

DESCRIPTION

LACTIC ACID BACTERIA FOR PROMOTING PHYSICAL ACTIVITY

5 Technical Field

The present invention relates to agents comprising *Lactobacillus gasseri* as an active ingredient for promoting physical activity, or food compositions that comprise these agents for promoting physical activity.

10 Background Art

In modern society where people often keep irregular hours and are under a lot of stress, moderate exercise and participation in sports are recommended for relieving stress and maintaining health including prevention of lifestyle-related diseases.

However, muscle fatigue occurs immediately when an ordinarily sedentary person
15 suddenly exercises or participates in sports, and the person often suffers severe muscle fatigue or such after exercise. This may become the reason why the person cannot continue exercise routinely.

Furthermore, among the elderly, carrying out moderate exercise or rehabilitation, or such has been used as means for preventing reduction of physical capabilities. However, it is
20 quite difficult in practice due to the difficulty of staying motivated and risks of injury, and more effective methods are desired.

On the other hand, the definition “brain-gut interaction” has been receiving attention in recent years. Brain-gut interaction refers to the phenomena where various signals produced in the intestines are transmitted to the central nervous system via the nervous system, common
25 transmitters including hormones and cytokines, and receptors, and then these signals affect the central nervous system processing of the information (Non-Patent Document 1).

According to this brain-gut interaction, intestinal bacterial flora and the nervous system are bidirectionally related. For example, through ingestion, microorganisms having probiotic function may act on the intestinal bacterial flora and act on the central nervous system while
30 developing a healthy intestinal bacterial flora; and brain-activating effects can be expected.

Prior arts which focus on exercise and microorganisms such as lactobacilli include Patent Document 1 (Japanese Patent Application *Kokai* Publication No. (JP-A) 2004-269361 (unexamined, published Japanese patent application)) and Patent Document 2 (WO2007/023896). Patent Document 2 discloses the discovery of GH secretion-promoting action in GABA
35 produced from the *Lactobacillus hilgardii* K-3 bacterial strain by a fermentation method, and it leads one to anticipate physiological effects such as strengthening of muscles and bones,

reduction of fat, rejuvenation of the skin, and recovery of immunity. Furthermore, Patent Document 2 discloses that since fermented milk produced by fermentation using the *Lactobacillus helveticus* CM4 strain has (a) a function of expressing anti-oxidative enzymes, (b) a function of expressing heatshock proteins, and (c) a function of inhibiting neutrophil chemotaxis and tissue invasion, it is effective in suppressing delayed onset muscle soreness.

However, these are promotion of hormone secretion and alleviation of muscle soreness after exercise by substances produced by lactobacillus fermentation, and not promotion of the increase of brain-gut interaction-mediated activity.

[Prior Art Documents]

[Patent Document]

[Patent Document 1] JP-A (*Kokai*) 2004-269361

[Patent Document 2] WO2007/023896

[Non-Patent Document]

[Non-Patent Document 1] Aziz Q, Thompson DG, *Gastroenterology* 1998;114:559-578

Summary of the Invention

[Problems to be Solved by the Invention]

The present invention was achieved in view of the above circumstances. An objective of the present invention is to provide an agent for promoting physical activity containing, as an active ingredient, lactobacilli derived from human intestines, and/or a treatment product thereof, or food compositions that comprise this agent for promoting physical activity.

[Means for Solving the Problems]

As a result of dedicated research to solve the above-mentioned problems, the present invention led to the novel discovery that the administration of dead *Lactobacillus gasseri* OLL2809 to mice is effective to increase the amount of locomotor activity and also muscle mass (Fig. 1 and Fig. 2).

That is, the present inventors discovered that physical activity is promoted, or more specifically, the amount of activity is increased and muscle mass is increased by ingesting *Lactobacillus gasseri* OLL2809 or a fermentation product or treatment product thereof, and thereby completed the present invention.

