

FERMENTED MILK HAVING ENHANCED LACTOBACILLUS BULGARICUS GROWTH AND METHOD FOR PRODUCING THE SAME

Technical Field

[0001]

The present invention relates to a method for producing a fermented milk containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Examples of the fermented milk include plain type, hard type, stirred type, and drink type yogurts. In addition, the present invention relates to a fermented milk containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus*.

Background Art

[0002]

Conventionally, it has been known that yogurt is obtained by inoculating two kinds of lactic acid bacteria, *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, as a starter into a starting milk (a yogurt mixture) to cause fermentation. In general, such yogurt has a ratio of numbers of bacteria for *Lactobacillus bulgaricus* and *Streptococcus thermophilus* of around 1 : 4 to around 1 : 5. In this way, *Streptococcus thermophilus* is predominant over *Lactobacillus bulgaricus*.

[0003]

There is a yogurt product to which a standard for the number of bacteria for *Lactobacillus bulgaricus* (for example, 10^6 cfu/g or more after storage for 16 days) is provided. In addition, there is also a yogurt product characterized by containing a predetermined amount of functional polysaccharide (EPS: Exopolysaccharide) produced by *Lactobacillus bulgaricus*. In such yogurt, it is desirable to increase the number of bacteria for *Lactobacillus bulgaricus* during the producing process.

[0004]

In this regard, a method for enhancing the growth of lactic acid bacteria has been conventionally known, including adding a pH buffer to a starting milk (a yogurt mixture), fermented milk base material (a yogurt base), medium or the like, to cause fermentation or cultivation.

[0005]

In addition, for example, Patent Literature 1 discloses a method for producing low fat yogurt, including adding oleic acid or the like to a fermented milk base material (a yogurt base). According to Patent Literature 1, it is proposed to use oleic acid or the like, which makes it possible to increase the survival of lactic acid bacteria in the low fat yogurt.

[0006]

In addition, for example, Patent Literature 2 discloses a method for producing fermented food, including adding a guava leaf extract to a fermented milk base material (a yogurt base). According to Patent Literature 2, it is proposed to use a guava leaf extract, which acts as a survival improver for lactic acid bacteria or a growth enhancer for lactic acid bacteria, which makes it possible to increase the survival of lactic acid bacteria in the fermented food.

[0007]

In addition, for example, Patent Literature 3 discloses a method for producing fermented food, including adding gum arabic to a fermented milk base material (a yogurt base). According to Patent Literature 3, it is proposed to use gum arabic, which makes it possible to increase the survival rate of *Lactobacillus bifidus* during storage of the fermented food.

Citation List

Patent Literature

[0008]

Patent Literature 1: JP 2001-045968 A

Patent Literature 2: JP 2010-119305 A

Patent Literature 3: JP 2010-505390 W

Summary of Invention

Technical Problem

[0009]

However, there are problems that, as described in the above-mentioned conventional art, when a growth enhancer for lactic acid bacteria such as a pH buffer is added to a starting milk or fermented milk base material in order to increase the number of bacteria for lactic acid bacteria, the growth enhancer causes off-flavor, bitter taste, acid taste or the like, different from the original flavor of milk. Thus, in case of using a conventional growth enhancer for lactic acid bacteria, it is difficult to adjust the flavor of fermented milk.

[0010]

In addition, although it is possible to increase the number of bacteria for lactic acid bacteria contained in fermented milk by adding a growth enhancer for lactic acid bacteria, in case of using a conventional growth enhancer for lactic acid bacteria in a fermented milk containing both of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, the number of bacteria for *Lactobacillus bulgaricus* and *Streptococcus thermophilus* will increase together. That is, in case of using a conventional growth enhancer for lactic acid bacteria, it is difficult to relatively enhance the growth of

Lactobacillus bulgaricus, since the growth of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* is enhanced together. As a result, it is difficult to enhance production of polysaccharide derived from *Lactobacillus bulgaricus*. In contrast, some of the above-described yogurts include products which have enhanced growth of *Lactobacillus bulgaricus* alone, but do not need to have enhanced growth of *Streptococcus thermophilus* in the producing process. In this case, it is possible to increase the yield of polysaccharide derived from *Lactobacillus bulgaricus* by raising the ratio of the number of bacteria for *Lactobacillus bulgaricus* in a fermented milk containing both of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*.

