DESCRIPTION

COLLAGEN-CONTAINING FERMENTED MILK AND METHOD FOR PRODUCING SAME

Technical Field

[0001]

The present invention relates to a collagen-containing fermented milk blended with collagen and a method for producing the same.

Background Art

[0002]

Conventionally, it has been well known that a fermented milk, a representative example of which is yogurt, has an effect of maintaining or promoting health. In recent years, in expectation of exhibiting further specific effects, there has been a tendency that a fermented milk is imparted with certain functionality. For example, JP-A-2008-283948 (Patent Document 1) discloses a method for producing a fermented milk product in which bacteria and protease are acted on a raw material containing milk and collagen. In this method, although flavor, taste or the like are evaluated for a fermented milk product containing collagen, only a general description is made on the method for producing the same.

[0003]

Collagen is a major component of dermis or connective tissue. It is expected to have cosmetic effects, and is widely used in health food or the like. However, it is known that collagen has a unique unpleasant odor, and the flavor of a product obtained by blending with collagen is adversely affected. For example, JP-A-2003-210119 (Patent Document 2) discloses a method of using chlorogenic acid (3-caffeoyquinic acid) to suppress an unpleasant odor derived from collagen.

Related Art Documents

Patent Documents

[0004]

Patent Document 1: JP-A-2008-283948

Patent Document 2: JP-A-2003-210119

Summary of the Invention

Problems to be Solved by the Invention

[0005]

The present invention is aimed at providing a method for producing a collagen-containing fermented milk having a pleasant flavor. As a result of studies

made by the inventors, a problem has been confirmed that, when a milk-containing material mixture blended with collagen at a high concentration was fermented, an unpleasant flavor (odor) is generated, and during storage (in particular, during chilling storage), such unpleasant flavor was increased. In addition, with an increase in concentration of collagen, such an unpleasant flavor is increased. Therefore, the present invention is aimed at providing a method for producing a fermented milk in which very few unpleasant flavor is generated and an unpleasant flavor is not increased during storage (in particular, during chilling storage) even if a fermented milk is produced by using a milk-containing material mixture blending with collagen at a high concentration.

Means for Solving the Problems

[0006]

In order to solve the above-mentioned problems, the inventors examined a method for suppressing generation of an unpleasant odor and/or a method for producing a fermented milk which is free from generation of an unpleasant flavor during storage (in particular, during chilling storage), when producing a fermented milk by using a milk-containing material mixture blended with collagen at a high concentration. The inventors have found that, by adding a prescribed antioxidant to a milk-containing material mixture blended with collagen at a high concentration, it is possible to produce a fermented milk without generating an unpleasant flavor derived from collagen and without increasing an unpleasant flavor during storage (in particular, during chilling storage). The invention has been completed based on this finding.

[0007]

According to the invention, the following method for producing a fermented milk blended with collagen at a high concentration or the like can be provided.

1. A method for producing a collagen-containing fermented milk, comprising adding an antioxidant.

2. The method for producing a collagen-containing fermented milk according to 1, wherein the concentration of the antioxidant in a milk-containing material mixture is 0.001 mass% or more and 0.3 mass% or less.

3. The method for producing a collagen-containing fermented milk according to 1 or 2, wherein the concentration of the collagen in the milk-containing material mixture is 0.4 mass% or more and 7 mass% or less.

4. The method for producing a collagen-containing fermented milk according to any one of 1 to 3, wherein the antioxidant is one or two or more selected from a rosemary extract, a laffemas extract, rutin, enzyme-treated rutin, a bayberry extract, a

tea extract, a coffee extract, vitamin E and polyphenols.

5. The method for producing a collagen-containing fermented milk according to any one of 1 to 4, which suppresses generation of an unpleasant flavor and/or suppresses increase of an unpleasant flavor during storage.

6. The method for producing a collagen-containing fermented milk according to any one of 1 to 5, which suppresses generation of one or two or more selected from methyl mercaptan, DMDS (dimethyl disulfide) and DMTS (dimethyl trisulfide) and/or suppresses increase of one or two or more selected from methyl mercaptan, DMDS and DMTS during storage.

