

Claims

1. Preparation comprising consortia of at least one bacterial strain selected from the genus *Bacillus* and at least one bacterial strain selected from the genus *Lactobacillus*, for use in the degradation of gluten to a gluten content of 20 ppm or less,
 5 a) wherein said consortium of strains can degrade the 12-mer peptide QLQPFQPQLPY (Seq-ID No 1), the 14-mer peptide PQPQLPYQPQSFP (Seq-ID No 2), the 20-mer peptide QQLPQPQPQSFPQQQRPF (Seq-ID No 3), the 33-mer peptide LQLQPFQPQLPYQPQLPYQPQLPYQPQP (Seq-ID No 4).
- 10 2. Preparation for use according to claim 1, wherein the consortium of strains can degrade the 12-mer peptide QLQPFQPQLPY (Seq-ID No 1), the 14-mer peptide PQPQLPYQPQSFP (Seq-ID No 2), the 20-mer peptide QQLPQPQPQSFPQQQRPF (Seq-ID No 3), the 33-mer peptide LQLQPFQPQLPYQPQLPYQPQLPYQPQP (Seq-ID No 4) by at least 80
 15 %, or at least 90 %, preferably at least 95 %, more preferably at least 98 %.
3. Preparation for use according to any preceding claim,
 b) wherein said consortium of strains is capable of degrading gluten to a digest that does not cause an immunogenic or toxic response in the small intestine or small intestinal explant of a
 20 subject or animal affected by a gluten-related disorder, and/or
 c) wherein all strains of the consortium survive (less than 2 log CFU loss) simulated gastric (pH 1.0-4.0) and intestinal (pH 5.4-6.8; 0.05-0.6 % bile acids, or the concentration of bile acids present in humans under in vivo conditions) conditions, and/or
 d) wherein members of the consortia have complementary PepP, PepO, PepX, PepI, and
 25 PepN activities with at least one peptidase activity equal to or more than 3 U/g (PepP), 5 U/g (PepO), 20 U/g (PepX), 17 U/g (PepI), 20 U/g (PepN).
4. Preparation for use according to any preceding claim, wherein the *Bacillus* strains are selected from *Bacillus pumilus*, *Bacillus subtilis*, *Bacillus licheniformis*, *Bacillus megaterium*,
 30 preferably selected from *Bacillus pumilus* DSM 33297, DSM 33355, DSM 33301, *Bacillus subtilis* DSM 33353, DSM 33298, *Bacillus licheniformis* DSM 33354, *Bacillus megaterium* DSM 33300, DSM 33356.
5. Preparation for use according to any preceding claim, wherein the *Lactobacillus* strains are selected from *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*), *Lactobacillus casei* (*Lacticaseibacillus casei*), *Lactobacillus paracasei* (*Lacticaseibacillus paracasei*),
 35 *Lactobacillus brevis* (*Levilactobacillus brevis*), *Lactobacillus sanfranciscensis* (*Fructilactobacillus sanfranciscensis*), *Lactobacillus reuteri* (*Limosilactobacillus reuteri*), preferably selected from *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33362,
 40 DSM 33363, DSM 33364, DSM 33366, DSM 33367, DSM 33368, DSM 33369, DSM 33370,

Lactobacillus paracasei (*Lacticaseibacillus paracasei*) DSM 33373, DSM 33375, DSM 33376, *Lactobacillus reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *Lactobacillus brevis* (*Levilactobacillus brevis*) DSM 33377, *Lactobacillus sanfranciscensis* (*Fructilactobacillus sanfranciscensis*) DSM 33378, DSM 33379.

