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The influence of the gut microbiota on mental health: a biomedical approach.

The influence of the gut microbiota on mental health: a biomedical approach
The influence of the intestinal microbiota on mental health: a biomedical approach

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SUMMARY

Introduction: The gut microbiota plays crucial roles in regulating the immune system, metabolism, and the synthesis of neurotransmitters related to brain function. This study aimed to explore the relationship between the gut microbiota and neurotransmitter regulation in neuropsychiatric disorders, with particular attention to the gut-brain axis. Methodology: This is an integrative literature review conducted in the PubMed Central database between August 2025 and June 2026.

Articles published between 2020 and 2025 that directly addressed the relationship were selected. This study investigated the relationship between the gut microbiota, mental health, and the gut-brain axis. Results: The reviewed research indicated that changes in the gut microbiota are associated with conditions such as anxiety and depression. Dysbiosis has been shown to impact the synthesis of neurotransmitters such as serotonin, dopamine, and GABA, as well as interfering with inflammatory and neuroendocrine processes. The therapeutic potential of modifying the gut microbiota through probiotics, prebiotics, and dietary changes was also highlighted.
Discussion: The results highlight the relevance of the gut microbiota in the pathophysiology of neuropsychiatric disorders, although the methodological variability among the studies indicates the need for more uniform investigations. Final considerations: The research concludes that the gut microbiota plays an essential role in the regulation of neurotransmitters and presents promising potential for innovative therapeutic strategies in mental health.
Keywords: gut microbiota; gut-brain axis; neurotransmitters; mental health; dysbiosis

Descriptors: *gastrointestinal microbiome, mental disorders,* and the *brain-gut axis."*

INTRODUCTION

The gut microbiota is a diverse ecosystem of microorganisms, such as bacteria, viruses, Archaea and fungi. This microbial group plays fundamental roles in the physiology of host, including defense against pathogens, immune modulation, and regulation metabolic. Thus contributing directly to the maintenance of health (Paul et al., 2025)

The gut microbiota plays an essential role in the production of metabolites that They regulate the integrity of the intestinal barrier, metabolism, and immune responses. Metabolites act directly and indirectly on the body's functions, influencing both the host as well as the microbial community itself (Liu et al., 2022). Among these compounds, They highlight short-chain fatty acids such as acetate, propionate, and butyrate, which contribute In reducing inflammation, they modulate the immune response through molecular mechanisms.

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specific and contribute to maintaining intestinal integrity (Yoo et al., 2020)

In this context, the brain-gut axis stands out as a communication system.
bidirectional communication between the central nervous system and the gastrointestinal tract, via neural pathways,
endocrine and immunological. This relationship allows changes in the gut microbiota to affect
directly affects brain functions such as mood, cognition, and behavior (He et al., 2024).

The density of immune cells in intestinal tissue highlights the crucial role of the gut-brain axis.
The brain and the control of inflammatory homeostasis.

The interaction between the gut and the brain occurs through various pathways, including the vagus nerve, one of the main signaling pathways. In addition to the gut microbiota contributing to the production and modulation of neuroactive compounds, such as metabolites and neurotransmitters, serotonin, and Dopamine, gamma-aminobutyric acid (GABA), and glutamate are substances that help in... regulation of neural circuits associated with emotional and behavioral well-being (Mhanna et al., 2024; Guo et al., 2020). Therefore, the microbiota plays an important role in Maintaining neuropsychological health.

Changes in the composition of the gut flora, also known as dysbiosis, have been shown to be associated with the emergence of neuropsychiatric disorders, including anxiety, Depression and bipolar disorder. There is evidence that these conditions are associated with variations in the diversity and quantity of microorganisms, as well as modifications in the axes neuroendocrine and inflammatory systems, such as the hypothalamic-pituitary-adrenal axis (Carra et al., 2021; Xiong et al., 2023). These changes can directly affect the production of Neurotransmitters and the stress response contribute to the pathophysiology of these disorders.