7. A fermented milk produced by the method according to any one of 1 to 6.

Advantageous Effects of the Invention

[0008]

In a conventional method, there was a problem that, if a milk-containing material mixture blended with a collagen at a high concentration is fermented, an unpleasant flavor is generated, and during storage (in particular, during chilling storage), this unpleasant flavor is increased. On the other hand, in the present invention, it is possible to provide a method for producing a fermented milk having a good flavor since no unpleasant flavor is generated even if a fermented milk is produced by using a milk-containing material mixture blended with collagen at a high concentration, and during storage (in particular, during chilling storage), an unpleasant flavor is not newly generated and an unpleasant flavor is not increased.

Brief Description of the Drawings

[0009]

Fig. 1 is a graph showing a change with the passage of time of the concentration of methyl mercaptan during chilling storage of a liquid fermented milk obtained in Example 2. The vertical axis is a detection ratio (relative value) when a measured value of a control immediately after the storage is taken as 1;

Fig. 2 is a graph showing a change with the passage of time of the concentration of DMDS during chilling storage of a liquid fermented milk obtained in Example 2. The vertical axis is a detection ratio (relative value) when a measured value of a control immediately after the storage is taken as 1;

Fig. 3 is a graph showing a change with the passage of time of the concentration of DMTS during chilling storage of a liquid fermented milk obtained in Example 2. The vertical axis is a detection ratio (relative value) when a measured value of a control immediately after the storage is taken as 1;

Fig. 4 is a graph showing a change with the passage of time of the concentration of methyl mercaptan during chilling storage of a liquid fermented milk obtained in Comparative Examples 1 to 3. The vertical axis is a detection ratio (relative value) when a measured value of Comparative Example 1 immediately after storage is taken as 1;

Fig. 5 is a graph showing a change with the passage of time of the concentration of DMDS during a chilling storage of a liquid fermented milk obtained in Comparative Examples 1 to 3. The vertical axis is a detection ratio (relative value) when a measured value of Comparative Example 1 immediately after storage is taken as 1; and

Fig. 6 is a graph showing a change with the passage of time of the concentration of DMTS during chilling storage of a liquid fermented milk obtained in Comparative Examples 1 to 3. The vertical axis is a detection ratio (relative value) when a measured value of Comparative Example 1 immediately after storage is taken as 1.

Mode for Carrying out the Invention

[0010]

With an aim of producing a fermented milk to which functions such as beauty promotion or the like are added, the inventors blended collagen in a milk-containing material mixture at a high concentration, thereby to allow the milk to be fermented. As a result, an unpleasant flavor (odor) was generated. Further, it was revealed that such an unpleasant flavor was increased during chilling storage. In this phenomenon of generation of such an unpleasant flavor, since a tendency of increasing the unpleasant flavor was confirmed with an increase in concentration of blended collagen, it was considered that blending (addition) of collagen was the major cause (major causative component) of generation of an unpleasant flavor.

[0011]

Under such circumstances, in order to solve the above-mentioned problem, the inventors made various studies on a method for suppressing generation of an unpleasant flavor in fermented milk blended with collagen at a high concentration. As a result, the inventors have found that, by fermenting a milk-containing material mixture blended with collagen at a high concentration after addition of a prescribed antioxidant, generation of an unpleasant flavor in a fermented milk blended with collagen at a high concentration could be suppressed.

[0012]

In the present invention, the term "fermented milk" includes “fermented milk” or the like defined in "Ministerial Ordinance Concerning Compositional Standards, etc. for Milk and Milk Products" (Ministerial Ordinance on Milk, etc.; Article 52 of the Ordinance of the Ministry of Health, Labor and Welfare, December 26, 1947; finally revised: Article

142 of the Ordinance of the Ministry of Health, Labor and Welfare, December 25, 2014). In this ordinance, the “fermented milk” is defined as “one obtained by fermenting “milk” or “milk or the like containing fat-free solid matters that are equivalent to or higher than the milk” with lactobacillus or yeast to allow it to be a paste-like or liquid-like state, or to be frozen”. Therefore, in the present invention, the fermented milk includes solid-like fermented milk such as yogurt (set type yogurt), a paste-like fermented milk (soft type yogurt), a liquid-like fermented milk (drink type yogurt) or the like.

[0013]

“Collagen” is a type of proteins that make up tissues of bones, cartilages, ligaments, tendons, skin or the like, and the amount thereof is thought to occupy about one-third (1/3) of the proteins in the human body. In addition to functioning as a protein in the human body, collagen is also used as a raw material of foods, drinks, medicines, and cosmetics. Collagen is thought to have functions of moisturizing, promoting beauty, relieving arthralgia, promoting bone formation, etc.