- 5 6. Preparation for use according to any preceding claim, wherein the probiotic strains are present in a dormant form or as vegetative cells.
7. Preparation for use according to any preceding claim, wherein cytoplasmic extracts or cell-free supernatants or heat-killed biomass of the probiotic strains are used.
- 10 8. Preparation for use according to any preceding claim, wherein the preparation further comprises one or more probiotic strains, preferably selected from *Pediococcus sp.*, *Weissella sp.*, more preferably *Pediococcus pentosaceus* DSM 33371.
- 15 9. Preparation for use according to any preceding claim, wherein the preparation further comprises one or more of the following: microbial proteases purified from *Aspergillus niger*, *Aspergillus oryzae*, *Bacillus sp.*, *Lactobacillus sp.*, *Pediococcus sp.*, *Weissella sp.*, *Rothia mucilaginosa*, *Rothia aeria*, subtilisins, nattokinase, arabinoxylans, barley grain fibre, oat grain fibre, rye fibre, wheat bran fibre, inulins, fructooligosaccharides (FOS), galactooligosaccharides (GOS), resistant starch, beta-glucans, glucomannans, galactoglucomannans, guar gum, xylooligosaccharides, alginate.
- 20 10. Preparation for use according to any preceding claim for treating or preventing gluten-related disorders, preferably selected from celiac disease, non-celiac gluten sensitivity, wheat allergy, and gluten-sensitive irritable bowel syndrome in a subject or animal in need thereof.
- 25 11. Preparation for use according to any preceding claim for producing gluten-free foods, from gluten-containing cereals wheat, barley, rye, and oat, preferably containing less than 20 ppm gluten.
- 30 12. Preparation for use according to any preceding claim, further comprising a substance, which acts as permeabilizer of the microbial cell membrane of members of *Bacillus sp.*, *Lactobacillus sp.*, *Pediococcus sp.*, *Weissella sp.*, preferably alginate.
- 35 13. Preparation for use according to any preceding claim where one or more of the probiotic strains selected from *Bacillus sp.*, *Lactobacillus sp.*, *Pediococcus sp.* and *Weissella sp.* are immobilized individually or as consortia.
- 40 14. Preparation comprising at least one strain of each of the following groups 1-5:
Group 1: *Lactobacillus paracasei* (*Lacticaseibacillus paracasei*) DSM 33373, *Lactobacillus paracasei* (*Lacticaseibacillus paracasei*) DSM 33375,

- Group 2: *Bacillus subtilis* DSM 33298, *Bacillus pumilus* DSM 33297, *Bacillus licheniformis* DSM 33354, *Bacillus megaterium* DSM 33356, *Pediococcus pentosaceus* DSM 33371, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33370, *Lactobacillus brevis* (*Levilactobacillus brevis*) DSM 33377, *Lactobacillus paracasei* (*Lacticaseibacillus paracasei*) DSM 33376, *Lactobacillus paracasei* (*Lacticaseibacillus paracasei*) DSM 33375, *Lactobacillus reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33367, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33363, *Lactobacillus paracasei* (*Lacticaseibacillus paracasei*) DSM 33373, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33362,
- Group 3: *Lactobacillus sanfranciscensis* (*Fructilactobacillus sanfranciscensis*) DSM 33378, *Lactobacillus sanfranciscensis* (*Fructilactobacillus sanfranciscensis*) DSM 33379, *Pediococcus pentosaceus* DSM 33371, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33370, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33369, *Lactobacillus reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33363, *Lactobacillus paracasei* (*Lacticaseibacillus paracasei*) DSM 33373,
- Group 4: *Bacillus subtilis* DSM 33353, *Bacillus pumilus* DSM 33355, *Bacillus pumilus* DSM 33301,
- Group 5: *Bacillus megaterium* DSM 33300, *Lactobacillus sanfranciscensis* (*Fructilactobacillus sanfranciscensis*) DSM 33378, *Pediococcus pentosaceus* DSM 33371, *Lactobacillus brevis* (*Levilactobacillus brevis*) DSM 33377, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33368, *Lactobacillus reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33367, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33366, *Lactobacillus plantarum* (*Lactiplantibacillus plantarum*) DSM 33364, *Lactobacillus paracasei* (*Lacticaseibacillus paracasei*) DSM 33373.
15. Preparation according to claim 14, comprising at least three different strains, preferably at least four different strains, more preferably at least five different strains.
16. Preparation according to claim 14 or 15, comprising the following strains:
- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33370, DSM 33363, DSM 33364; *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33373; *L. brevis* (*Levilactobacillus brevis*) DSM 33377; *Bacillus pumilus* DSM 33297, DSM 33355, *Bacillus licheniformis* DSM 33354, *Bacillus megaterium* DSM 33300 and *Bacillus subtilis* DSM 33353, or
 - *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33362, DSM 33367, DSM 33368; *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33375; *L. sanfranciscensis* (*Fructilactobacillus sanfranciscensis*) DSM 33379; *Bacillus pumilus* DSM 33301, *Bacillus megaterium* DSM 33300, DSM 33356, *Bacillus subtilis* DSM 33298 and DSM 33353, or

- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33366 and DSM 33369, *Lactobacillus reuteri* (*Limosilactobacillus reuteri*) DSM 33374; *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33376; *Pediococcus pentosaceus* DSM 33371; *L. sanfranciscensis* (*Fructilactobacillus sanfranciscensis*) DSM 33378; *Bacillus licheniformis* DSM 33354, *Bacillus pumilus* DSM 33301, *Bacillus megaterium* DSM 33300, DSM 33356 and *Bacillus subtilis* DSM 33298, or
- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33363 and DSM 33364, *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33373, *Bacillus subtilis* DSM 33298, and *Bacillus pumilus* DSM 33301, or
- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33363 and DSM 33364, *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33375, *Lactobacillus reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *Bacillus megaterium* DSM 33300, and *Bacillus pumilus* DSM 33297, or
- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33363 and DSM 33364, *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33373, *Lactobacillus reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *Bacillus megaterium* DSM 33300, *Bacillus pumilus* DSM 33297, *Bacillus pumilus* DSM 33355, or
- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33370, DSM 33363 and DSM 33364, *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33373 *L. brevis* (*Levilactobacillus brevis*) DSM 33377, *Bacillus pumilus* DSM 33297, DSM 33355, DSM 33301, or
- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33362 and DSM 33367, DSM 33368, *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33375, *Bacillus subtilis* DSM 33298, *Bacillus licheniformis* DSM 33354, and *Bacillus megaterium* DSM 33300, or
- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33366, DSM 33369, *Lactobacillus reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33376, *Pediococcus pentosaceus* DSM 33371, *Bacillus megaterium* DSM 33356, and *Bacillus subtilis* DSM 33353, or
- *L. brevis* (*Levilactobacillus brevis*) DSM 33377, *Pediococcus pentosaceus* DSM 33371, *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33369, *Bacillus pumilus* DSM 33297 and *Bacillus megaterium* DSM 33300, or
- *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33375, *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33367, DSM 33368; *Bacillus pumilus* DSM 33355, and *Bacillus licheniformis* DSM 33354, or
- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33370, DSM 33362, and DSM 33366, *Lactobacillus reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *Bacillus megaterium* DSM 33356, and *Bacillus subtilis* DSM 33353, or
- *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33375, *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33367, *L. reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *B. megaterium* DSM 33300, *B. pumilus* DSM 33297, *B. licheniformis* DSM 33354, or

- *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33363, DSM 33364, DSM 33370, *L. brevis* (*Levilactobacillus brevis*) DSM 33377, *B. pumilus* DSM 33297, *Bacillus megaterium* DSM 33356, or
 - *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33362, DSM 33367, DSM 33368, *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33375, *B. megaterium* DSM 33300, *B. subtilis* DSM 33353, or
 - *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33366, DSM 33369, *L. reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33376, *P. pentosaceus* DSM 33371, *B. pumilus* DSM 33297, DSM 33355, or
 - *L. brevis* (*Levilactobacillus brevis*) DSM 33377, *P. pentosaceus* DSM 33371, *L. sanfranciscensis* (*Fructilactobacillus sanfranciscensis*) DSM 33379, *B. megaterium* DSM 33300, *B. pumilus* DSM 33297, or
 - *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33368, *L. paracasei* (*Lacticaseibacillus paracasei*) DSM 33375, *L. sanfranciscensis* (*Fructilactobacillus sanfranciscensis*) DSM 33378, *B. megaterium* DSM 33300, *B. pumilus* DSM 33297, *B. licheniformis* DSM 33354, or
 - *L. plantarum* (*Lactiplantibacillus plantarum*) DSM 33362, DSM 33366, DSM 33370, *L. reuteri* (*Limosilactobacillus reuteri*) DSM 33374, *L. sanfranciscensis* (*Fructilactobacillus sanfranciscensis*) DSM 33378, DSM 33379, *B. licheniformis* DSM 33354, *B. subtilis* DSM 33353.
17. A food or pet food supplement or food or pet food product or pharmaceutical product, comprising a preparation according to any one of claims 14-16.