal mucosa and thus make the absorption of viruses and bacteria difficult. These benefits are due to its cellular and humoral immunomodulatory role through the production of pro-inflammatory cytokines. After oral administration of *Lactobacillus casei* in mice infected with influenza, it was observed that the viral load decreased significantly. There was an increase in interferon (IFN) and tumor necrosis factors.[13] Probiotics can also act by inducing the synthesis of immunoglobulins in blood and respiratory secretions. In animals infected with *Pseudomona aeruginosa* pneumonia, the production of regulatory T cells increased after the administration of Lactobacillus.[14]

Probiotics used in pediatric patients

In India, a randomized, double-blind, placebo-controlled study was carried out in 4,500 neonates who were administered *Lactobacillus plantarum* for a duration of one week. A significant reduction was observed in the sepsis-death relationship, an objective that prevailed in this study.[15] In 2022, Cochrane published a systematic review that included 6,950 people ranging in age from children (1 year to 11 years), adults with an average age of 37 years, and seniors with an average age of 84 years. Two strains were used: *Lactobacillus plantarum* and *Lactobacillus paracasei* administered for more than three months. The authors conclude that compared to placebo, probiotics can reduce the number of respiratory infections and the duration of RTIs.[16]

Table 1: Comparison of the reduction of respiratory tract infections before and after the use of probiotics.

Diagnosis	Before using probiotics Frequency	percentage	After using probiotics Frequency	percentage	Decreased percentage in ITR
Recurrent Rhinitis	21	30	9	12	17
Recurrent otitis media	17	24	7	10	10
Recurrent tonsilitis pharyngitis	15	21	6	8	12
Pneumonia	11	15	4	5	10
Bronchitis	6	8	3	4.29	4.28

DISCUSSION

In recent years, the effect of probiotics on immune function has been a highly debated topic regarding the role they play in the improvement of certain diseases. Multiple studies indicate that after the administration of probiotics there is immunomodulation, generating and modifying T cells, which produces a reduction in infections of the gastrointestinal and respiratory tract. However, there are some answers that remain in the air, the establishment time, a strain or several combinations is necessary, in addition to which diluent is the most indicated and with the best tolerance.[17] The results of multiple investigations show that the probiotic *Lactobacillus casei* was superior to all others in reducing respiratory tract infections. It is important to highlight the substantial heterogeneity between administration time, age and dose. Adverse effects have been few after administration. The main ages that have been presented in studies on the use of probiotics are based on pediatric patients and few studies in adolescents and adults, making it necessary to carry out trials in these age groups, because there is a high prevalence of respiratory tract infections in these ages. In a randomized placebo-controlled meta-analysis where *Lactobacillus rhamnosus* GG was used compared to placebo, a potential effect of reducing respiratory tract infections, otitis media and inappropriate use of antibiotics was evident.[18] However, our analysis does not confirm this hypothesis because several studies confirm that within the series of probiotics used for RTI it is in the fifth priority. Furthermore, the combination of this probiotic added to another did not show efficacy in reducing respiratory symptoms.

Since only the probiotic *Lactobacillus casei* has shown positive effects on the reduction of respiratory tract infections, determining that there is not enough evidence for the widespread use of probiotics on the treatment or prevention of RTIs. A greater number of randomized and controlled studies with a greater number of participants are required to help determine a real benefit, however the evidence leaves us with wide doors and beneficial results that over the years can be satisfactorily confirmed with positive results.

CONCLUSION

Multiple probiotics are used continuously to avoid or reduce the number of cases or the severity of different respiratory tract infections. Only Lactobacillus casei has shown efficacy against infections, making it necessary to carry out more studies to help substantiate its effectiveness. use in daily practice. All studies carried out in animals or people indicate some beneficial effect on the use of probiotics, none report adverse effects, making their use safe. The implementation time is not clear, on the contrary, real benefits are found after six months of implementation.

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