

**GUT MICROBIOTA AND NEUROPSYCHOLOGICAL DEVELOPMENT IN CHILDREN: CURRENT PERSPECTIVES AND REHABILITATION STRATEGIES**

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**ANNOTATSIYA:**

*The gut microbiota has emerged as one of the most important regulators of human health during childhood. Recent studies have demonstrated that intestinal microorganisms play a critical role not only in digestion and immune maturation but also in neuropsychological development through the gut-brain axis. Alterations in microbial diversity during early life have been associated with cognitive impairment, behavioral disorders, emotional dysregulation, and delayed neurodevelopment. This review summarizes current scientific evidence regarding the relationship between gut microbiota and neuropsychological development in children and discusses rehabilitation strategies aimed at restoring intestinal microbial balance. Literature published in major international databases was analyzed, focusing on microbial composition, immune regulation, microbial metabolites, dietary interventions, probiotics, and pediatric rehabilitation. Current evidence suggests that modulation of gut microbiota may become an important component of multidisciplinary rehabilitation programs for children with neurodevelopmental disorders.*

## **Introduction**

The first years of life represent a critical period for brain maturation and neuropsychological development. During this period, the intestinal microbiota undergoes rapid maturation and establishes a complex ecosystem that interacts continuously with the immune, endocrine, and nervous systems. The gut–brain axis is a bidirectional communication system involving neural pathways, immune mediators, hormones, microbial metabolites, and the vagus nerve. Growing evidence indicates that disturbances in gut microbiota composition may influence emotional regulation, learning ability, cognition, and social behavior. Several pediatric disorders, including autism spectrum disorder, attention-deficit/hyperactivity disorder, anxiety disorders, and developmental delay, have been associated with intestinal dysbiosis. Consequently, gut microbiota has become an important research target in pediatric neurology and rehabilitation medicine.

## **Aim of the Study**

To review current evidence regarding the role of gut microbiota in neuropsychological development in children and evaluate modern rehabilitation approaches targeting intestinal microbial balance.

## **Materials and Methods**

A narrative review of scientific literature was conducted using PubMed, Scopus, Web of Science, and Google Scholar databases. Publications from 2020–2026 concerning gut microbiota, neurodevelopment, cognitive function, pediatric rehabilitation, probiotics, and dietary interventions were included. Original research articles, systematic reviews, and meta-analyses published in English were evaluated. Duplicate studies, conference abstracts, and animal-only experiments were excluded.

## **Results**

Current evidence demonstrates that early microbial colonization significantly influences normal brain development. Beneficial microorganisms participate in immune regulation, vitamin synthesis, neurotransmitter production, and maintenance of intestinal barrier integrity. Reduced microbial diversity has been associated with delayed language acquisition, impaired cognitive development, emotional instability, sleep disorders, and behavioral abnormalities.

Several studies indicate that intestinal microorganisms regulate serotonin, dopamine, gamma-aminobutyric acid (GABA), and short-chain fatty acid production, all of which are essential for normal neuronal function. Clinical trials evaluating probiotic supplementation have reported improvements in gastrointestinal symptoms, sleep quality, emotional regulation, and certain cognitive outcomes, although results remain heterogeneous.

## **Discussion**

The gut microbiota has become an important therapeutic target in pediatric rehabilitation. Microbial metabolites influence synaptic plasticity, neurogenesis, immune homeostasis, and neuroinflammation. Dietary interventions rich in dietary fiber, fermented foods, probiotics,

and prebiotics may positively modify gut microbial composition and improve rehabilitation outcomes.

However, current evidence remains limited by differences in study design, microbiome analysis methods, intervention duration, and patient characteristics. Future multicenter randomized controlled trials are needed to establish standardized rehabilitation protocols incorporating microbiota-based therapies.

### **Conclusion**

Gut microbiota plays a fundamental role in normal neuropsychological development during childhood. Increasing evidence supports the hypothesis that intestinal dysbiosis contributes to various neurodevelopmental disorders through immune, metabolic, and neural pathways. Microbiota-targeted rehabilitation strategies, including dietary management, probiotics, and multidisciplinary interventions, may improve neurological outcomes and quality of life in affected children. Further high-quality clinical research is necessary to translate current evidence into routine pediatric practice.

### **Conflict of Interest**

The authors declare no conflict of interest.

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