[0011]

Accordingly, there is now a demand for a technology by which it is possible to enhance the growth of *Lactobacillus bulgaricus* and minimize the growth of *Streptococcus thermophilus* relative to each other in a fermented milk containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, without using additives such as a growth accelerator for lactic acid bacteria.

Solution to Problem

[0012]

Now, as a result of intensive studies of approaches for solving such conventional problems, the inventors have unexpectedly found that the growth of *Lactobacillus bulgaricus* is enhanced and the growth of *Streptococcus thermophilus* is minimized by performing steps of adding a lactic acid bacteria starter containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus* to a (heat) sterilized starting milk, and holding its fermented milk base material at low temperatures prior to the fermentation. As a result, successfully, we have been able to relatively increase the

number of bacteria for *Lactobacillus bulgaricus*, without using additives such as a growth accelerator for lactic acid bacteria, thereby producing a polysaccharide-rich fermented milk, having no off-flavor. Moreover, the inventors have come to a solution of the problem with the conventional art based on the above-mentioned findings, leading to completion of the present invention.

[0013]

A first aspect of the present invention relates to a method for producing fermented milk.

A method for producing fermented milk of the present invention includes a sterilization step, a cooling step, a starter addition step, a low temperature holding step, a heating step, and a fermentation step.

The sterilization step is a step of (heat) sterilizing a starting milk.

The cooling step is a step of cooling the starting milk after the sterilization step.

The starter addition step is a step of adding a lactic acid bacteria starter containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus* to the starting milk during the cooling step or after the cooling step in order to obtain a fermented milk base material.

The low temperature holding step is a step of holding the fermented milk base material after the starter addition step at a temperature that is lower than a fermentation promotion temperature. Note that the fermentation promotion temperature means a temperature at which lactic acid bacteria are activated, and the fermentation of the fermented milk base material is promoted. In case where the temperature is lower than the fermentation promotion temperature, it does not mean that the fermented milk base material does not ferment at all, but the fermented milk base material may be slightly

fermented.

The heating step is a step of heating the fermented milk base material after the low temperature holding step to the fermentation promotion temperature.

The fermentation step is a step of fermenting the fermented milk base material after the heating step in order to obtain fermented milk.

[0014]

As mentioned above, in the present invention, the fermented milk base material to which the lactic acid bacteria starter containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus* has been added is designed so as to be purposely held at low temperatures. After the fermented milk base material is held at low temperatures for a predetermined period, the fermented milk base material is heated to promote the fermentation. In this way, in the process of producing fermented milk, a result has been unexpectedly obtained that once operation to hold the fermented milk base material at low temperatures is purposely performed, the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk relatively increases. That is, if the fermented milk having undergone the low temperature holding step (low temperature holding treatment) compared with that not having undergone the low temperature holding step (low temperature holding treatment), the former has a larger number of bacteria for *Lactobacillus bulgaricus* than the latter, whereas the former has a smaller number of bacteria for *Streptococcus thermophilus* than the latter. Thus, it may be said that, by performing the low temperature holding step, minimizing the growth of *Streptococcus thermophilus* was successful, while enhancing the growth of *Lactobacillus bulgaricus*. Moreover, some *Lactobacillus bulgaricus* produces functional polysaccharide (EPS: Exopolysaccharide). Therefore, according to the present invention, it is possible to produce a polysaccharide-rich fermented milk having

no off-flavor by relatively increasing the number of bacteria for *Lactobacillus bulgaricus*, without using additives such as a growth accelerator for lactic acid bacteria.

[0015]

In the present invention, it is preferable for the cooling step to be a step of cooling the starting milk to 15°C or lower. More specifically, it is preferable for the starting milk to be cooled to 1°C or higher and 15°C or lower.

In addition, it is preferable for the low temperature holding step to be a step of holding the fermented milk base material at low temperatures of 15°C or lower for a period of 1 day or longer. More specifically, it is preferable for the fermented milk base material to be held at 5°C or higher and 15°C or lower for 1 day (24 hours) to 10 days (240 hours).