[0014]

In the present invention, "collagen" also includes collagen peptide that is obtained by decomposing collagen with an enzyme, thereby allowing it to have a low molecular weight. The collagen may be commercially-available collagen and collagen peptide.

[0015]

For example, "Ikuosu HDL" and “SCP-5200” sold by Nitta Gelatin Inc., "PS-1” and "FCP" sold by Nippi. Inc., “Matrix Neo (DR)” sold by Yaizu Suisankagaku Industry, “Fish Collagen WP” sold by Uniques Corporation, “Marin Collagen NH” sold by Nippon Ham Group, “Marin Collagen LM” sold by Nissui Pharmaceutical Co., Ltd. and “Amino Collagen” solid by Meiji Co., Ltd. or the like can be given.

[0016]

In the present invention, the concentration of collagen added in a milk-containing material mixture is preferably 0.4 mass% or more and 7 mass% or less, more preferably 0.8 mass% or more and 6 mass% or less, further preferably 1.0 mass% or more and 5 mass% or less, and particularly preferably 1.5 mass% or more and 4 mass% or less.

[0017]

As for collagen peptide, a lower weight-average molecular weight thereof leads to well absorption into the body. However, collagen peptide having a lower weight-average molecular weight has a strong odor peculiar to collagen peptide. Therefore, when collagen peptide is used, if it has a lower weight-average molecular weight, the effects of the present invention become significant. Specifically, the effects of the present invention become significant when the weight-average molecular weight of collagen peptide is 5000Da or less, 4000Da or less, or 500Da to 3500Da. The weight-average molecular weight of collagen peptide can be measured by the method

described in “Methods for Testing Photographic Gelatin (PAGI method), the 10th edition” of the Japan Collagen Peptide Industrial Association.

[0018]

Here, the “milk-containing material mixture” means a mixture of all materials used in the method for producing a collagen-containing fermented milk of the present invention. For example, in addition to the collagen, the antioxidant and the starter explained below, materials that are required to produce a normal fermented milk or a conventional fermented milk are also included.

[0019]

The “antioxidant” is a material that prevents oxidation of foods, pharmaceuticals, and cosmetics. As a natural antioxidant, vitamin E (α-tocopherol) or the like can be given. As a synthetic antioxidant, butyl hydroxy anisole (BHA), dibutylhydroxytoluene (BHT) or the like can be given. These antioxidants are used for preventing oxidization of oil and fat or the like. In the present invention, no specific restrictions are imposed on an antioxidant as long as it is used in foods and drinks, and exhibits advantageous effects of the present invention. The antioxidant is not necessarily a pure product (reagent), and it may be an antioxidant that is generally available, inclusive of a mixture or a mixed preparation.

[0020]

In the present invention, the antioxidant is an extracted natural product, purified vitamin B, β-carotene, lycopene or polyphenols. It is preferred that the antioxidant be one or two or more selected from a rosemary extract, a laffemas (Apocynum venetum) extract, rutin, enzyme-treated rutin, a bayberry extract, a tea extract (main component: catechin), a coffee extract, vitamin E and polyphenols. It is more preferred that the antioxidant be one or two or more selected from rutin, a tea extract, vitamin E and polyphenols.

[0021]

The “polyphenols” are a substance having within its molecule an aromatic ring on which a hydroxyl group(s) are bonded. The “polyphenols” include a flavonoid (anthocyanin, isoflavone, tannin or the like), ellagic acid, chlorogenic acid, curcumin, lignan, procyanidin, punicalin, punicalagin and pomegraniin, for example. As the polyphenols, polyphenols derived from pomegranate or the like can be given.

[0022]

The “rosemary extract” means a non-water-soluble fraction obtained by extracting rosemary protophyll with hydrous ethanol.

The “laffemas extract” means one obtained by extracting leaves of laffemas with water, ethanol, hydrous ethanol or an organic solvent, followed by concentration.

The “enzyme-treated rutin” means one obtained by α-1,4-addition of glucose to a mixture of a rutin extract and starch or dextrin by using cyclodextrin glucocyltransferase.

[0023]

The “bayberry extract” means one obtained by extracting from the fruit, the bark or the leaves of bayberry by using water, ethanol or methanol.

The “tea extract” means one obtained by extracting leaves, stems or the like of tea with water or an organic solvent.

For the “polyphenols derived from pomegranate”, generally, an extract of pomegranate can be used. Specifically, it can be obtained by a method in which pericarp, inner membrane and seeds are ground, heated, and treated with an enzyme (pectinase, cellulase), and water is added, followed by filtration.

