



Zinc and *Bacillus clausii*: a promising combination to improve immunity in children?

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Dietary administration of zinc and use of probiotics can strengthen the immune system in humans, including children. This may lead to fewer and shorter respiratory tract infection episodes. Whether the combination of zinc and probiotics exerts synergistic effects remains to be tested.

Respiratory tract infections are common in childhood. While they are mostly mild, they not only cause suffering of the children but also impact the life of the parents, for instance by forcing them to stay home and miss work. On the other hand, exposure to viruses that are not considered life-threatening helps develop the immune system, thereby strengthening its ability to deal with more dangerous infectious agents in later life. Nonetheless, shortening and weakening periods of acute infection in children is desirable because it alleviates suffering of children and mitigates its impact on the life of the parents. This holds particularly true with interventions to shorten and weaken acute infections, such as those of the respiratory tract, that do not target the viruses but rather strengthen the pediatric immune system.

An expert panel of the European Food Safety Agency has stated that a cause-effect relationship exists between the dietary intake of zinc and normal function of the immune system [2]. It found that zinc deficiency renders people more susceptible to infections, while zinc supplementation has shown benefit for immune responses to bacterial and viral infections including effects in humans, including infants. The role of Zinc as an antiviral can be divided into two categories: 1. zinc supplementation to improve the antiviral response and systemic immunity in patients with zinc deficiency and 2. zinc treatment to specifically inhibit viral replication or infection-related symptoms [3].

Another general factor regulating immunity is the intestinal microbiome which has a complex and dynamic relationship with the immune system. The observed symbiotic dialogue plays an important role in the induction, education and function of the immune system [4]. Therefore, treatment with probiotics can improve the immune status as highlighted in a recent review [7]. For instance, the probiotic *Bacillus clausii*

has shown antimicrobial and immunomodulatory properties in multiple studies [5]. These appear to occur primarily in the gut and secondarily affect the overall immune function. Two studies in children with respiratory tract infections highlight these effects.

An initial study treated 10 allergic children with frequent upper respiratory infections attending a nursery school (mean age 4.4 years) for 4 weeks with a *B. clausii* preparation and evaluated its effects on various cytokines recovered from nasal lavage [1]. Treatment with *B. clausii* induced a biologically relevant and statistically significant decrease of IL-4 levels, and a significant increase of IFN- γ , IL-12, TGF- β , and IL-10 levels. These data suggested that oral treatment with *B. clausii* may exert immunomodulating activity by affecting the cytokine pattern at the nasal level in allergic children with recurrent respiratory infections.

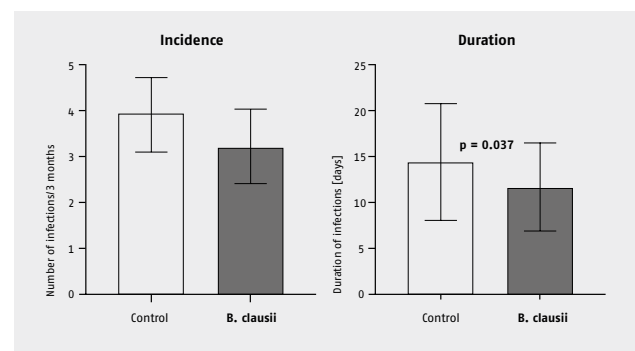


Fig. 1. Impact of treatment with *B. clausii* on incidence and duration of respiratory tract infection in children. Data obtained from [6] where no p-value was reported for the numeric reduction in incidence.

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To test the clinical relevance of such findings, a later study randomized 80 children (mean age 4.3 years; 37 known to be atopic) to receive *B. clausii* for 3 months or to be in the control group in a single-blind design with an additional 3 months of follow-up [6]. During the treatment period, children receiving *B. clausii* had fewer respiratory infections with a shorter duration (Fig. 1). Similar data were observed in the follow-up period and in the group of children with allergies.

In conclusion, evidence shows that dietary intake of zinc and administration of probiotics such as *B. clausii* can strengthen the developing immune system to reduce and shorten acute infections. Whether their combination exerts synergistic effects remains to be studied.

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