The need therefore remains high to provide an effective solution for the treatment of gastrointestinal disorders, in particular functional gastrointestinal disorders, more in particular for irritable bowel syndrome (IBS), constipation, diarrhoea, alternating constipation and diarrhoea and unclassified IBS.
Furthermore, there is a need to provide an effective solution for the treatment of inflammatory gastrointestinal disorders, such as, for example, chronic inflammatory bowel diseases (IBD).

Following an extensive research and development activity, the Applicant addresses and solves the aforementioned needs by providing: novel strains of isolated bacteria, such as, (I.i) *Bifidobacterium breve* BbIBS01 (DSM 33231), (I.ii) *Bifidobacterium breve* BbIBS02 (DSM 33232), (I.iii) *Bifidobacterium animalis subsp. lactis* BIIBS01 (DSM 33233) and (I.iv) *Lactobacillus plantarum* LpIBS01 (DSM 33234) (in short, novel bacterial strains (I.i-I.iv) of the invention or (I.i-I.iv)); mixtures (M) comprising a bacterial strain *Bifidobacterium bifidum* MIMBb23sg or BbfIBS01 (DSM 32708), at least one or more of said bacterial strains (I.i-I.iv) and, optionally, at least one further bacterial strain selected from the group comprising or, alternatively, consisting of: *Lactobacillus casei* DG® (CNCM I-1572) and *Lactobacillus paracasei* LPC-S01™ (DSM 26760) (in short, mixtures (M) of the invention); compositions comprising said mixtures (M) (in short, compositions of the invention); the use of said strains, mixtures or compositions for the preventive and/or curative treatment of gastrointestinal disorders, preferably functional or inflammatory gastrointestinal disorders, more preferably irritable bowel syndrome (IBS) (diarrhoea, constipation, alternating constipation and diarrhoea, unclassified IBS), and/or inflammatory gastrointestinal disorders, more preferably chronic inflammatory bowel diseases (IBD), as reported in the present description and in the claims

SUMMARY

In one aspect, provided herein is a composition comprising a mixture M comprising or, alternatively, consisting of: a bacterial strain identified as Bifidobacterium bifidum MIMBb23sg and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 32708 on 4 December 2017 by Sofar S.p.A; and at least one bacterial strain selected from the group A consisting of: a bacterial strain identified as Bifidobacterium breve BbIBS01 and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 33231 on 31 July 2019 by Sofar S.p.A., a bacterial strain identified as Bifidobacterium breve BbIBS02 and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 33232 on 31 July 2019 by Sofar S.p.A., a bacterial strain identified as Bifidobacterium animalis subsp. lactis BIIBS01 and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 33233 on 31 July 2019 by Sofar S.p.A., a bacterial strain identified as Lactobacillus plantarum LpIBS01 and

deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 33234 on 31 July 2019 by Sofar S.p.A., and mixtures thereof; and wherein said composition comprises at least one food or pharmaceutical grade additive and/or excipient.

In another aspect, provided herein is the composition as described herein for use as a medicament.

In another aspect, provided herein is use of a composition in the manufacture of a medicament for the treatment of functional gastrointestinal diseases, disorders and/or symptoms, wherein the composition comprises a mixture M, wherein said mixture M consists of the bacterial strains: *Bifidobacterium bifidum* MIMBb23sg (o BbfIBS01) DSM 32708, *Bifidobacterium breve* BbIBS01 DSM 33231, *Bifidobacterium breve* BbIBS02 DSM 33232, *Bifidobacterium animalis* subsp. lactis BlIBS01 DSM 33233, *Lactobacillus plantarum* LpIBS01 DSM 33234, and *Lactobacillus casei* DG® CNCM I-1572, and wherein the bacterial strains are present at a ratio of 1:1:1:1:1:1 in the mixture.