Specifically, the present invention relates to the invention of [1]-[11] below:

[1] an agent for promoting physical activity, comprising *Lactobacillus gasseri* as an active ingredient;

[2] an agent for promoting physical activity comprising, as an active ingredient, at least one treatment product of *Lactobacillus gasseri* selected from a culture, concentrate, paste, spray-dried product, freeze-dried product, vacuum-dried product, drum-dried product, liquid,

diluted product, and crushed product of the lactobacillus;

[3] the agent for promoting physical activity of [1] or [2], wherein the promotion of physical activity is an increase in the amount of activity of a subject;

[4] the agent for promoting physical activity of [1] or [2], wherein the promotion of physical activity is an increase of muscle mass in a subject;

[5] the agent for promoting physical activity of any one of [1] to [4], wherein the *Lactobacillus gasseri* is *Lactobacillus gasseri* OLL2809 deposited under the accession number NITE BP-72;

[6] a food composition for promoting physical activity, comprising an effective amount of the agent for promoting physical activity of any one of [1] to [5];

[7] use of the agent for promoting physical activity of any one of [1] to [5] in the production of a food composition for promoting physical activity;

[8] the use of [7], wherein the food composition for promoting physical activity is: an infant formula, food for young children such as powdered milk, food for breastfeeding women such as powdered milk, health-promoting food, food for sick people, or fermented milk;

[9] a method for promoting physical activity, comprising administering *Lactobacillus gasseri* or a treatment product thereof;

[10] a method for producing a food composition for promoting physical activity, comprising using *Lactobacillus gasseri* or at least one treatment product selected from a culture, concentrate, paste, spray-dried product, freeze-dried product, vacuum-dried product, drum-dried product, liquid, diluted product, and crushed product thereof; and

[11] *Lactobacillus gasseri* or a treatment product thereof which is at least one selected from: a culture, concentrate, paste, spray-dried product, freeze-dried product, vacuum-dried product, drum-dried product, liquid, diluted product, and crushed product, for use in a method for promoting physical activity.

Brief Description of the Drawings

Fig. 1 depicts the rate of change in the amount of locomotor activity of mice from week 2 to week 3 of administration of *Lactobacillus gasseri* OLL2809 (Accession Number: NITE BP-72). Regarding week 2 (average of two measurements) and week 3 (average of two measurements) of administration, the water-administered group and the lactobacilli-administered group were compared for the rate of change (%) in the measured values at week 2 of administration and week 3 of administration.

Fig. 2 shows the values obtained by dividing the gastrocnemius muscle mass by body weight. *Lactobacillus gasseri* OLL2809 (Accession Number: NITE BP-72) was administered for 26 days and the mouse gastrocnemius muscle was removed.

Mode for Carrying Out the Invention

The present invention provides agents for promoting physical activity comprising lactobacilli as an active ingredient. Agents of the present invention for promoting physical activity comprise *Lactobacillus gasseri* as the lactobacilli. As long as it has effects of promoting physical activity, any type of *Lactobacillus gasseri* can be used, but the types with high survivability after administration into the body are preferred. Specific examples of *Lactobacillus gasseri* that may be used in the present invention include the *Lactobacillus gasseri* OLL2809 strain.

The above-mentioned *Lactobacillus gasseri* OLL2809 has been found to have effects of inducing the production of IL-12 from immunocompetent cells to shift the Th1/Th2 balance towards Th1 when orally administered to various allergy model animals (International Publication WO2006/093022). It was examined from 273 strains of lactobacilli of the *Lactobacillus* genus independently isolated from human adult feces by using the evaluation tests of: (1) gastric acid/bile acid resistivity; (2) IL-12 production-promoting activity in mouse-derived spleen cells and Th1/Th2 balance-improving effect; (3) suppression effect on the antigen-specific IgE production induced by intraperitoneally administering ovalbumin to BALB/c mice; (4) suppression effect on the antigen-specific IgE production induced by orally administering a food antigen (casein) to C57BL/6N mice; (5) Natural Killer cell-activating ability; (6) IL-12 production-promoting activity to spleen cells and mesenteric lymph node cells derived from mice immunized with ovalbumin and Th1/Th2 balance-improving effect; and (7) ability to suppress eosinophilia induced by a cedar pollen-extracted antigen; and showed high activities in each test.

