Nutritional factors affecting the gut-lung axis

Dietary factor	Effects on gut-lung axis
Dietary fibre	• Dietary fibre and resistant starch increase *Roseburia*, *Ruminococcus* and *Eubacterium* resulting in increased butyrate production. Dietary fibre reduces inflammation and shows beneficial effects in asthma, cystic fibrosis and COPD (1–3) • Fibre-rich diets are associated with better lung function and decreased risk of lung disorders. The beneficial effect of fibre on lung function is clinically more significant in smokers (4) • A healthy diet can lead to 33% decreased risk of COPD and a high fibre diet leads to a reduction in mortality from respiratory disease (4) • A high fibre diet changes not only the intestinal microbiota but also affects the lung microbiota and lung immunity. Dietary fibre increases short-chain fatty acid (SCFA) levels in the blood, providing protection against airway inflammation in the lungs through the induction of T regulatory cells (5–7)
Saturated fat	• Dysbiosis resulting from saturated fat results in reduced SCFA levels which enhances lung inflammation in response to allergens or infections (7–9)
Prebiotics, probiotics & synbiotics	• Administration of probiotics in cystic fibrosis may improve clinical respiratory as well as GI outcomes (10–12). For example, *L. reuteri* (1 tablet per day containing 100 million CFU) significantly decreases intestinal inflammation and digestive discomfort (13). Probiotic administration over 6 months (2 tablets per day, each containing 6 billion CFU *L. acidophilus*, *L. bulgaricus*, *B. bifidum* and *Streptococcus thermophiles*) results in a reduction in pulmonary exacerbations rate (16). In children, one month of probiotic treatment (2 capsules per day each containing 1 billion CFU *L. casei, L. rhamnosus, Streptococcus thermophilus, B. breve, L. acidophilus, B. infantis* and *L. bulgaricus*) results in a decline in pulmonary exacerbations in children (14) • Prebiotics and probiotics may be useful in treating asthma. For example, in children aged 6-14 with mild persistent asthma with *L. reuteri* for 60 days reduces bronchial inflammation (7,22). Supplementation with *L. gasseri* (2 capsules per day each containing 2 billion cells/capsule for 8 weeks) improves pulmonary function and symptoms in school children (23) • Synbiotics hold promise to suppress allergic responses and asthmatic inflammation when used in conjunction with other immunotherapies. The efficacy of synbiotics is age-dependent and transient, and may require continuous use (7). Synbiotic supplementation (*L. salivarius* or *B. breve* and GOS/FOS) significantly improves lung function in children with asthma while reducing asthma-like symptoms and the use of medications (24,25)
Omega 3	• Omega-3 fatty acid intake increases *Roseburia*, *Ruminococcus* and *Eubacterium* species in the gut resulting in increased butyrate production and reduced inflammation. Omega-3 has been shown to ameliorate asthma, pneumonia and COPD (8,26–28)
Western diet	• A diet high in animal protein, saturated and trans fat and low in fibre results in decreased *Bifidobacteria* and *Eubacterium* species, reducing SCFA levels and increasing inflammation (8)
Flavonoids	• Evidence is emerging that non-nutrient dietary constituents such as flavonoids can influence gut microbiota composition. Gallocatechin from black tea consumption is associated with changes in gut microbiota in cystic fibrosis (29)