

Probiotics and Respiratory Tract Diseases

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Common infectious diseases (CID) of the airways and the gastrointestinal tract are still a considerable cause of morbidity and mortality in the elderly as aged people experience more frequent and severe community-acquired CID. Oral administration of specific probiotics has been reported to influence defense by the host in a beneficial way by modulating the immune system and increasing the transepithelial resistance [1–9]. Several studies documented that certain probiotics increase the number and activity of natural killer cells [3, 10], enhance antibody response to vaccination [1, 2, 4, 7] and increase the rate of seroprotection and seroconversion [1]. Probiotics were not only shown to enhance immune responses at the systemic level [8, 9], but there is also evidence for beneficial effects on the prevention and management of infections by probiotics [10].

For instance, it has been shown that probiotics reduce the risk of diarrhea including traveller's diarrhea [11–13]. Furthermore effects on the severity, duration and incidence of CID were demonstrated in a number of clinical trials [4, 14–25].

A meta-analysis of 8 controlled trials [26] showed a decrease in the occurrence of respiratory tract diseases as defined by the number of persons having at least 1 episode during the observation period. In this meta-analysis the severity and duration of the episodes was not significantly affected.

In a double-blind randomized controlled trial (DBRCT) in 1,000 shift workers [23] the intake of fermented milk drinks containing *Lactobacillus casei* DN-114 001 twice daily reduced the occurrence of CID during the cold season, the time until infections occurred and the duration of fever episodes. During infections the counts of leucocytes, granulocytes and natural killer cells were enhanced. In a multicentric, likewise DBRCT in 1,072 elderly the intake of the same drink reduced the mean duration of CID [24]. During the consumption period of 3 months the average duration of a CID episode has been significantly shortened to 6.5 versus 8 days in the control group ($p = 0.008$) as well as the cumulative duration of CID (7 vs. 8 days in the control group; $p = 0.009$). The reduction in both episode and cumulative duration was also significant for all upper respiratory tract infections and for rhinopharyngitis. In conclusion, the consumption of a fermented dairy product containing the probiotic strain *L. casei* DN-114 001 in elderly was associated with a decreased duration of CID and results in enhanced resistance of the elderly to CID.

Like elderly and shift workers, children show higher susceptibility to infections. Intense contacts in day care centers and schools predispose to transmissions of respiratory infections, which often result in missed days of both day care and parental work. Several studies have shown effects of probiotics on diarrhea [11–16]. In

DBRCT in children aged 3–5 years *L. acidophilus* NCFM alone and together with *Bifidobacterium animalis ssp. lactis* Bi 07 reduced the incidence of fever, cough and sneezing, their duration and the incidence of application of antibiotics [25]. Children receiving probiotic products were less absent from group child care, by 31.8% (single strain; $p = 0.002$) and 27.7% (strain combination; $p < 0.001$), compared with subjects receiving placebo treatment. Daily dietary probiotic supplementation for 6 months reduced fever, rhinorrhea and cough incidence and duration and antibiotic prescription incidence, as well as the number of missed school days attributable to illness.

Another recently published DBRCT examined the effect of a probiotic product containing *L. casei* DN-114 001 in 638 children 3–6 years old in day care/schools [27]. The incidence rate for CIDs in the active group was 19% lower than that of the control group ($p = 0.046$). However, the

effects of one product cannot be transferred to another. In a study recently conducted by the same working group [28] and following a similar study design, the strain *B. animalis ssp. lactis* (*B. lactis*) BB-12 did not show significant effects on CIDs. Therefore there is need for controlled clinical trials evaluating the health benefits of each probiotic food product containing well-defined probiotic strains.

There is increasing evidence for the efficacy of probiotics in respiratory tract diseases, which may justify the application of certain probiotics in this area.

Disclosure Statement

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