CLAIMS

1. A method for selecting a bacterial strain for use in treating a disease related to serotonin deficiency, the method comprising:

culturing (S1), under aerobic conditions, bacteria of a *Lactobacillus* bacterial strain selected from the group consisting of a *L. reuteri* bacterial strain and a *L.* mucosae bacterial strain in a culture medium comprising tryptophan;

detecting (S2) any serotonin produced by the bacteria of the *Lactobacillus* bacterial strain in the culture medium or a sample thereof;

determining (S15) whether the bacteria of the *Lactobacillus* bacterial strain are capable of attaching to intestinal mucus and/or are capable of adhering to a gastrointestinal mucosa; and

selecting (S3) the *Lactobacillus* bacterial strain as effective in treating a disease related to serotonin deficiency in a subject if serotonin is detected in the culture medium or the sample thereof and if the bacteria of the *Lactobacillus* bacterial strain are capable of attaching to intestinal mucus and/or are capable of adhering to the gastrointestinal mucosa, wherein the disease related to serotonin deficiency is selected from the group consisting of anxiety, depressed mood, aggression, poor memory, eating disorders, obsessive-compulsive disorder, panic disorder, post-traumatic stress disorder, social anxiety disorder, irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), a cardiovascular disease, osteoporosis, gastrointestinal motility disorder, autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED), osteopenia and a bone loss condition.

2. The method according to claim 1, wherein the culture medium comprises a carbon source.

3. The method according to claim 1 or 2, wherein selecting (S3) the *Lactobacillus* bacterial strain comprises selecting (S3) the *Lactobacillus* bacterial strain as effective in treating the disease related to serotonin deficiency in a subject if the *Lactobacillus* bacterial strain is capable of producing serotonin and extracellularly releasing serotonin as detected in the culture medium or the sample thereof and if the bacteria of the *Lactobacillus* bacterial strain are capable of attaching to intestinal mucus and/or are capable of adhering to the gastrointestinal mucosa.

4. The method according to any of the claims 1 to 3, further comprising:

culturing (S10), under anaerobic conditions, bacteria of the *Lactobacillus* bacterial strain in a culture medium comprising tryptophan;

detecting (S11) any serotonin produced by the bacteria of the *Lactobacillus* bacterial strain in the culture medium or a sample thereof when cultured under anaerobic conditions; and

calculating (S12) a ratio between a concentration of serotonin detected in the culture medium or the sample thereof when cultured under aerobic conditions and a concentration of serotonin detected in the culture medium or the sample thereof when cultured under anaerobic conditions, wherein

selecting (S3) the *Lactobacillus* bacterial strain comprises selecting (S3) the *Lactobacillus* bacterial strain as effective in treating the disease related to serotonin deficiency in a subject if the ratio is equal to or larger than 1.0, preferably larger than 1.0, and if the bacteria of the *Lactobacillus* bacteria strain are capable of attaching to intestinal mucus and/or are capable of adhering to the gastrointestinal mucosa.

5. The method according to any of the claims 1 to 4, wherein selecting (S3) the *Lactobacillus* bacterial strain comprises selecting (S3) the *Lactobacillus* bacterial strain as effective in treating the disease related to serotonin deficiency in a subject if serotonin is detected in the culture medium or the sample thereof and if the bacteria of the *Lactobacillus* bacterial strain have a mucus adhesion ability that is higher than a mucus adhesion ability of *Lactobacillus reuteri* DSM 27131.

6. A *Lactobacillus reuteri* strain selected from the group consisting of *L. reuteri* strain DSM 33509, *L. reuteri* strain DSM 33632, *L. reuteri* strain DSM 33633, *L. reuteri* strain DSM 33634, and *L. reuteri* strain DSM 33635, preferably in lyophilized form.

7. A *Lactobacillus reuteri* strain according to claim 6 for use as a medicament.

8. A *Lactobacillus reuteri* strain according to claim 6 for use in treatment of a disease related to serotonin deficiency, wherein the disease related to serotonin deficiency is selected from the group consisting of anxiety, depressed mood, aggression, poor memory, eating disorders, obsessive-compulsive disorder, panic disorder, post-traumatic stress disorder, social anxiety disorder, irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), a cardiovascular disease, osteoporosis, gastrointestinal motility disorder, autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED), osteopenia and a bone loss condition.

9. A *Lactobacillus mucosae* strain selected from the group consisting of *L. mucosae* strain DSM 33291, *L. mucosae* strain DSM 33292, *L. mucosae strain* DSM 33293, and *L. mucosae* strain DSM 33661, preferably in lyophilized form.

10. A *Lactobacillus mucosae* strain according to claim 9 for use as a medicament.

11. A *Lactobacillus mucosae* strain according to claim 9 for use in treatment of a disease related to serotonin deficiency, wherein the disease related to serotonin deficiency is selected from the group consisting of anxiety, depressed mood, aggression, poor memory, eating disorders, obsessive-compulsive disorder, panic disorder, post-traumatic stress disorder, social anxiety disorder, irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), a cardiovascular disease, osteoporosis, gastrointestinal motility disorder, autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED), osteopenia and a bone loss condition.

12. The *Lactobacillus reuteri* strain for use according to claim 8, or the *Lactobacillus mucosae* strain for use according claim 11, wherein the disease related to serotonin deficiency is selected from the group consisting of IBS, IBD, a cardiovascular disease, osteoporosis, gastrointestinal motility disorder, APECED, osteopenia and a bone loss condition.

13. A *Lactobacillus* bacterial strain selected from the group consisting of a *L. reuteri* bacterial strain and a *L. mucosae* bacterial strain capable of attaching to intestinal mucus and/or capable of adhering to the gastrointestinal mucosa and capable of producing and extracellularly releasing serotonin under aerobic conditions on the intestinal mucosae of a subject for use in treatment of a disease related to serotonin deficiency in a subject, wherein the disease related to serotonin deficiency is selected from the group consisting of anxiety, depressed mood, aggression, poor memory, eating disorders, obsessive-compulsive disorder, panic disorder, post-traumatic stress disorder, social anxiety disorder, irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), a cardiovascular disease, osteoporosis, gastrointestinal motility disorder, autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED), osteopenia and a bone loss condition.

14. The *Lactobacillus* bacterial strain for use according to claim 13, wherein the disease related to serotonin deficiency is selected from the group consisting of IBS, IBD, a cardiovascular disease, osteoporosis, gastrointestinal motility disorder, APECED, osteopenia and a bone loss condition.

15. The lactic acid producing bacterial strain for use according to claim 13 or 14, wherein

the *L. reuteri* strain is selected from the group consisting of *L. reuteri* DSM 32846, *L. reuteri* DSM 32848, *L. reuteri* DSM 32849, *L. reuteri* DSM 27131, *L. reuteri* DSM 33509, *L. reuteri* DSM 33632, *L. reuteri* DSM 33633, *L. reuteri* DSM 33634, *L. reuteri* DSM 33635 and *L. reuteri* DSM 32465; and

the *L. mucosae* strain is selected from the group consisting of *L. mucosae* DSM 33291, *L. mucosae* DSM 33292, *L. mucosae* DSM 33293 and *L. mucosae* DSM 33661.