The gut microbiota also actively participates in the regulation of production and neurotransmitter communication, playing an essential role in the interaction between the system digestive system and central nervous system. Research suggests that changes in this system may to affect serotonergic, dopaminergic, and GABAergic pathways, influencing the state emotional and mental health (Qu et al., 2024; Gurow et al., 2025; Huang and Wu, 2021). In that In this context, microbiota modulation emerges as a promising approach for interventions. therapeutics, which may include the use of probiotics and prebiotics, as well as modifications to diet.

Thus, the importance of this study lies in the need to elucidate the mechanisms. that connect gut flora to mental health, considering the growing impact of this relationship. in public health and the therapeutic potential of the gut flora. Furthermore, it is important to highlight the contribution of the biomedical professional in exploring these processes, aiming at the development of evidence-based diagnostic and treatment strategies (Neves; Silva; Cunha, 2021).

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Therefore, the overall objective of this study is to investigate the relationship between the gut microbiota and the Neurotransmitter modulation in the context of neuropsychiatric disorders. Among the Specific objectives include understanding the cellular and molecular mechanisms that involve the gut-brain axis, identifying changes in the microbiota associated with Disorders such as anxiety and depression, and the analysis of the potential for therapeutic interventions. that aim to modulate the microbiota

1. METHODOLOGY

This study is characterized as an integrative literature review, a method that allows for... A synthesis of scientific knowledge on a given topic, enabling critical analysis and... Integration of relevant research results. A literature review was conducted. between August 2025 and June 2026, through a structured search in the database of PubMed Central data were used to select articles after language restriction criteria were applied. published in the last five years.

The search strategy was based on descriptors obtained from the Health Sciences Descriptors. (DeCS), including “gastrointestinal microbiome”, “mental disorders” and “brain-gut axis”, combining them using the Boolean operators AND, OR, and NOT, in order to expand and refine the results. The search was conducted systematically, ensuring greater Scope, relevance, and reliability of the selected studies.

The inclusion criteria adopted were: articles published between 2020 and 2025, available in complete texts, written in the selected languages, and directly addressing the relationship between the gut microbiota and the gut-brain axis, focusing on the physiological mechanisms and molecular and their implications for mental health. On the other hand, articles were excluded. duplicates, abstracts, incomplete studies, articles without a clearly described methodology and publications not directly related to the research objectives.

2 RESULTS

Through a structured database search, 4,388 studies were identified. After screening by reading titles, articles that did not have a direct link were excluded. with the proposed theme, as well as those focusing on studies with animals or in conditions not covered in this topic. Immediately afterwards, the remaining abstracts of the [documents/resources] were read. which articles were excluded due to low quality, not focusing on mental health, or for