The “coffee extract” means one obtained by a method in which roasted coffee ground products are immersed in a mixed solvent of water and ethanol or are extracted under reflux with heating with the mixed solvent, whereby matters insoluble in the solvent are removed, or by a method in which fractioning is conducted with a ultrafiltration membrane.

[0024]

In the present invention, in respect of flavor of a fermented milk (sensory evaluation), the antioxidant is preferably one or two or more selected from rutin, vitamin E and polyphenols, the antioxidant is preferably rutin, vitamin E and polyphenols derived from pomegranate. In respect of odor components of a fermented milk, the antioxidant is further more preferably one or two or more selected from a tea extract, a coffee extract and polyphenols derived from pomegranate. It is particularly preferred that the antioxidant be polyphenols derived from pomegranate.

[0025]

In the present invention, the concentration of the antioxidant added in a milk-containing material mixture is preferably 0.001 mass% or more and 0.3 mass% or less, more preferably 0.005 mass% or more and 0.25 mass% or less, further preferably 0.01 mass% or more and 0.2 mass% or less, and particularly preferably 0.05 mass% or more and 0.15 mass% or less.

[0026]

In the present invention, the “unpleasant flavor” means a flavor that does not suited to a fermented milk. For example, aroma components can be used as the index of an unpleasant flavor. No specific restrictions are imposed on aroma components as long as they are contained in foods and drinks and can evaluate the action and effects of the present invention. It is preferred that the aroma components be one or two or more selected from methyl mercaptan, DMDS (dimethyl disulfide) and DMTS (dimethyl trisulfide). It is more preferred that the aroma components be one or two or more selected from DMDS and DMTS.

[0027]

In the present invention, as for the matters other than those mentioned above, the similar methods or materials that are required for producing a normal fermented

milk or a conventional fermented milk can be applied. For example, in the present invention, as the material for a fermented milk, a milk raw material such as raw milk, sterilized milk, skim milk, whole milk powder, powdered skim milk, whole concentrated milk, concentrated skim milk, cream, butter, butter milk, whey, a whey protein concentrate (WPC), a whey protein isolate (WPI), α-lactoalbumen (α-La) and α-lactoglobulin (β-Lg); sugar; sweeteners; saccharides; flavoring agents; water or the like can be given. In addition, as the raw material for a fermented milk, a gelling agent such as gelatin, agar, pectin and carboxymethyl cellulose (CMC), a thickening agent and a stabilizer can be given.

[0028]

As the starter, one or two or more selected from lactobacillus or yeast that is generally used in production of fermented milk, such as Lactobacillus bulgaricus, Streptococcus thermophilus and Lactobacillus lactis, can be selected for use.

[0029]

In the present invention, the concentration of bacteria in a mixed starter is preferably 10^6 cfu/mL or more and 10^{12} cfu/mL or less, more preferably 10^7 cfu/mL or more and 10^{11} cfu/mL or less, with 10^8 cfu/mL or more and 10^{10} cfu/mL or less being further preferable. Further, the amount of a mixed starter added to a milk-containing material mixture is preferably 1 mass% or more and 8 mass% or less, more preferably 2 mass% or more and 6 mass% or less, and further preferably 2 mass% or more and 4 mass% or less.

[0030]

At this time, in addition to those mentioned above, one or two or more selected from probiotics such as bacteria, yeast or the like belonging to Lactobacillus gasseri, Lactobacillus helveticus, Lactobacillus plantarum, Bifidobacterium or Propionibacterium.

[0031]

In the present invention, preparation (formulation) of a milk-containing material mixture is conducted by the following procedures. That is, after mixing (dissolving or dispersing) various raw materials, a prescribed amount of collagen and a prescribed amount of an antioxidant are added, homogenized and/or sterilized according to need, and cooled to a prescribed temperature (fermentation temperature, for example). Next, a starter is inoculated (added) to this mixture at a prescribed concentration. The milk-containing material mixture thus obtained was fermented after mixing (stirring) according to need. At this time, in the case of the so-called pre-fermentation type yogurt (soft type yogurt, drink type yogurt, or the like), fermentation is conducted in a large-sized tank or the like. In the case of the so-called post-fermentation type yogurt (set-type yogurt), fermentation is conducted in a container or the like that is to be actually sold at stores.