In the present invention, it was newly revealed that subjects who took or were administered the above-mentioned *Lactobacillus gasseri* OLL2809 undergo promotion of physical activity; and it became possible to provide new agents for promoting physical activity through the use of this lactobacilli, or food compositions that comprise these agents for promoting physical activity, which are effective for promoting physical activity.

The present inventors deposited this strain with the Incorporated Administrative Agency, National Institute of Technology and Evaluation, Patent Microorganisms Depositary. The specific content of the deposition is described below.

The present inventors deposited *Lactobacillus gasseri* OLL2809 with the Incorporated Administrative Agency, National Institute of Technology and Evaluation, Patent Microorganisms Depositary. The specific content of the deposition is detailed below:

(1) Name of depositary institution: The Incorporated Administrative Agency, National Institute of Technology and Evaluation, Patent Microorganisms Depositary.

(2) Contact: 2-5-8 Kazusakamatari, Kisarazu-shi, Chiba-ken, 292-0818.

Phone: 0438-20-5580

(3) Accession number: NITE BP-72

(4) Identification label: *Lactobacillus gasseri* OLL2809

5 (5) Date of original deposition: February 1, 2005

(6) Date of transfer to the depositary under the Budapest Treaty: January 18, 2006.

Lactobacillus gasseri OLL2809 (Accession Number: NITE BP-72) is a Gram-positive bacillus. The morphology of colonies on the Lactobacilli MRS Agar, Difco, is round, light yellow, and flat. It possesses physiological characteristics such as homolactic fermentation, growth at 45°C, and fermentability for glucose, mannose, fructose, galactose, sucrose, cellobiose, lactose, and trehalose.

Media suitable for lactobacilli in general may also be used to culture the *Lactobacillus gasseri* OLL2809 strain (Accession Number: NITE BP-72). Thus, any medium containing, other than the main carbon source, a good extent of a nitrogen source, inorganic substances, and other nutrients can be used. Depending on the assimilating ability of the bacteria selected, lactose, glucose, sucrose, fructose, starch hydrolysate, molasses, and such can be used as the carbon source. Organic nitrogen-containing materials, such as casein hydrolysate, whey protein hydrolysate, and soybean hydrolysate, can be used as the nitrogen source. In addition, meat extracts, fish meat extracts, yeast extracts, and such can be used as growth-promoting agents.

Culture is preferably performed under anaerobic conditions; however, it may also be performed under microaerobic conditions, for example in the context of the commonly used stationary liquid culture. Known methods, such as the method of culturing under a nitrogen gas layer, can be applied to the anaerobic culturing, though other methods are contemplated as well. In general, the culture temperature preferably ranges between 30 and 40°C; however, other temperature conditions may be used, so long as they allow the bacteria to grow. The pH of the medium is preferably maintained between 6.0 and 7.0 during culture; however, other pH conditions may be used, so long as the pH allows bacterial growth. Moreover, culture can also be carried out under batch culture conditions. In general, the duration of culture preferably ranges between 10 and 24 hours; however, other culture periods may be used, so long as they permit bacterial growth.

Other strains of *Lactobacillus gasseri* that can be used in the context of the present invention should possess characteristics similar to those of *Lactobacillus gasseri* OLL2809, such as Gram-positive bacilli and other physiological characteristics. Those skilled in the art can isolate such *Lactobacillus gasseri* from human feces and such based on known physiological characteristics. The effect of preventing and/or treating allergies can be confirmed performing, for example, assays that evaluate the IL-12 production-promoting effect and the Th1/Th2

balance-improving effect; the suppressive effect on antigen-specific IgE production (intraperitoneal or oral administration of the antigens); the Natural Killer cell-activating ability; and the ability to suppress eosinophilia. Specific confirmatory methods are described in the Examples below. In addition, the viability after *in vivo* administration can be confirmed by a gastric acid/bile acid resistance assay, and more particularly, by the method described in the Examples herein. Culture can also be performed by methods similar to those described above for *Lactobacillus gasseri* OLL2809.