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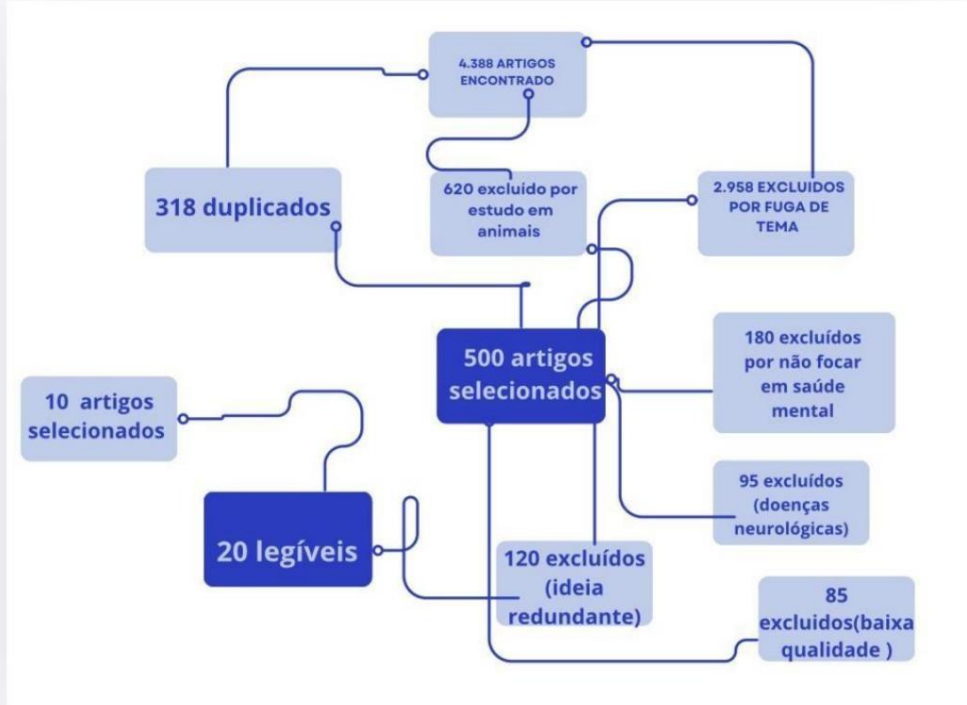
focusing on neurological diseases. After applying the inclusion and exclusion criteria and the After a comprehensive reading of potentially relevant articles, 10 articles were selected. How se muestra en la Figura 1.

Figure 1. Article selection flowchart, 2026



Source: Author's own work, 2026.

Among the 10 selected articles, studies investigating the relationship between the The gut microbiota and mental health, with an emphasis on the gut-brain axis mechanism. Studies address the influence of microorganisms on the modulation of neurotransmitters, in inflammation and disorders such as depression and anxiety, as well as assessing dysbiosis and use. using probiotics as a therapeutic strategy.

Details of the articles, such as title, authors, year, objectives, and main findings, can be visualized in Table 1.

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Table 1. Scientific articles by year of publication, objective and results, 2026.

Article title	Author(s)	Year	Study Objective	General Summary/Abstract
Human Gut Microbiota and Mental Health: Advancements and Challenges in Microbe-Based Therapeutic Interventions	Verma H. et al.	2020	To analyze the role of the gut microbiota in mental health.	Evidence suggests that the microbiota influences neurological functions through metabolic pathways. immunological and neuroendocrine.
Gut microbiota and major depressive disorder: A systematic review and meta-analysis	Sanada K. et al.	2020	To assess the relationship between microbiota and depression.	This demonstrates the association between alterations in the gut microbiota and major depressive disorder.
The role of the gut microbiota in the pathophysiology of mental and neurological disorders	Pusceddu MM et al. 2020		Investigating the role of microbiota in mental and neurological diseases to these conditions.	shows that dysbiosis contributes such as depression, anxiety, and Alzheimer's.
Microbes and mental health: Can the microbiome help explain clinical heterogeneity in psychiatry?	Hayes CL et al.	2020	To assess the influence of microbiota on psychiatric clinical variability.	It suggests that differences in the microbiota explain distinct responses in psychiatric patients.
Influence of gut microbiota dysbiosis on brain function: A systematic review	Liu T. et al.	2020	To analyze the effects of dysbiosis on brain function.	It links microbial changes to the modulation of neurotransmitters and behavior.
Updated review of research on the gut microbiota and depression	Yang Y. et al.	2020	Reviewing the relationship between microbiota and depression.	Evidence of bidirectional communication between the gut and the brain associated with depression.
Gut microbes in neurocognitive and mental health disorders	Halverson T. et al.	2020	Investigating microbiota in neurocognitive disorders	It points to the microbiota as a relevant factor in the development of mental illnesses.
The brain–gut–microbiome axis in psychiatry	Jang SH et al.	2020	Analyzing the gut-brain axis in psychiatry	It highlights two-way communication and its clinical importance.
A gut feeling: The importance of the intestinal microbiota in psychiatric disorders	Ochoa-Repáraz J. et al. 2020		Assessing the microbiota in psychiatric disorders	It shows the interaction between the microbiota, the immune system, and the nervous system.
The gut microbiota–brain axis in behavior and brain disorders	Morais LH et al.	2021	Investigating the gut-brain axis and behavior.	This demonstrates that the microbiota regulates the immune, metabolic, and nervous systems.

