Lactobacillus as potential psychobiotic treatment for depression and anxiety-related diseases

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Introduction

Several commensal species of bacteria are being tested as a possible treatment for stress-derived mental diseases, and Lactobacillus seems to have a main role in the research due to its capacity to produce γ-aminobutyric acid (GABA), which alters serotonin concentration in brain [1].

With the knowledge that the gut microbiota status can affect motivation and cognitive functions, arises the possibility of new prophylactic or therapeutic approaches to stress-related disorders, one of these being the oral administration of selected commensal bacteria, usually referred as probiotics [2][3].

The objective of this work is to focus on the Lactobacillus genus to assess its potential as psychobiotic for depression and anxiety treatment.

Methodology

All material of information was taken from the research database PubMed, via the National Centre for Biotechnology Information (NCBI). Searches were limited to Full Text, accessible through the Universitat Autònoma de Barcelona (UAB) ARE program, which grants access to most databases, books and journals for free.

Tests performed

Mice subjected to Early-Life Stress (ELS) were administrated with Lactobacillus rhamnosus Y, and examined before and after treatment.

Subjects experiencing physical symptoms were observed and classified into the placebo group or the LcS group, and were administered with a probiotic or a placebo, respectively. The administration was performed 2 weeks before, 1 day before and immediately after the exam day.

Conclusion

All studies indicated that a dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, a complex set of interactions among the three endocrine glands that controls reactions to stress, could be normalized by administration of probiotic Lactobacillus strains. Neurotransmitters levels that affect directly stress-related diseases were stabilized, and depression and anxiety related symptoms decreased with the administration of various strains both in mice and human subjects.

These results demonstrate a possible application as adjuvant therapy [8] or maybe even to replace chemotherapeutic agents in part [9].

Results

Administration of treatment on mice

Administration of L. plantarum PS128 to germ-free mice

Administration of L. plantarum PS128 to Early-Life Stressed (ELS) mice

Administration of L. rhamnosus (JB-1) to adult healthy mice and vagotomized mice

Administration of L. plantarum PS128 to Early-Life Stressed (ELS) mice

A significant increase in the total distance traveled by mice treated with Lactobacillus plantarum PS128 is observed on the Open Field Test, commonly used as a qualitative and quantitative measure of the general locomotor activity and willingness to explore in rodents (Fig. 1 [4,5]).

A significant reduction in the immobility time was significantly reduced by L. rhamnosus (JB-1) administration in adult healthy mice compared to both the control, mice which acted as the control (A), and by a. plantarum PS128 administration in ELS mice (B).

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References


Results

Effects of probiotic Lactobacillus casei strain Shiraia (LcS) on psychological, physiological and physical stress responses in medical students undergoing an authorised nationwide examination for promotion [7].

Administration of treatment on humans

Plasma Trp (μM)

• Salivary cortisol levels increased significantly 1 day before the examination in the placebo group, but remained steady in the group treated with the bacteria (LcS group).

• Concentration of typtophan in plasma was also examined, showing similar results as salivary cortisol. Typtophan levels increased the day before the examination in the placebo group, but remained steady in the LcS group (Fig. 3).

• The rate of subjects experiencing physical symptoms was considered to be increased in the placebo group (Fig. 4). Subjects who had not been administrated LcS were more likely to suffer higher levels of stress as the day of the academic examination approached (7).