In the present invention, “physical activity is promoted (promotion of physical activity)” may be specifically exemplified by an embodiment in which “amount of (physical) activity is increased” or “muscle mass is increased” in subjects of administration or subjects of intake as a preferred embodiment, but it is not particularly limited to this embodiment.

Furthermore, individuals with promoted physical activity and high levels of physical activity have been found to have a low mortality rate and susceptibility to ischemic heart disease, hypertension, diabetes, obesity, osteoporosis, colon cancer, and such. That is, in the present invention, “promoting physical activity” also means decreasing mortality rate and susceptibility to ischemic heart disease, hypertension, diabetes, obesity, osteoporosis, colon cancer, and such.

Furthermore, promotion of physical activity has been found to have effects of improving mental health and quality of life (QOL). That is, in the present invention, “promoting physical activity” also means improving mental conditions or improving quality of life.

Promotion of physical activity has also been known to have effects of reducing body weight and reducing the amount of visceral fat. That is, in the present invention, “promoting physical activity” also means reducing body weight or reducing the amount of visceral fat.

Furthermore, among the elderly, promoting physical activity in daily life such as walking has been shown to be effective in decreasing bedridden conditions and reducing deaths. That is, in the present invention, “promotion of physical activity” also means maintaining muscles, bones, joints, and brain functions by suppressing the decrease in the amount of activity in elderly individuals who are likely to have decreased amount of physical activity.

As described in the Example, the effect of promoting physical activity can be confirmed, among subjects of administration or subjects of intake, by comparing the average amount of (physical) activity between the administered group (intake group) and the non-administered group (non-intake group). When the subjects are mice, physical activity level can be measured by measuring the amount of locomotor activity in the dark period, which is the period of activity for mice. The difference in the amount of locomotor activity between the standard week and the following week was defined as the “level of change in the amount of locomotor activity”; and the “rate of change in the amount of locomotor activity” can be calculated by dividing the level of change in the amount of locomotor activity by the amount of locomotor activity in the

standard week to confirm the degree of the effect of promotion of physical activity. When the “rate of change in the amount of locomotor activity” is greater than 0%, the administered lactobacilli can be certified as having the effect of promoting physical activity. In the present invention, the range of values of the “rate of change in the amount of locomotor activity”

improved as a result of the effect of promoting physical activity is not particularly limited, but examples include a rate of change in the range of preferably 1% or more, more preferably 5% or more, and more preferably 10% or more.

Furthermore, the effect of promoting physical activity can be confirmed among subjects of administration or subjects of intake, by comparing muscle mass, body weight, or amount of visceral fat between the administered group (intake group) and the non-administered group (non-intake group). The region for measuring the amount of muscles may be any region and includes the limbs (upper arm, forearm, thigh, lower leg) and trunk. When confirming an increase in muscle mass according to the present invention, the weight of muscle mass at a specific muscular region (for example, gastrocnemius muscle) is measured, and the muscle mass is compared between the administered group (intake group) and the non-administered group (non-intake group), as described in the Examples. When the muscle mass of the administered group (intake group) is heavier than that of the non-administered group (non-intake group), the administered lactobacilli can be certified as having the effect of promoting physical activity.

Furthermore, when the subject is human, the amount of physical activity can be measured from the time spent on a physical activity and the type of the physical activity, by using METs (metabolic equivalents) which is an index of exercise intensity, or by using an indicator called METs · time (Ex: exercise) obtained by multiplying METs by the exercise time. METs is a unit indicating the intensity of physical activity, and shows the folds of energy consumption level due to exercise when compared to at rest. Each exercise intensity can be expressed as “1 METs = state of resting while sitting”, “3 METs = normal walking”, and such. Exercise (Ex) is a unit expressing the amount of physical activity which is indicated by “intensity of physical activity [METs] x time spent carrying out the physical activity [hours]”, and the consumed calories (kcal) can be calculated by multiplying this unit by the body weight (kg) and a standard value (e.g., 1.05). The effect of promoting physical activity can also be confirmed by comparing the amount of calorie consumption calculated by the above-mentioned method.

