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Psychobiotics: An emerging probiotic in psychiatric practice



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ABSTRACT

Intestinal microbial flora plays critical role in maintenance of health. Probiotic organisms have been recognized as an essential therapeutic component in the treatment of intestinal dysbiosis. Current research suggests their health benefits extends beyond intestinal disorders. The neuroactive molecules produced by the gut microbiota has been found to modulate neural signals which affect neurological and psychiatric parameters like sleep, appetite, mood and cognition. Use of these novel probiotics opens up the possibility of restructuring of intestinal microbiota for effective management of various psychiatric disorders.

There is compelling evidence that most organic human diseases also have psychiatric component [1]. This is especially common in gastro-intestinal disorders such as inflammatory bowel disease. Altered intestinal microbiota, i.e., dysbiosis has been found to be strongly associated with these conditions [2]. In the light of research on human microbiome, it is now possible to explain the significance of gut microbial consortia in mental health. Among numerous commensal gut microbes, *Lactobacillus*, *Bifidobacterium*, and *Saccharomyces* exert beneficial health effects by restoring the balance of gut flora. These beneficial bacteria, traditionally known as probiotics, have been employed to treat intestinal dysbiosis associated with prolonged antibiotic use, chemotherapy, *Clostridium difficile* infection, and traveler's diarrhea. Interestingly, some of the intestinal microbes, i.e., *Lactobacillus acidophilus*, *Bifidobacterium infantis*, *Bifidobacterium longum*, *Candida*, and *Streptococcus*

have been found to produce psychotropic effects either by secreting neurotransmitter molecules (e.g. gamma-aminobutyric acid, glycine, serotonin, and catecholamines) or by regulating endocannabinoid receptor expression [3]. The term "psychobiotic" has been introduced to designate this novel class of probiotics, which has wider applications in psychiatric practice [4].

Enteric nervous system and vagus nerve connect intestine with central nervous system. Microbe-derived neurotransmitters or neuroactive molecules from enterocytes under control of gut microbes influence the neural signaling of this gut–brain axis [2]. The proinflammatory, anti-inflammatory, and serotonergic signals are imperative for modulating sleep, appetite, mood, and cognition [5]. Experimentally, mice with altered intestinal flora (induced by vancomycin) and germ-free mice (devoid of gut flora) displayed features of anxiety,

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depression, and abnormal stress response, which were reversible on restoration of eubiosis by fecal transplant [2]. In addition, the fecal transplant was found to reassign the personality of the donor mice to germ-free recipient animal. Although psychobiotics have demonstrated encouraging results in animal model, the research data on human are inadequate. Reduction in anxiety, depression, and gut inflammation was reported in patients on probiotics [5].

Given the high-cost and sophisticated techniques imperative for drug designing, there is a lesser prospect of developing novel synthetic molecules for therapy on continuous basis. Moreover, prolonged use of traditional psychotropic drugs often results in serious adverse effects. In contrast, psychobiotics are well-adapted to intestinal environment and naturally modulate gut–brain axis, reducing the chance of adverse reactions [4]. Wide spectrum of mental illnesses varying from anxiety, autism, disorders of mood, behavior, and cognition could be treated effectively [2]. Currently, there is immense interest in studying the ancestral microbiota in primitive man to restore the beneficial flora which is unaffected by modernization. This approach may increase the possibility of identifying unique psychobiotics with novel attributes for therapeutic use. Since diet has immense influence on the gut flora, it is likely that simple prescribing of particular diet may be sufficient to promote the selective proliferation of natural or therapeutically introduced psychobiotics, precluding the need for repeated doses for maintenance therapy. Owing to their inert and commensal nature, these organisms are less prone to induce immune reaction. Thus, they are suitable candidates for genetic engineering. This may open up infinite possibilities

to design and restructure the gut microbiota predictably to achieve society-wide control on mental illnesses in future.

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Conflicts of interest

There are no conflicts of interest.

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