In another aspect, provided herein is use of a composition in the manufacture of a medicament for the treatment of inflammatory gastrointestinal diseases, disorders and/or symptoms, wherein the composition comprises a mixture M, wherein said mixture M consists of the bacterial strains: *Bifidobacterium bifidum* MIMBb23sg (o BbfIBS01) DSM 32708, *Bifidobacterium breve* BbIBS01 DSM 33231, *Bifidobacterium breve* BbIBS02 DSM 33232, *Bifidobacterium animalis* subsp. lactis BlIBS01 DSM 33233, *Lactobacillus plantarum* LpIBS01 DSM 33234, and *Lactobacillus casei* DG® CNCM I-1572, and wherein the bacterial strains are present at a ratio of 1:1:1:1:1:1 in the mixture.

Lactobacillus plantarum LpIBS01 (DSM 33234) was isolated from the human gastrointestinal tract. The Bifidobacteria in question, such as *Bifidobacterium breve* BbIBS01 (DSM 33231), (I.ii) *Bifidobacterium breve* BbIBS02 (DSM 33232), (I.iii) *Bifidobacterium animalis subsp. lactis* BlIBS01 (DSM 33233), are of human origin and they are naturally found in the human intestine.

Specifically, said novel bacterial strains of the invention (I.i-I.iv) or derivatives thereof, mixtures (M) of bacterial strains of the present invention and compositions comprising said mixtures (M) of the present invention, are effective in the preventive and/or curative treatment of gastrointestinal disorders, in particular with regard to functional gastrointestinal disorders, such as for example IBS, given that they determine:

- at the level of the gut microbiota, a positive modulation of the microbial populations present, such as for example an increase in the bacterial population of the genus *Lactobacillus* and of the genus

CLAIMS

1. A composition comprising

a mixture M comprising or, alternatively, consisting of:

- a bacterial strain identified as *Bifidobacterium bifidum* MIMBb23sg and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 32708 on 4 December 2017 by Sofar S.p.A; and
- at least one bacterial strain selected from the group A consisting of:
  - a bacterial strain identified as *Bifidobacterium breve* BbIBS01 and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 33231 on 31 July 2019 by Sofar S.p.A.,
  - a bacterial strain identified as *Bifidobacterium breve* BbIBS02 and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 33232 on 31 July 2019 by Sofar S.p.A.,
  - a bacterial strain identified as *Bifidobacterium animalis subsp. lactis* BIIBS01 and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 33233 on 31 July 2019 by Sofar S.p.A.,
- a bacterial strain identified as *Lactobacillus plantarum* LpIBS01 and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under deposit number DSM 33234 on 31 July 2019 by Sofar S.p.A.,

and mixtures thereof;

and wherein said composition comprises at least one food or pharmaceutical grade additive and/or excipient.

2. The composition according to claim 1, wherein said mixture M comprises or, alternatively consists of bacterial strains:

- *Bifidobacterium bifidum* MIMBb23sg (o BbfIBS01) DSM 32708,
- *Bifidobacterium breve* BbIBS01 DSM 33231,
- *Bifidobacterium breve* BbIBS02 DSM 33232,
- *Bifidobacterium animalis subsp. lactis* BIIBS01 DSM 33233, and
- *Lactobacillus plantarum* LpIBS01 DSM 33234.

3. The composition according to claim 1 or 2, wherein said mixture M further comprises at least one further bacterial strain selected from the group B consisting of:

- a bacterial strain identified as *Lactobacillus casei* DG® and deposited at the National Collection of

Cultures of Microorganisms of the Pasteur Institute in Paris under accession number CNCM I-1572 on 05 May 1995 by SOFAR S.p.A., and

- a bacterial strain identified as *Lactobacillus paracasei* LPC-S01™ and deposited at Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (DSMZ) under accession number DSM 26760 on 15 May 2017 by SOFAR S.p.A.