Source: Author's own work, 2026.

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3 DISCUSSION

The results found are in agreement with Verma et al. (2020), who highlight the microbiota.
The gut as an important modifier of mental health, with well-founded therapeutic potential.
in microbial interactions. According to the authors, the interaction between intestinal microorganisms and
The central nervous system is directly related to neurochemical processes associated with
behavior, cognition, and mood. Similarly, Morais et al. (2021) describe the axis
The gut-brain system acts as a fundamental means of bidirectional communication, capable of interfering.
directly in brain functions and behavioral responses mediated by neural systems,
immunological and metabolic.

Furthermore, Sanada et al. (2020), in a methodological review and meta-analysis, showed strong evidence.
association between alterations in the gut microbiota and depressive disorders, corroborating the
The authors analyzed findings from this study. They noted significant changes in the composition of the microbiota.
The intestinal tract of individuals with depression compared to healthy individuals. Also, a relationship...
maintained by Yang et al. (2020), who emphasize that dysbiosis is directly associated with
pathophysiology of depression.

Pusceddu et al. (2020) reinforced these data by revealing that the gut microbiota acts as
a relevant form in the pathophysiology of neurological and mental disorders, influencing both the
development regarding the evolution of these conditions. Similar to Halverson et al.
(2020), reinforcing the link between gut microorganisms and neurocognitive changes and
psychiatric disorders, demonstrating that variations in microbial diversity can directly affect
emotional and cognitive functions.

Additionally, Jang et al. (2020) highlight the importance of the gut-brain axis, revealing
Its influence on the microbiota, brain function, and emotional regulation. Ochoa Repáraz
This perspective is further enhanced by emphasizing the role of the microbiota in controlling immunological processes.
related to mental disorders, especially those linked to systemic inflammation and
neuroinflammation.

HAYES et al. (2020) highlight that the gut microbiota can contribute to the understanding of
Clinical variation observed in psychiatric disorders, since people with the same
Diagnoses can present distinct profiles of microorganisms. This point underscores the
The complexity of the relationship between the gut microbiota and mental health highlights the importance
more specific strategies for each individual.

According to the data analyzed, it is noted that the gut microbiota directly affects modulation.
of neurotransmitters and the stability of the gut-brain axis. A process that involves multiple

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pathways, such as endocrine, immunological, and neural pathways, allowing constant communication between the central nervous system and intestines.

According to Liu et al. (2020), gut dysbiosis can influence brain function through of neurochemical changes, directly impacting emotional response and behavior.

Aligning with Yang et al. (2020), who highlight the relationship between the gut microbiota and changes in neurotransmitter levels associated with depression.

Verma et al. (2020) emphasize that the gut microbiota influences the production of metabolites that They act on the central nervous system, modulating cognitive and emotional responses. Interaction that This is also discussed by Morais et al. (2021), who highlight the role of microbiota in controlling behavior and neurological disorders.

Pusceddu et al. (2020) and Halverson et al. (2020) show that the interaction between the microbiota and the The immune system contributes to inflammatory processes, which can affect the brain, which This is also reinforced by Ochoa-Repáraz et al. (2020). Mechanisms that contribute to explaining the The observed association between dysbiosis and neuropsychiatric disorders, considering that the Chronic inflammation can affect neurotransmission and neural plasticity.

Jang et al. (2020) emphasize that the connection between the brain and the gut microbiota impacts the reactions to stress and neuroendocrine processes, increasing understanding.