[0032]

In the present invention, the pH at the time of fermentation is preferably 4.7 or less, more preferably 4.65 or less, and further preferably 4.6 or less, within four hours from the start of fermentation. The pH can be measured by using a known pH meter. In the present invention, the fermentation temperature is preferably 30°C or higher and 50°C or lower, more preferably 35°C or higher and 47°C or lower, further preferably 40°C or higher and 45°C or lower, and particularly preferably 42°C or higher and 44°C or lower. The fermentation time is preferably 2 hours or longer and 24 hours or shorter, more preferably 2 hours or longer and 12 hours or shorter, further preferably 3 hours or longer and 7 hours or shorter, and particularly preferably 3 hours or longer and 5 hours or shorter.

[0033]

In another aspect, the present invention is an agent for suppressing generation of an unpleasant flavor during production of a collagen-blended fermented milk, and/or an agent for suppressing an increase in an unpleasant flavor during storage (in particular, during chilling storage) of a collagen-blended fermented milk, wherein the agent comprises an antioxidant as an effective ingredient. The antioxidant is preferably one or two or more selected from rutin, a tea extract (catechin), vitamin E and polyphenols, more preferably one or two or more selected from rutin, vitamin E and polyphenols, further preferably one or two or more selected from rutin, vitamin E, polyphenols derived from pomegranate and a coffee extract, and most preferably polyphenols derived from pomegranate.

[0034]

In another aspect, the present invention is a method for suppressing generation of an unpleasant flavor during production of a collagen-blended fermented milk, and/or a method for suppressing an increase of an unpleasant flavor during storage (in particular, during chilling storage) of a collagen-blended fermented milk, wherein the method comprises using an antioxidant as an effective ingredient. The antioxidant is preferably one or two or more selected from rutin, a tea extract (catechin), a coffee extract, vitamin E and polyphenols, more preferably one or two or more selected from rutin, vitamin E and polyphenols, further preferably one or two or more selected from rutin, vitamin E, polyphenols derived from pomegranate and coffee extract, and most preferably polyphenols derived from pomegranate.

[0035]

In another aspect, the present invention is an agent for suppressing generation of one or two or more selected from methyl mercaptan, DMDS and DMTS (preferably one or two selected from DMDS and DMTS) during production of a collagen-free fermented milk, and/or an agent for suppressing an increase of one or two or more selected from methyl mercaptan, DMDS and DMTS (preferably one or two selected from DMDS and DMTS) during storage (in particular, during chilling storage) of a collagen-blended fermented milk, wherein the method comprises using an antioxidant

as an effective ingredient. The antioxidant is preferably one or two or more selected from rutin, a tea extract (catechin), a coffee extract, vitamin E and polyphenols, more preferably one or two or more selected from a tea extract and polyphenols, further preferably one or two or more selected from a tea extract, a coffee extract and polyphenols derived from pomegranate, and most preferably polyphenols derived from pomegranate.

[0036]

Further, in another aspect, the present invention is a method for suppressing generation of one or two or more selected from methyl mercaptan, DMDS and DMTS (preferably one or two selected from DMDS and DMTS) during production of a collagen-blended fermented milk, and/or a method for suppressing an increase of one or two or more selected from methyl mercaptan, DMDS and DMTS (preferably one or two selected from DMDS and DMTS) during storage (in particular, during chilling storage) of a collagen-blended fermented milk, wherein the method comprises using an antioxidant as an effective ingredient. The antioxidant is preferably one or two or more selected from rutin, a tea extract (catechin), a coffee extract, vitamin E and polyphenols, more preferably one or two or more selected from rutin, vitamin E and polyphenols, further preferably one or two or more selected from rutin, vitamin E, polyphenols derived from pomegranate and a coffee extract, and, most preferably polyphenols derived from pomegranate.

[0037]

In each of the other aspects of the present invention, it is preferred that the concentration of the antioxidant in the milk-containing material mixture be 0.001 mass% or more and 0.3 mass% or less, and it is preferred that the concentration of collagen blended in the milk-containing material mixture be 0.4 mass% or 7 mass% or less.

EXAMPLES

[0038]

Hereinbelow, the present invention will be explained in more detail with reference to the following examples. The present invention will not be limited to these examples.