4. The composition according to claim 3, wherein said mixture M comprises or, alternatively consists of bacterial strains:

- *Bifidobacterium bifidum* MIMBb23sg (o BbfIBS01) DSM 32708,
- *Bifidobacterium breve* BbIBS01 DSM 33231,
- *Bifidobacterium breve* BbIBS02 DSM 33232,
- *Bifidobacterium animalis subsp. lactis* BlIBS01 DSM 33233,
- *Lactobacillus plantarum* LpIBS01 DSM 33234, and
- *Lactobacillus casei* DG® CNCM I-1572.

5. The composition according to claim 3, wherein said mixture M comprises or, alternatively consists of bacterial strains:

- *Bifidobacterium bifidum* MIMBb23sg (o BbfIBS01) DSM 32708,
- *Bifidobacterium breve* BbIBS01 DSM 33231,
- *Bifidobacterium breve* BbIBS02 DSM 33232,
- *Bifidobacterium animalis subsp. lactis* BlIBS01 DSM 33233,
- *Lactobacillus plantarum* LpIBS01 DSM 33234, and
- *Lactobacillus paracasei* LPC-S01™ DSM 26760.

6. The composition according to any one of claims 1 to 5, wherein said composition is formulated for oral, sublingual or buccal, transmucosal, topical rectal, topical cutaneous or topical vaginal use; preferably said composition is formulated for oral use.

7. The composition according to any one of claims 1 to 6 for use as a medicament.

8. Use of a composition in the manufacture of a medicament for the treatment of functional gastrointestinal diseases, disorders and/or symptoms, wherein the composition comprises a mixture M, wherein said mixture M consists of the bacterial strains:

- *Bifidobacterium bifidum* MIMBb23sg (o BbfIBS01) DSM 32708,
- *Bifidobacterium breve* BbIBS01 DSM 33231,

- *Bifidobacterium breve* BbIBS02 DSM 33232,
- *Bifidobacterium animalis subsp. lactis* BIIBS01 DSM 33233,
- *Lactobacillus plantarum* LpIBS01 DSM 33234, and
- *Lactobacillus casei* DG® CNCM I-1572,

and wherein the bacterial strains are present at a ratio of 1:1:1:1:1:1 in the mixture.

9. The use according to claim 8, wherein said functional gastrointestinal diseases, disorders and/or symptoms is selected from the group consisting of: irritable bowel syndrome (IBS), dyspepsia, pyrosis, oesophagus, stomach and duodenum disorders, small intestinal bacterial overgrowth (SIBO), gastrointestinal disorders with sub-inflammatory conditions.

10. The use according to claim 9, wherein said functional gastrointestinal diseases, disorders and/or symptoms is irritable bowel syndrome (IBS) with constipation or irritable bowel syndrome (IBS) with diarrhoea or irritable bowel syndrome (IBS) with alternating constipation and diarrhoea or unclassified irritable bowel syndrome (IBS).

11. Use of a composition in the manufacture of a medicament for the treatment of inflammatory gastrointestinal diseases, disorders and/or symptoms, wherein the composition comprises a mixture M, wherein said mixture M consists of the bacterial strains:
- *Bifidobacterium bifidum* MIMBb23sg (o BbfIBS01) DSM 32708,
- *Bifidobacterium breve* BbIBS01 DSM 33231,
- *Bifidobacterium breve* BbIBS02 DSM 33232,
- *Bifidobacterium animalis subsp. lactis* BIIBS01 DSM 33233,
- *Lactobacillus plantarum* LpIBS01 DSM 33234, and
- *Lactobacillus casei* DG® CNCM I-1572,

and wherein the bacterial strains are present at a ratio of 1:1:1:1:1:1 in the mixture.

12. The use according to claim 11, wherein said inflammatory gastrointestinal disorders is selected from the group consisting of: chronic inflammatory bowel diseases (IBD), Crohn's disease, ulcerative colitis, microscopic colitis, diverticular disease, diverticulitis, Helicobacter pylori infection, peptic or gastric ulcer, and duodenal ulcer; preferably selected from chronic inflammatory bowel diseases (IBD), Crohn's disease, ulcerative colitis, microscopic colitis, diverticular disease, and diverticulitis.