GUT-BRAIN AXIS: we are what we eat

Vale, Abel (up.201806943@edu.ff.up.pt); Santos, Jibo (up.201807053@edu.ff.up.pt); Silva, Sara (up.201806946@edu.ff.up.pt); Oliveira, M. Beatriz P. P (beatoliv@ff.up.pt)
Faculdade de Farmácia da Universidade do Porto, Portugal

Introduction

The human gut has around hundred trillion microbes constituted by a complex mixture of bacteria, fungi to even viruses, designated as microbiota. The gut-brain axis is characterized by a bidirectional communication in which the Central Nervous System (CNS) influences gastrointestinal functions, and the microbiota also influences the CNS through the metabolites it produces. It is our responsibility to make it work in the best way, preventing diseases and promoting well-being.

A promising strategy to mitigate some neurological dysfunctions through the microbiota is to use either pre- or probiotics, even combining these two approaches or even act directly on some sorts of dysbiosis that may be caused by such irregularities in the human being[1].

Aim

In this study, we collect information from the literature about the gut microbiota and cerebral bidirectional axis, and how they are intertwined. Specifically, on how it may have a role in anxiety or depression and even influence diseases as Schizophrenia, Autism, Alzheimer and Parkinson.

NORMAL MICROBIOTA:
The two most prominent phyla are Firmicutes and Bacteroidetes, accounting for at least 70–75% of the microbiome. Proteobacteria, Actinobacteria, Fusobacteria, and Verrucomicrobia are also present but in reduced numbers. However, microbiome is a dynamic entity, influenced by several factors such as genetics, diet, metabolism, age, geography and use of antibiotics[2].

PARKINSON (PD):
- **↑** Probiotics; **↓** Enterobacteriaceae associated with postural instability and gait disturbance[3];
- **↑** Bacteroidetes **↑** Proteobacteria **↑** Verrucomicrobia in fecal samples and "pro-inflammatory" bacteria were in a higher abundance[4];
- **↓** Lactobacillus in fecal samples **↓** Clostridium and B. fragilis[5];
- **↓** Verrucomicrobiaceae **↑** Firmicutes **↓** Prevotellaceae **↓** Erysipelotrichaceae in PD patients who were diagnosed in the past year and were L-DOPA-therapy naïve although other medications were in use[6].

AUTISM:
- **↓** Bifidobacterium (B. longum); **↑** Desulfovibrio e Clostridiod[7];
- Cpiz gene encodes toxin b (neurotoxic doses induce autistic behaviour) more expressed in C. perfringens (isolated from autistic patients)[8];
- Casein gluten free and prebiotic B-GOS diet helps in behaviour symptoms[9];
- Probiotic L. reuteri **↑** improves behaviour (increases the production of oxytocin, in male mice)[10]; B. fragilis **↑** early administration improves behaviour[11];
- Delpro® (five probiotic strains and cell wall components from Lysed Bifidobacterium longum var. lactis) **↑** improves gastrointestinal behaviour and regulates symptoms[12].

ANXIETY:
- Probiotics: multi strain [S. thermophilus (two different strains), L. bulgaricus, L. lactis subsp. lactis, L. acidophilus, L. plantarum, B. lactis, L. reuteri] have an anxiolytic effect[13]; Lactobacillus plantarum DR7 **↓** relieves anxiety and is a promising psychobiotic[14];
- Prebiotic: B-GOS **↑** showed an improvement on anxiety levels in individuals with IBS (irritable bowel syndrome)[15].

EFFECTS OF THE MEDITERRANEAN DIET AND HEALTHY LIFESTYLE ON THE MICROBIOTA:
Rich in cereals, fruits, vegetables, legumes, garlic and onions accompanied by meat and fish;
- **↓** Cancer, neurodegenerative diseases, mobility difficulties and cardiovascular diseases when compared to other diets[16][17][18];
- **↑** Bacteroides and Clostridiod;
- **↑** Proteobacteria and Firmicutes[19].

Research shows that individuals who initially had a different diet and start implementing this one have a reduction in the symptoms of depression[20];

Regular physical activity contributes to a greater diversity of the microbiota[21];

Good food (like vegetables, fruits and fish) contributes to a healthy microbiota while bad food (such as red meat) is associated with an unhealthy one[22][23].

References


Conclusion

Microbiota takes an important role in the overall well-being whether in health or illness mainly due to the close communication between the brain and gut. Taking this into account, it is in the best interest to aim for a healthy microbiota, which produces metabolites that contribute to homeostasis. The healthy microbiota can be promoted by the consumption of healthy foods such as fruit, vegetables and fish combined with regular exercise. It also can be helped by introducing pre or probiotics (even a mixture of both) to the diet. It has been shown in CNS diseases that the gut microbiota is altered. This may explain some exacerbation of symptoms, which can be mitigated by regulating it. Although this might be difficult due to high individual variability (caused by genetics, age, use of antibiotics and metabolism).

However, there is a growing need for more studies to better understand the healthy microbiota, to characterize the microbiota in illness and the use of pre and probiotics in the improvement of symptoms.