[0039]

[Example 1]

34.6 kg of milk (produced by Meiji Holding Co., Ltd.), 5.89 kg of powdered skim milk (produced by Meiji Holding Co., Ltd.) and 51.95 kg of water were mixed. With this mixture, 4.46 kg of collagen and 0.1 kg of any one of the antioxidants shown in Table 1 were blended (added), following by sterilization with heating at 95°C for 10 minutes. Thereafter, the mixture was cooled to 45°C. Then, 3.0 kg of lactobacillus starter (a mixed starter of lactobacillus bulgaricus and Streptococcus thermophiles separated

from Meiji Bulgaria Yogurt (product name; produced by Meiji Holing Co., Ltd.)) was inoculated. The yogurt mix thus obtained was retained in a tank, and fermented by allowing the tank to stand at 43°C. When the pH of the tank reached 4.6, the yogurt mix was cooled to 10°C or less, whereby a fermented milk was obtained. The resulting fermented milk was homogenized by means of a homogenizer having a processing power of 190 l/hr at 15 MPa (first stage: 10 MPa, second stage: 5 MPa), whereby a liquid-like fermented milk was obtained.

By using each of the antioxidants shown in Table 1, liquid-like fermented milks were similarly obtained.

[0040]

Table 1

Anti-oxidant	Supplier	Immediately after storage	After 7-day storage	After 16-day storage
Laffemas extract	San-Ei Gen F.F.I	B	B	D
Bayberry extract	San-Ei Gen F.F.I	D	C	D
Rosemary extract	San-Ei Gen F.F.I	F	D	D
Rutin	San-Ei Gen F.F.I	C	D	B
Coffee extract	Ogawa & Co., Ltd.	E	D	B
Polyphenol derived from pomegranate	Ogawa & Co., Ltd.	F	D	B
Vitamin E	Riken Vitamin Co., Ltd.	A	B	B
Enzyme-treated rutin	Givandan Japan	E	C	D

[0041]

[Test Example 1]

The fermented milks of Example 1 were obtained by blending with collagen and 0.1 mass% of an antioxidant. Each of these fermented milks was stored with chilling at 10°C, and a sensory test was conducted immediately after the storage (at the time of starting storage), 7 days after the storage and 16 days after the storage. The results are shown in Table 1. In the sensory test, evaluation was conducted in 6 stages of A, B, C, D, E and F, with A being the most excellent. A means that an unpleasant odor of collagen was not felt at all; B means that an unpleasant odor of collagen was very weakly felt; C means that an unpleasant odor of collagen was weakly felt; D means that an unpleasant odor of collagen was felt; E means that an unpleasant odor of collagen was slightly strongly felt; and F means that an unpleasant odor of collagen was significantly strongly felt. According to the results shown in Table 1, the fermented milk obtained by blending, as the antioxidant, rutin, a coffee extract (polyphenols derived from coffee), polyphenols derived pomegranate or vitamin E, had an pleasant flavor after chilling storage for 16 days.

[0042]

From the results mentioned above, during storage (chilling) of a fermented milk obtained by blending with collagen, rutin, a coffee extract, polyphenols derived

pomegranate and vitamin E were thought to be effective for suppressing an increase of an unpleasant favor.

[0043]

[Example 2]

A liquid-like fermented milk was obtained in the same manner as in Example 1, except that rutin (San-Ei Gen F.F.I., Co., Ltd.), a coffee extract (Ogawa & Co., Ltd.), polyphenols derived from pomegranate (Ogawa & Co., Ltd.), vitamin E (Riken Vitamin Co., Ltd.) and a tea extract (Taiyo Kagaku Co., Ltd.) were used as an antioxidant. A liquid fermented milk as a control was obtained in the same manner as in Example 1, except that no antioxidant was blended.

[0044]

[Test Example 2]

The fermented milks of Example 2 were obtained by blending with collagen and 0.1 mass% of an antioxidant. Each of these fermented milks was stored with chilling at 10°C, and measurement of aroma components was conducted immediately after the storage (at the time of starting storage), 7 days after the storage, 18 days after the storage and 26 days after the storage.

[0045]

The measurement of aroma components was conducted as follows. Specifically, 5g of a sample of the liquid-like fermented milk was mixed with 5g of saturated saline and the mixture was dispensed to a 20 ml-vial container. At a temperature of 25°C, nitrogen was continuously blown at a speed of 40 mL/min. Aroma components evaporated were extracted by adsorbing in a TDU tube (manufactured by Gestel K.K. Japan), and analyzed by GC/MS (HP5975C (GC), HP7890A (MS), both are manufactured by Agilent technologies, Japan, Ltd.). For the GC column for analysis, DB-WAX (30 m × inner diameter 0.25 mm, film thickness 0.25 μm, manufactured by Agilent technologies, Japan, Ltd.) was used. At this time, the TDU tube was heated to 230°C to allow aroma components to be desorbed. The TDU tube was cooled to -50°C to concentrate the aroma components. The concentrated aroma components were introduced to the GC/MS. As for the temperature-elevating conditions of the column, after retaining the column at 40°C for 2.5 minutes, the column was heated to 240°C at a temperature-elevating rate of 5°C/min, and retained at 240°C for 10 minutes, whereby the aroma components were separated.

