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RELATIONSHIP OF GUT MICROBIOTA AND MENTAL HEALTH: THE INFLUENCE OF THE GUT-BRAIN AXIS

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Abstract: Introduction: The intestinal microbiota, composed of a diversity of microorganisms, plays a crucial role in mental health through the Gut-Brain Axis. This study sought to deepen the understanding of this relationship and its influence on the organism's homeostasis. Rationale: Understanding the influence of the intestinal microbiota on the Gut-Brain Axis is essential to identify new therapeutic and preventive approaches in the area of mental health, emphasizing the importance of a balanced microbiota for emotional and cognitive balance. **Objectives:** Analyze the relationship between the intestine and the brain and its influence on maintaining body stability. **Methods:** A qualitative approach was adopted through a literature review. The research involved the selection of scientific articles in databases such as PubMed, SciELO and LILACS, using descriptors such as "Brain-Gut Axis", "Brain" and "Mental Health" combined with the Boolean term "AND". Articles in Portuguese and English from the last seven years (2017 to 2023) were considered, excluding studies outside the scope of the research or with paid access. Results: Evidence indicates that the intestinal microbiota has significant potential to modulate the functions of the gastrointestinal tract and the brain through the Gut-Brain Microbiota Axis, a bidirectional communication pathway between these organs. Conclusions: The gut microbiota plays a crucial role in regulating gastrointestinal and brain functions through the Gut-Brain Microbiota Axis, using microbial signals and metabolites. However, longitudinal studies in humans are urgently needed to understand the origins and consequences of microbial imbalances, which are linked to neurological and neuroendocrine disorders. New experimental approaches under development promise to significantly contribute to essential advances in this field, providing essential discoveries in this area, highlighting the solid connection between the gut microbiota and mental health, reinforcing the importance of maintaining a balanced microbiota for psychological well-being.

Keywords: Brain. Gut-Brain Axis. Mental health.

INTRODUCTION

Recent research by Agus et al. (2021), revealed that the human intestine houses a complex community of microorganisms, including bacteria, fungi, viruses, archaea and protozoa. This diverse ecosystem plays a crucial role in fermenting non-digestible substances, synthesizing essential vitamins, defending against pathogens, strengthening the immune system and maintaining intestinal health.

The configuration of the intestinal microorganism community is strongly influenced by factors such as date of birth, method of delivery, dietary patterns during breastfeeding and use of antibiotics, as pointed out by Rinninella et al. (2019).

Passos and Morais-Filho (2017), highlight that the microbial community in the intestine is highly personalized, mainly made up of the groups Bacteroidetes, Firmicutes, Proteobacteria, Actinobacteria and other phylogenetic groups. Bacteroidetes and Firmicutes are particularly prevalent. Initial colonization occurs at birth, but the microbial profile can be modified throughout life, influenced by factors such as mode of birth, dietary patterns, hygiene practices, lifestyle and others.

According to research by Banfi et al. (2021), the initial colonization of the newborn's intestine is strongly influenced by the bacterial community's present in the mother's feces and vagina. The crucial stage of colonization occurs during birth, when the newborn comes into contact with the mother's vaginal

and intestinal microorganisms, establishing its own intestinal microbiota.

According to the findings of Oliveira et al. (2020), research has shown that exclusively breastfed newborns have a more limited microbial diversity than those who consume infant formula. During the first days of life, the microbiota of babies who receive only breast milk is mainly composed of Bifidobacterium sp. and Lactobacillus sp., which together can represent up to 90% of the microbial composition, in contrast to the microbiota of babies fed infant formula.

The study emphasizes the significant influence of the intestinal microbial community on the Enteric Nervous System (ENS) and Central Nervous System (CNS), playing a crucial role in the body's balance. Although the importance of the microbiota for mental health is increasingly recognized, more research is needed to fully understand this relationship. The objective of the study is to analyze this interaction and its implications for mental health and body balance.

METHODOLOGY

This study adopted a qualitative approach, using a literature review to understand the interaction of the Gut-Brain Axis and its impact on the stability of the organism and mental health. The methodology included searching for articles in the PubMed, SciELO and LILACS databases, using terms such as "Brain-Gut Axis", "Brain" and "Mental Health".

Articles in Portuguese and English published between 2017 and 2023 were considered, excluding those not related to the research objectives or that required payment for access. This methodological approach enabled a comprehensive analysis of updated scientific literature, contributing to a deeper understanding of the interrelationship between the intestine and the brain, emphasizing the importance of a balanced microbiota for psychological well-being.

RESULTS AND DISCUSSIONS

According to studies conducted by Pannaraj et al. (2017), highlight the gradual transformation of the intestinal microbiome of healthy babies in the first three years of life, resulting in a stable anaerobic pattern similar to that of adults. The complex process of colonization of the intestine is influenced by factors such as infections, method of delivery, use of antibiotics, diet and genetic makeup of the host, as mentioned by Cryan et al. (2019).