Furthermore, the survivability of the agent for promoting physical activity after being administered into the body can be checked by gastric-acid and bile-acid tolerance tests. Culturing can also be carried out by methods similar to those described above for *Lactobacillus gasseri* OLL2809.

The agents of the present invention for promoting physical activity can include the aforementioned *Lactobacillus gasseri* in various forms, for example as a lactobacillus

suspension, a lactobacillus culture (bacteria, culture supernatant (comprising culture medium components)), or a lactobacillus fermentation product (lactobacillus beverages, sour milk, yogurt, etc.).

The agent of the present invention for promoting physical activity may include the
 5 above *Lactobacillus gasseri* as is or as a lactobacillus treatment product, in which some treatment has been carried out to the *Lactobacillus gasseri*. Examples of lactobacillus treatment products suitable for use as agents of the present invention for promoting physical activity include lactobacilli, materials containing lactobacilli, concentrates of fermented milk, pastes, dried products (at least one selected from spray-dried products, freeze-dried products,
 10 vacuum-dried products, and drum-dried products), liquids, diluted materials, and crushed materials. Live, moist, or dried bacteria can be appropriately used. Dead bacteria to which sterilization, such as a heat-sterilization treatment, an irradiation sterilization treatment, or a crushing treatment had been performed may be used as well. The bacteria can also be added to pharmaceuticals and/or food/drink that meet biological standard, such as powdered milk, and are
 15 applicable to a variety of pharmaceuticals and/or food/drink, regardless of the forms of the pharmaceuticals and/or food/drink.

The agents of the present invention for promoting physical activity are effective for promoting physical activity in humans and animals when orally administered alone or when mixed with other components that may be commonly used in pharmaceuticals or food products,
 20 or when used in combination with other compounds, microorganisms, and such that have an activity of promoting physical activity.

As an agent of the present invention for promoting physical activity, the culture solution of cultured lactobacilli can be used as it is, or by concentrating it to a concentrate, or by further drying the concentrate. The concentration of these bacteria is not particularly limited; and 4×10^{10} per gram or more as a concentrate, and 5×10^{11} per gram or more as a dried product are
 25 preferred.

The amount of the agents of the present invention for promoting physical activity mixed in pharmaceuticals or food/drink differs depending on its configuration, dosage form, symptoms, body weight, use, and such; thus it is not limited in particular. However, the agents can be
 30 mixed, for example, at a content of 0.001 to 100% (w/w), preferably at a content of 0.01 to 100% (w/w), and more preferably at a content of 0.1 to 100% (w/w).

The amount of the pharmaceuticals or food/drink comprising the agents of the present invention for promoting physical activity that is taken per day varies with age, symptoms, body weight, use, and such; thus, it is not particularly limited. However, the pharmaceuticals or
 35 food/drink can be taken at 0.1 to 10000 mg/kg body weight, and preferably at 0.1 to 1000 mg/kg body weight.

The agents of the present invention for promoting physical activity can be configured both as a pharmaceutical and as a food/drink. For example, promotion of various physical activities described above are expected through their direct administration as pharmaceuticals, or through direct injection as foods for special dietary uses such as food for specific health use, or nutrition-promoting foods. Moreover, they can be added to various food and drink (e.g., milk, processed milk, milk beverages, soft drinks, fermented milk, yogurt, cheese, bread, biscuits, crackers, pizza crusts, ice creams, candy, gummy candy, gum, formula milk, fluid diet, food for sick people, food for young children such as powdered milk, food for breastfeeding women such as powdered milk, nutritious foods, etc.), and this can be ingested.