[0046]

Here, the aroma components to be analyzed (measured) actually were methyl mercaptan, DMDS (dimethyl disulfide) and DMTS (dimethyl trisulfide). In the detection of these detection objects, the results of the total ion chromatogram and the mass spectrum were confirmed by correlating with the library.

[0047]

The results of the measurement of methyl mercaptan are shown in Fig. 1, the

results of the measurement of DMDS are shown in Fig. 2 and the results of the measurement of DMTS are shown in Fig. 3. The vertical axis in each of these figures is a detection ratio (relative value) taking the measured value of the liquid-like fermented milk of the control immediately after the storage as 1. The horizontal axis is the days for storing the liquid-like fermented milk.

[0048]

In the fermented milk with which polyphenols derived from pomegranate were blended, immediately after the storage (at the time of starting the storage), the content of each of the aroma components, i.e. methyl mercaptan, DMDS and DMTS, was low. Further, during chilling storage, the content of each of the aroma components, i.e. methyl mercaptan, DMDS and DMTS, was kept low. Further, in the fermented milk blended with a tea extract, immediately after the storage (at the time of starting the storage), the content of each of the aroma components, i.e. methyl mercaptan, DMDS and DMTS, was low. Further, during chilling storage, the content of each of the aroma components, i.e. methyl mercaptan, DMDS and DMTS, was kept low.

[0049]

From the above-mentioned results, as the antioxidant that is effective for suppressing an increase of the unpleasant flavor during chilling storage of the collagen-containing fermented milk, polyphenols derived from pomegranate and a tea extract could be considered.

[0050]

[Comparative Example 1]

34.6 kg of milk (produced by Meiji Holding Co., Ltd.), 5.89 kg of powdered skim milk (produced by Meiji Holding Co., Ltd.) and 56.51 kg of water were mixed, following by sterilization with heating at 95°C for 10 minutes. Thereafter, the mixture was cooled to 45°C. Then, 3 kg of lactobacillus starter (a mixed starter of lactobacillus bulgaricus and Streptococcus thermophiles separated from Meiji Bulgaria Yogurt (product name; produced by Meiji Holding Co., Ltd.)) was inoculated. The yogurt mix thus obtained was retained in a tank, and fermented by allowing the tank to stand at 43°C. When the pH of the tank reached 4.6, the yogurt mix was cooled to 10°C or lower, whereby a fermented milk was obtained. The resulting fermented milk was homogenized by means of a homogenizer having a processing power of 190 l/hr at 15 MPa (first stage: 10 MPa, second stage: 5 MPa), whereby a liquid-like fermented milk was obtained.

[0051]

[Comparative Example 2]

34.6 kg of milk (produced by Meiji Holding Co., Ltd.), 5.89 kg of powdered skim milk (produced by Meiji Holding Co., Ltd.) and 53.83 kg of water were mixed, following by sterilization with heating at 95°C for 10 minutes. Thereafter, the mixture was cooled to 45°C. Then, 3 kg of a lactobacillus starter (a mixed starter of lactobacillus bulgaricus and Streptococcus thermophiles separated from Meiji Bulgaria Yogurt

(product name; produced by Meiji Holding Co., Ltd.)) was inoculated. The yogurt mix thus obtained was retained in a tank, and fermented by allowing the tank to stand at 43°C. When the pH of the tank reached 4.6, the yogurt mix was cooled to 10°C or lower, whereby a fermented milk was obtained. The resulting fermented milk was homogenized by means of a homogenizer having a processing power of 190 l/hr at 15 MPa (first stage: 10 MPa, second stage: 5 MPa), whereby a liquid-like fermented milk was obtained.

