

CLAIMS

1. A bacterial strain for use in a method for the preventive or curative treatment of a vitamin D deficiency and/or insufficiency (or hypovitaminosis D) and/or of a disease, symptom and/or disorder associated with said vitamin D deficiency, preferably vitamin D3,
 5 wherein said bacterial strain belongs to the species *Lactobacillus paracasei*, reclassified *Lactocaseibacillus paracasei*.
2. The bacterial strain for use according to claim 1, wherein said bacterial strain belongs to the species
 10 *Lactobacillus paracasei* is selected from the group comprising or, alternatively, consisting of:
 - a bacterial strain belonging to the species *Lactobacillus paracasei* identified as *Lactobacillus paracasei* DG® and deposited at the National Collection of Cultures of Microorganisms of the Pasteur Institute in Paris under the accession number CNCM I-1572 and name *Lactobacillus casei* DG® sub. *casei*,
 - a bacterial strain belonging to the species *Lactobacillus paracasei* identified as *Lactobacillus paracasei*
 15 LPC-S01® and deposited at *Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH* (DSMZ) under the accession number DSM 26760,
 and a mixture thereof.
3. The bacterial strain for use according to claim 1 or 2, wherein said vitamin D deficiency is a vitamin D3
 20 (cholecalciferol) and/or vitamin D2 (ergocalciferol), preferably vitamin D3, deficiency and/or insufficiency.
4. The bacterial strain for use according to any one of claims 1-3, wherein said bacterial strain is administered associated/combined with vitamin D, preferably vitamin D3, wherein said administration of said bacterial strain and of vitamin D is simultaneous or delayed over time.
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5. A composition comprising
 - a mixture M comprising or, alternatively, consisting of:
 - at least one vitamin D, and
 - at least one bacterial strain belonging to the species *Lactobacillus paracasei*,
 30 and, optionally, said composition comprises
 - at least one acceptable pharmaceutical or food grade additive and/or excipient.
6. A composition according to claim 5, wherein said at least one bacterial strain belonging to the species *Lactobacillus paracasei* is selected from the group comprising or, alternatively, consisting of:

- a bacterial strain belonging to the species *Lactobacillus paracasei* identified as *Lactobacillus paracasei* DG® and deposited at the National Collection of Cultures of Microorganisms of the Pasteur Institute in Paris under the accession number CNCM I-1572 and name *Lactobacillus casei* DG® sub. *casei*,
- a bacterial strain belonging to the species *Lactobacillus paracasei* identified as *Lactobacillus paracasei* LPC-S01® and deposited at *Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH* (DSMZ) under the accession number DSM 26760, and
- a mixture thereof.

7. The composition according to claim 5 or 6, wherein said at least one vitamin D is a vitamin D3 (cholecalciferol) and/or a vitamin D2 (ergocalciferol), preferably vitamin D3.

8. The composition according to claim 6 or 7, wherein said mixture M comprises or, alternatively, consists of:

- a bacterial strain *Lactobacillus paracasei* DG® CNCM I-1572 and/or a bacterial strain *Lactobacillus paracasei* LPC-S01® DSM 26760; and
- at least one vitamin D, preferably a vitamin D3 (cholecalciferol).

9. The composition according to any one of claims 6-8, wherein said mixture M comprises or, alternatively, consists of:

- a bacterial strain *Lactobacillus paracasei* DG® CNCM I-1572 and/or a bacterial strain *Lactobacillus paracasei* LPC-S01® DSM 26760, and furthermore at least one bacterial strain selected from the group consisting of:
 - a bacterial strain belonging to the species *Bifidobacterium breve* identified as *Bifidobacterium breve* BbIBS01 and deposited at *Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH* (DSMZ) under deposit number DSM 33231,
 - a bacterial strain belonging to the species *Bifidobacterium breve* identified as *Bifidobacterium breve* BbIBS02 and deposited at *Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH* (DSMZ) under deposit number DSM 33232,
 - a bacterial strain belonging to the species *Bifidobacterium animalis* identified as *Bifidobacterium animalis* subsp. *lactis* BbIBS01 and deposited at *Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH* (DSMZ) under deposit number DSM 33233,
 - a bacterial strain belonging to the species *Lactobacillus plantarum* identified as *Lactobacillus plantarum* LpIBS01 and deposited at *Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH* (DSMZ) under deposit number DSM 33234,

- a bacterial strain belonging to the species *Bifidobacterium bifidum* identified as *Bifidobacterium bifidum* BbflBS01 and deposited at *Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH* (DSMZ) under deposit number DSM 32708 and a mixture thereof;
- at least one vitamin D, preferably a vitamin D3 (cholecalciferol).

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10. The composition according to any one of claims 5-9 for use as medicament.

11. The composition for use according to claim 10, wherein said composition is for use in the preventive and/or curative treatment of a vitamin D deficiency and/or of a disease, symptom and/or disorder associated with said vitamin D deficiency in a subject in need;
preferably wherein said vitamin D is a vitamin D3 (cholecalciferol) and/or a vitamin D2 (ergocalciferol), more preferably vitamin D3.

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12. The bacterial strain for use according to any one of claims 1-4 or the composition for use according to claim 10 or 11, wherein said disease, symptom and/or disorder is selected from among: cardiovascular disorders or diseases selected from: heart failure, myocardial infarction, sudden cardiac death, stroke, atrial fibrillation and peripheral vascular disease; obesity, insulin resistance, hypertension and diabetes; diabetes, dyslipidaemia, metabolic syndrome, hypertension, renal dysfunction, acute and/or chronic inflammation of the gastrointestinal tract, changes in the immune system, cancer, colon cancer, breast cancer, skin cancer, lung cancer and prostate cancer, autoimmune diseases, seasonal depression and other mental disorders, Alzheimer's disease, multiple sclerosis.

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13. The bacterial strain for use according to any one of claims 1-4 or the composition for use according to claim 10 or 11, wherein said disease, symptom and/or disorder is selected from: rickets, fragile bones, bone deformation, osteoporosis, osteomalacia, bone pain, joint pain, bone fragility, hypocalcaemia, hypophosphatemia, bone abnormalities due to demineralisation defects.

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14. The bacterial strain for use according to any one of claims 1-4 or the composition for use according to claim 10 or 11, wherein said disease, symptom and/or disorder is selected from: muscle weakness, difficulty concentrating, recurrent fatigue, cognitive disorders, psychological and emotional disorders, secondary hyperparathyroidism, sweating hands.

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15. The bacterial strain for use according to any one of the preceding claims or the composition for use according to any one of the preceding claims, wherein said subjects in need are paediatric subjects.