Food and drink containing the agents of the present invention for promoting physical activity can be used after mixing with water, proteins, sugars, lipids, vitamins, minerals, organic acids, organic bases, fruit juices, flavors, and such. Examples of proteins include animal or plant proteins, such as whole powdered milk, powdered skim milk, partially-skimmed milk, casein, whey powder, whey proteins, whey protein concentrates, whey protein isolates, α -casein, β -casein, κ -casein, β -lactoglobulin, α -lactalbumin, lactoferrin, soy bean proteins, chicken egg proteins, and meat proteins as well as their hydrolysates; and various milk-derived components such as butter, milk minerals, cream, whey, non-protein nitrogen, sialic acid, phospholipids, and lactose. Examples of sugars include processed starch (dextrin, soluble starch, British starch, oxidized starch, starch ester, starch ether, etc.) and dietary fibers. Examples of lipids include animal oils, such as lard and fish oils, as well as their separated oils, hydrogenated oils, and interesterified and/or transesterified oils; and vegetable oils, such as palm oil, safflower oil, corn oil, rapeseed oil, coconut oil, as well as their separated oils, hydrogenated oils, and interesterified and/or transesterified oils. Examples of vitamins include vitamin A, carotenes, vitamin B group, vitamin C, vitamin D group, vitamin E, vitamin K group, vitamin P, vitamin Q, niacin, nicotinic acid, pantothenic acid, biotin, inositol, choline, and folic acid. Examples of minerals include calcium, potassium, magnesium, sodium, copper, iron, manganese, zinc, and selenium. Examples of organic acids include malic acid, citric acid, lactic acid, and tartaric acid. When producing food/drink containing the agents of the present invention for promoting physical activity, these components may be synthesized or naturally derived, and/or food abundantly including these components may also be used as source material. Moreover, two or more of these components can be used in combination.

When the agents of the present invention for promoting physical activity are used to produce food compositions and pharmaceuticals, production methods known to those skilled in the art can be used. Those skilled in the art can appropriately combine the steps of mixing the *Lactobacillus gasseri* bacteria of the present invention or treatment products with other components, shaping, sterilizing, fermenting, firing, drying, cooling, granulating, packing, and

such to produce desired food and pharmaceuticals.

Moreover, when the *Lactobacillus gasseri* of the present invention is used to produce a variety of milk products, the desired milk products can be produced by methods known to those skilled in the art. For example, in the case of yogurt, yogurt can be produced through the steps of: preparing a starter using the *Lactobacillus gasseri* of the present invention; adding the starter to pre-treated milk and culturing it; cooling; flavoring; packing; and such. Cheese can be produced, for example, through the steps of: lactic fermentation after adding the *Lactobacillus gasseri* of the present invention as a starter to milk to which a pretreatment such as sterilization had been carried out; producing cheese curd by adding rennet; cutting the curd; discarding whey; adding salt; and maturation. Alternatively, in the above-described production of the various types of milk products, other lactobacilli may be used as the starter in place of the *Lactobacillus gasseri* of the present invention, and the *Lactobacillus gasseri* bacteria of the present invention or the treatment products may be added during a production step.

The agents of the present invention for promoting physical activity can be administered in various configurations, when used as pharmaceuticals. Examples of configurations include oral administrations using tablets, capsules, granules, powders, syrups, etc. These various formulations can be formulated using, in addition to the main agent, known auxiliary agents that can generally be used in the technical field of pharmaceutical formulation, such as excipients, binding agents, disintegrants, lubricants, odor-improving agents, solubilizing agents, suspending agents, and coating agents, according to standard methods. By producing an enteric-coated preparation using a method well-known to those skilled in the art, an agent of the present invention for promoting physical activity may be efficiently transported to the intestines without being affected by gastric acid.

All prior art documents cited herein are incorporated by reference into the present specification.

Example

Herein below, results obtained using *Lactobacillus gasseri* OLL2809 (Accession Number: NITE BP-72) will be described in detail as Example of the present invention.

However, the present invention is not to be construed as being limited to the following examples.

