

Healthy Living, Good Food and the Gut Microbiota

CarboMet

Relevance and problem

The promotion and maintenance of a healthy relationship with our gut microbiota is increasingly understood to be important for human health and well-being, through every stage of life. The 100 trillion symbiotic microorganisms that reside in the human gut fulfil several vital biological functions and these imbalances in the microbial populations are associated with a number of inflammation and infection conditions, such as gut disorders (e.g. Irritable Bowel Syndrome, and the Irritable Bowel Diseases, Ulcerative Colitis and Crohn's disease) and non-communicable diseases (e.g. diabetes, cardiovascular diseases and cancers). In Europe, an estimated 2.5 - 3 million people are affected by Irritable Bowel Disease (IBD) with a direct healthcare cost of more than EUR 4 billion per year.¹ In conjunction with other related disease, the total cost of healthcare will likely reach tens of billions by 2030.

Challenges and opportunities

Carbohydrates play a number of crucial roles in maintaining microbial communities. For example, dietary fibre has a major influence on overall gut health and carbohydrates are the main modulators of the gut microbiota structure and function.² Carbohydrates are also found in the human gut lining and are the first point of contact between the microbiota and the host. Alteration of the carbohydrates in the lining give rise to several disease profile and are associated to gut disorders such as IBD. Therefore, a comprehensive understanding of the role of carbohydrates in the gut is essential to elucidate the interactions between the human host and gut microbiota in order to exploit these relationships for the benefit of human health. The ageing population and the growing prevalence of non-communicable disease is continuously adding strain to the healthcare system and it is vital to develop new strategies to improve health outcomes and to reduce healthcare costs. To stimulate growth in microbiome research, CarboMet identified 5 key areas³ that will expedite the development of new treatments and preventative measures.

- **Elucidating the relationship between microbiota and human health**
- **Biotechnological production of carbohydrates**
- **New metrology and analytical tools**
- **Data management and integration**
- **New strategies to promote healthy diet**

Social and economic impact

IBD is generally managed through anti-inflammatory drugs or through supplements to reduce inflammation. As a last resort, surgery can be used but this results on removing the entire colon. As a result, the quality of life for patients suffering from IBD is drastically reduced and the negative effect on the patients emotional and social life is estimated to cost the European industry EUR 1.5 billion per year.⁴

Impact on human health - HMO case study

At the end of the 19th century physicians observed that breast-fed infants had a higher survival rate than those who were bottle-fed in cases of infection and other disease. To date more than 150 of the 200 different human milk oligosaccharide (HMO) structures have been identified, 30 of which have been successfully synthesized and used in formula milk.

The most abundant of these is 2-fucosyllactose commercialised by a European biotechnology company and was granted the first EU approval of a HMO as a novel food ingredient.

References

1. Lakatos et. al., *J. Crohn's and Colitis*, **2013**, 7, 322-337.
2. Juge et. al., *Biochem. J.*, **2017**, 474, 1823-1836.
3. Microbiome Briefing paper - Carbomet.eu
4. Calculated from the average cost to industry per patient per year of EUR 500 taken from Canavan et. al. *Aliment Pharmacol Ther.*, **2014**, 40, 1023-1034.

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