THE IMPACT OF MICROBIOTA AND DIET ON ASTHMA

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Background
Asthma affects 300 million individuals worldwide, approximately. Usually, asthma manifests in early childhood with a hyper-activation of the T-helper 2 arm of the adaptive immune response, and an over-expression of the pro-inflammatory cytokines IL-4, IL-5 and IL-13, as well eosinophilia and mast cell infiltration of the airways. Furthermore, asthma development is closely related to the altered microbiota in childhood. The microbiota changes over time in response to environmental factors.

Microbiota
Gut microbiota
EPHEMERAL
Bacteroidetes
Firmicutes
Lactobacillus (1)
Proteobacteria (1)
Haemophilus
Pseudomonas

Gut microbiota
RESIDENT
Bacteroidetes
Firmicutes
Actinobacteria
Verrucomicrobia
Fusobacteria (lower)

They resemble due to microaspiration (gut to lung) and breathing (environment to lung), but at the same time differ due to clearance (coughing, mucociliary clearance, immune response).

The following microbiota modifications during early life are related to the increased risk of asthma:

- Nasopharyngeal microbiota: dominance of Moraxella, Streptococcus, Corynebacterium, Staphylococcus, Haemophilus, or Alloacoccus
- Faecal microbiota: (1) Bacillus fragilis and (1) Faecalibacterium, Rothia, Veillonella, Lachnospira species

Lower airway
Staphylococcaceae
Propionibacteriaceae
Corynebacteriaceae
Streptococcaceae
Veillonellaceae
Prevotellaceae

Upper airway
Bacteroidetes
Prevotellaceae
Veillonellaceae
Proteobacteria
Neisseria

Colon
Bacteroidaceae
Prevotellaceae
Rikenellaceae
Lachnospiraceae
Ruminococcaceae

Microaspiration

Dysbiosis

Early life critical window

Formula feeding
Diet can only modify microbiota in a long-term form applied during pregnancy, other situations (childhood and adult life) does in a transient form.

Diet recommendations to reduce exacerbations:
- Balance of polyunsaturated fatty acids - omega-3 promotes T helper-1 phenotype and stimulate regulatory T cells (Tregs)
- Vitamin D intake - it has a receptor in many immune cells and promote specific Tregs population
- High-fibre consumption - production short-chain fatty acids, energy source for colonocytes, reduce pH and other immune benefits

Mediterranean diet (Intangible Cultural Heritage of Humanity by UNESCO, 2010):
- high intake of unrefined plant-based foods (fruits and fresh vegetables, whole grains, legumes, olive oil and nuts)
- low to moderate consumption of foods of animal origin
- low intake of sugar, refined flour and fast food

Conclusions
- Asthmatics present an increased burden, and higher diversity (number of different species not balanced population) during bronchial hyperactivity
- Needed to define microbiota in order to diagnose and avoid dysbiosis state
- First efforts focused on gut microbiota ➔ GUT-LUNG AXIS

References