According to the findings of Quinones et al. (2018), the relevance of functional foods in promoting a healthy intestine is highlighted, showing that nutrients such as prebiotics and probiotics play essential roles in regulating the intestinal microbial community. These elements have functional characteristics that help improve the composition of the intestinal microbiota, resulting in significant advantages for the individual's general health.

According to the definition of the Food and Agriculture Organization (FAO, 2001) and the World Health Organization (WHO, 2001), probiotics are live, non-pathogenic microorganisms that, when consumed in appropriate quantities, offer benefits for the host health.

According to Shen et al. (2018), their observations indicate that a breakdown in the balance of the intestinal microbiota, called dysbiosis, results in a reduction in the intestinal defense capacity and regulation of the immune system. This, in turn, leads to a decrease in the body's immunity and an increase in the presence of pathogens, which can invade the intestinal mucosa.

Illiano et al. (2020), confirm the idea that the microbiota present in the intestine can influence the CNS in several ways. This is possible through the release of molecules that, when entering the bloodstream, have the

ability to reach the CNS and stimulate specific receptors on neural cells.

This influence was highlighted by Osadchiy and colleagues (2019), highlighting that communication between the intestinal microbiome and the CNS is mediated by intermediates derived from intestinal microorganisms, such as short-chain fatty acids (SCFAs), secondary bile acids (2BAs) and tryptophan metabolites.

Disruption of this complex relationship is directly associated with the pathogenesis of several disorders, including motility disorders, behavioral changes, neurodegenerative diseases and immune system disorders, as highlighted by Strandwitz (2018).

In studies carried out by Banfi et al. (2021), the complex communication system of the Intestine-Brain Microbiota Axis is portrayed through several pathways, which include the neural pathways of the Autonomic Nervous System (ANS), the ENS, in addition to hormonal pathways, such as the hypothalamic-pituitary axis- adrenal (HPA), and humoral pathways.

In their research, Sun et al. (2020), emphasize that the ANS, together with the HPA axis, plays an essential role in regulating intestinal function, particularly in stressful situations. One way to achieve this effect is by stimulating the release of signaling substances by neurons and glands, such as norepinephrine, catecholamines, serotonin and cytokines, as shown in figure 1.

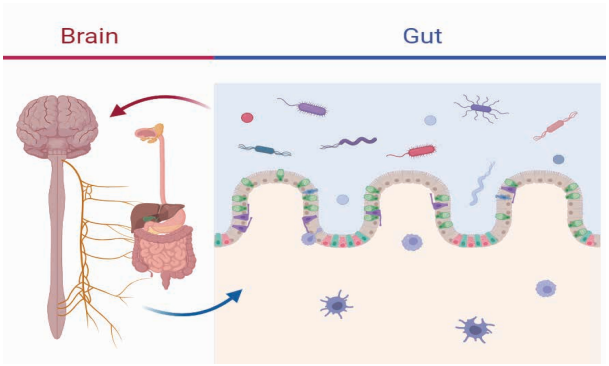

Figure 1: Representation of the bidirectional interaction between the intestinal microbiota and the brain.

Source: Adapted Biorender (2023).

As emphasized by Deng et al. (2021), the main metabolite resulting from this process is serotonin. Serotonin is predominantly produced by enterochromaffin cells, playing a significant role in modulating several aspects, such as cognition, reward and physiological processes. It is present in greater quantities in the GIT (around 90%) and also in the brain.

According to research conducted by Gao et al. (2020), serotonin is identified as an essential monoamine that operates as a crucial neurotransmitter in the CNS, playing a fundamental role in regulating emotional control, food intake, sleep and pain processing. It is essential to highlight, however, that the amount of serotonin present in the CNS constitutes only a tiny fraction of the total serotonin existing in the body.

Increasing evidence indicates that the gut microbiota not only affects gastrointestinal physiology but also plays a significant role in regulating CNS function. This occurs through the modulation of communication pathways in the so-called gut-brain microbiota axis, influenced by the various metabolites produced by intestinal microorganisms, as highlighted by Kennedy et al. (2017).

FINAL CONSIDERATIONS

Accumulated studies demonstrate that

the intestinal microbiota has considerable potential to regulate the fundamental functions of both the gastrointestinal tract and the brain, influencing these systems through signals and metabolites produced by microorganisms. This happens through the so-called gut-brain microbiota axis, a bidirectional communication pathway between the intestine and the brain.

However, it is urgent to carry out longitudinal studies in humans that can clarify the origins and consequences of dysbiotic states, since these states are related to the pathogenesis of several neurological and neuroendocrine disorders. The new experimental approaches that will be developed in the coming years will certainly contribute to essential discoveries in this field of the Gut-Brain Axis.

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