[0052]

[Comparative Example 3]

34.6 kg of milk (produced by Meiji Holding Co., Ltd.), 5.89 kg of powdered skim milk (produced by Meiji Holding Co., Ltd.) and 52.05 kg of water were mixed, following by sterilization with heating at 95°C for 10 minutes. Thereafter, the mixture was cooled to 45°C. Then, 3 kg of a lactobacillus starter (a mixed starter of lactobacillus bulgaricus and Streptococcus thermophiles separated from Meiji Bulgaria Yogurt (product name; produced by Meiji Holding Co., Ltd.) was inoculated. The yogurt mix thus obtained was retained in a tank, and fermented by allowing the tank to stand at 43°C. When the pH of the tank reached 4.6, the yogurt mix was cooled to 10°C or lower, whereby a fermented milk was obtained. The resulting fermented milk was homogenized by means of a homogenizer having a processing power of 190 l/hr at 15 MPa (first stage: 10 MPa, second stage: 5 MPa), whereby a liquid-like fermented milk was obtained.

[0053]

[Test Example 3]

The fermented milk obtained in Comparative Example 1 was a liquid-like fermented milk obtained without blending collagen, and the fermented milk obtained in Comparative Example 2 and Comparative Example 3 were fermented milks obtained by blending with collagen but not blending with an antioxidant. These fermented milks were stored with chilling at 10°C, and measurement of aroma components was conducted immediately after the storage (at the time of starting storage), 7 days after the storage, 16 days after the storage and 27 days after the storage. The method of the Test Example 2 was applied for the measurement of aroma components.

[0054]

The results of the measurement of methyl mercaptan are shown in Fig. 4, the results of the measurement of DMDS are shown in Fig. 5 and the results of the measurement of DMTS are shown in Fig. 6. The vertical axis in each of these figures is a detection ratio (relative value) taking the measured value of the liquid-like fermented milk of the control immediately after the storage as 1. The horizontal axis is the days for storing the liquid-like fermented milk.

[0055]

In each of the fermented milk in Comparative Examples 1 to 3, almost no

change was observed in methyl mercaptan during chilling storage, and the measurement value was kept constant. On the other hand, in the fermented milk obtained in Comparative Example 1, almost no change was observed in DMDS and DMTS, and the measurement value was kept constant. On the other hand, in Comparative Examples 2 and 3, DMDS and DMTS tended to increase during chilling storage.

[0056]

From the above-mentioned results, it was considered that, during chilling storage of a fermented milk obtained by blending with collagen, the major factor (major causative components) that caused an unpleasant flavor was thought to be DMDS or DMTS, not methyl mercaptan.

Industrial Applicability

[0057]

According to the present invention, when fermented milk is produced by using a milk-containing material mixture containing collagen at a high concentration, no unpleasant odor was generated. During storage, in particular chilling storage, no unpleasant odor is newly generated or increased. Therefore, according to the present invention, it is possible to provide a method for producing a fermented milk in which an unpleasant flavor is not generated or not increased during storage, in particular, during chilling storage, even when a fermented milk is produced by using a milk-containing material mixture blended with collagen at a high concentration.

[0058]

Although only some exemplary embodiments and/or examples of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments and/or examples without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention.

The contents of the documents described in this specification are incorporated herein by reference in its entirety.

CLAIMS

1. A method for producing a collagen-containing fermented milk, comprising adding an antioxidant.

2. The method for producing a collagen-containing fermented milk according to claim 1, wherein the concentration of the antioxidant in a milk-containing material mixture is 0.001 mass% or more and 0.3 mass% or less.

3. The method for producing a collagen-containing fermented milk according to claim 1 or 2, wherein the concentration of the collagen in the milk-containing material mixture is 0.4 mass% or more and 7 mass% or less.

4. The method for producing a collagen-containing fermented milk according to any one of claims 1 to 3, wherein the antioxidant is one or two or more selected from a rosemary extract, a laffemas extract, rutin, enzyme-treated rutin, a bayberry extract, a tea extract, a coffee extract, vitamin E and polyphenols.

5. The method for producing a collagen-containing fermented milk according to any one of claims 1 to 4, which suppresses generation of an unpleasant flavor and/or suppresses increase of an unpleasant flavor during storage.

6. The method for producing a collagen-containing fermented milk according to any one of claims 1 to 5, which suppresses generation of one or two or more selected from methyl mercaptan, DMDS (dimethyl disulfide) and DMTS (dimethyl trisulfide) and/or suppresses increase of one or two or more selected from methyl mercaptan, DMDS and DMTS during storage.

7. A fermented milk produced by the method according to any one of claims 1 to 6.