Regardless of the relevant findings, this study has limitations, especially regarding... to the nature of the data analyzed. The methodological heterogeneity among the included studies, which This can influence the analysis of the results, as discussed by Sanada et al. (2020). evidenced by the variations observed between them.

Furthermore, Liu et al. (2020) indicate that several studies still show limitations regarding Methodological standardization makes it difficult to achieve a more precise comparison between results. Halverson et al. (2020) highlight the need for greater detail in clinical studies, especially to understand the possible relationship between microbiota and mental disorders

Another crucial aspect is the intricate relationship between the gut-brain axis, as evidenced by Jang et al. al. (2020), according to which genetic, dietary and emotional factors can affect the microbiota and neuropsychiatric outcomes. HAYES et al. (2020) highlight that the clinical diversity of Psychiatric disorders make it challenging to establish a specific microbiological pattern. related to mental illnesses

The results of this study have relevant implications for understanding disorders. neuropsychiatric. From a theoretical perspective, it strengthens the role of the gut microbiota as A central component in the control of the central nervous system. As reported by Morais et al. (2021) and Verma et al. (2021)

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In the clinical sphere, the findings suggest that modulating the microbiota may constitute a promising therapeutic strategy. Verma et al. (2020) highlight the advancement of mediations based in microorganisms, while Yang et al. (2020) reinforce the relevance of this A method of treating depression and other mood disorders.
Furthermore, Ochoa-Repárazi et al. (2020) show that microbiota variation can interfere directly affecting immune function, contributing to the reduction of inflammatory processes. associated with mental disorders. Sanada et al. (2020) also suggest that microbial changes They may, in the future, be used as biomarkers to aid in and monitor diseases. mental.

Given the findings, the need for further research on the subject becomes clear. Molecular and cellular mechanisms involved in the interaction between the microbiota and the nervous system. central.

Morais et al. (2021) recommend that future studies focus on understanding in-depth study of the gut-brain axis; however, Verma et al. (2020) emphasize the need for Develop therapies based on microbial modulation.
Additionally, Sanada et al. (2020) and Liu et al. (2020) reinforce the importance of clinical studies. robust and standardized. Jang et al. (2020) reinforce the need for integrative strategies in psychiatry, considering the complexity of the gut microbiota.
Thus, the results of this study show that the gut flora plays a role. crucial in the modulation of neurotransmitters and in the regulation of the gut-brain axis, being directly associated with the emergence of neuropsychiatric disorders. The findings are in In accordance with the reviewed research, emphasizing the relevance of the microbiota as a target. therapeutic and as a vital component for understanding mental health.

FINAL CONSIDERATIONS

The final considerations of this study allowed us to understand that the gut microbiota plays a role. plays a crucial role in the regulation of neurotransmitters and in the interaction between the gut and the system. central nervous system, and is directly linked to the development of disorders neuropsychiatric conditions, as well as anxiety and depression. Thus, the established objectives were affected, allowing for a greater understanding of the cellular and molecular mechanisms at play. in the gut-brain axis , as well as microbial modifications related to disorders mental health issues and the therapeutic potential of interventions focused on modulating the gut microbiota. Furthermore, the investigation highlights the need to advance research in this field, considering

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the growing connection between mental health and gut health

In this context, it is important to highlight the relevance of biomedical professionals, especially in the areas of analysis.
clinical, microbiological and biomolecular fields, as well as scientific research, contributing to the
improvement of diagnostic methods, studies on biomarkers and new strategies of
Treatments related to the gut microbiota. For the population, the results of this study
They highlight the importance of prevention and health promotion, and the adoption of habits that are favorable to...
Balancing the gut microbiota, with the goal of improving quality of life and health.
mental. Finally, it is recommended that future investigations explore in more depth the
molecular mechanisms involved in the gut-brain axis and seek new strategies.
therapies based on modulating the gut microbiota.

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NEVES, CA; SILVA, RP; CUNHA, AS Biomedical applications in the study of microbiota

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