[Example 1]

Six-week-old male BALB/c mice were habituated for one week and then subjected to the experiment. One week prior to the start of the experiment, the animals were grouped according to their locomotor activity levels to minimize variation in the measured values. Each group included eight animals. From the starting date of the experiment, dead *Lactobacillus*

gasseri OLL2809 was orally administered at 2 mg/body/day (1×10^8 to 5×10^8 for every 2 mg) to the lactobacilli-administered group, and distilled water was orally administered to the distilled water-administered group for 25 days; and the amount of locomotor activity in the dark period, which is the period of activity for mice, was measured. The amount of locomotor activity was measured twice a week for 24 hours using an infrared apparatus for monitoring locomotor activity level (manufactured by Shinfactory). On day 26 from the start of the experiment, the mice were placed under ether anesthesia, blood was collected from the facial vein of their cheek, gastrocnemius muscle was removed, and the muscle weight was measured. Statistical treatment was performed for the water-administered group and the lactobacilli-administered group using Student's t-test.

The amount of locomotor activity was compared between week 2 (average of two measurements) and week 3 (average of two measurements) of administration by the rate of change (%) of the measured values at week 2 of administration and week 3 of administration.

The results showed that the rate of change in the amount of locomotor activity of the lactobacilli-administered group indicates a significantly higher value than that of the water-administered group (Fig. 1: $p = 0.049$). Furthermore, upon autopsy, the weight of the right gastrocnemius muscle relative to body weight in the lactobacilli-administered group indicated a significantly higher value than that of the water-administered group (Fig. 2: $p = 0.016$).

The above-described results confirmed that administration of *Lactobacillus gasseri* promotes physical activity of the subject of administration. This technique is not limited to the *Lactobacillus gasseri* shown in the Example, and it is likely to be widely applicable to *Lactobacillus gasseri* species.

Industrial Applicability

As confirmed in the later-described Examples, an agent of the present invention for promoting physical activity increases the amount of activity and increases the muscle mass of the subject of administration. This has enabled the present invention to provide a novel agent for promoting physical activity which is effective for relieving stress and maintaining health such as prevention of life-style diseases, or to provide food compositions that comprise this agent for promoting physical activity.

The present invention actualizes continued exercise and improvement of QOL by supporting increase in the amount of activity in people who lack exercise. In particular, for the elderly whose amount of activity is decreased, intake of lactobacilli of the present invention is expected to provide health-maintaining effects such as maintenance of muscle, bone, joint, and brain function by suppressing decrease in the amount of activity.

Industrially, the food compositions of the present invention for promoting physical activity can be used as a food taken at the start of exercise or food taken during exercise for young individuals to middle-aged and older individuals who want to adhere to exercise, and for the elderly for whom moderate exercise is recommended.

CLAIMS

1. An agent for promoting physical activity, comprising *Lactobacillus gasseri* as an active ingredient.

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2. An agent for promoting physical activity comprising, as an active ingredient, at least one treatment product of *Lactobacillus gasseri* selected from a culture, concentrate, paste, spray-dried product, freeze-dried product, vacuum-dried product, drum-dried product, liquid, diluted product, and crushed product of the lactobacillus.

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3. The agent for promoting physical activity of claim 1 or 2, wherein the promotion of physical activity is an increase in the amount of activity of a subject.

4. The agent for promoting physical activity of claim 1 or 2, wherein the promotion of physical activity is an increase of muscle mass in a subject.

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5. The agent for promoting physical activity of any one of claims 1 to 4, wherein the *Lactobacillus gasseri* is *Lactobacillus gasseri* OLL2809 deposited under the accession number NITE BP-72.

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6. A food composition for promoting physical activity, comprising an effective amount of the agent for promoting physical activity of any one of claims 1 to 5.

7. Use of the agent for promoting physical activity of any one of claims 1 to 5 in the production of a food composition for promoting physical activity.

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8. The use of claim 7, wherein the food composition for promoting physical activity is: an infant formula, food for young children such as powdered milk, food for breastfeeding women such as powdered milk, health-promoting food, food for sick people, or fermented milk.

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9. A method for promoting physical activity, comprising administering *Lactobacillus gasseri* or a treatment product thereof.

10. A method for producing a food composition for promoting physical activity, comprising using *Lactobacillus gasseri* or at least one treatment product selected from a culture, concentrate, paste, spray-dried product, freeze-dried product, vacuum-dried product, drum-dried product,

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liquid, diluted product, and crushed product thereof.