[0016]

As mentioned above, holding the fermented milk base material at a low temperature of 15°C or lower for 1 day or longer before the fermentation step may reasonably adjust the activity of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, which unexpectedly increases the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk, and decreases the number of bacteria for *Streptococcus thermophilus* relative to each other. That is, performing the low temperature holding step increases the growth rate of *Lactobacillus bulgaricus* and decreases the growth rate of *Streptococcus thermophilus* in the fermentation step. By performing such operation, it is possible to adjust the ratio of numbers of bacteria for *Lactobacillus bulgaricus* and *Streptococcus thermophilus* contained in the fermented milk to a preferable numerical value.

[0017]

In the present invention, it is preferable for the heating step to be a step of

heating the fermented milk base material to a fermentation promotion temperature of 30°C or higher and 50°C or lower.

[0018]

As mentioned above, after the low temperature holding step, in case where the temperature of the fermented milk base material is 15°C or lower, setting the fermentation promotion temperature at 30°C or higher and 50°C or lower will heat the fermented milk base material at at least 15°C or higher in the heating step. In this way, by giving a large temperature difference of 15°C or higher between the temperature at which the low temperature holding is performed and the temperature at which the fermentation is performed, it is possible to increase the growth rate of *Lactobacillus bulgaricus*, while reducing the growth rate of *Streptococcus thermophilus* in the fermentation step.

[0019]

In the present invention, at least in the low temperature holding step, it is preferable to further include an anaerobic step of bringing about an anaerobic condition by injecting an inert gas into the fermented milk base material. Note that the anaerobic step may be performed not only in the low temperature holding step, but also in the cooling step, starter addition step, heating step, and fermentation step.

[0020]

As mentioned above, by mixing an inert gas into the fermented milk base material to bring about an anaerobic condition during the low temperature holding of the fermented milk base material, it is possible to inhibit or prevent oxidation of the fermented milk base material, while reasonably adjusting the activity of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* in the low temperature holding step. Thus, the fermentation step after the low temperature holding step may suitably activate

Lactobacillus bulgaricus and *Streptococcus thermophilus*, in particular *Lactobacillus bulgaricus*, thereby, for example, producing a polysaccharide-rich fermented milk.

[0021]

In the present invention, it is assumed that the numerical value of the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk base material prior to the low temperature holding step to the number of bacteria for *Streptococcus thermophilus* contained therein (the number of bacteria for *Lactobacillus bulgaricus*/the number of bacteria for *Streptococcus thermophilus*) is α . Moreover, in the present invention, it is assumed that the numerical value of the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk to the number of bacteria for *Streptococcus thermophilus* contained therein (the number of bacteria for *Lactobacillus bulgaricus*/the number of bacteria for *Streptococcus thermophilus*) is β . In this case, it is preferable for the numerical value of β/α to be 1.1 or higher.

[0022]

In the present invention, it is preferable for the fermented milk base material prior to the low temperature holding step to have a ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus* (the number of bacteria for *Lactobacillus bulgaricus*/the number of bacteria for *Streptococcus thermophilus*) of 0.01 or higher and 0.5 or lower. Meanwhile, in the present invention, it is preferable for the fermented milk to have a ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus* (the number of bacteria for *Lactobacillus bulgaricus*/the number of bacteria for *Streptococcus thermophilus*) of 0.6 or higher.

[0023]

As mentioned above, according to a method for producing fermented milk of

the present invention, even in case where the lactic acid bacteria starter having a small ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus* is used, a fermented milk having a large ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus* may be produced. That is, according to a method for producing fermented milk of the present invention, it is possible to drastically increase the ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus*.

[0024]

In the present invention, it is preferable not to add a growth accelerator for lactic acid bacteria. The growth accelerator for lactic acid bacteria is an additive other than ones that derived from milk for the purpose of enhancing the growth of lactic acid bacteria. For example, the growth accelerator for lactic acid bacteria includes a conventionally known additive agent such as a pH buffer, oleic acid, guava leaf extract, or gum arabic.

[0025]

As mentioned above, according to a method for producing fermented milk of the present invention, it is possible to produce a fermented milk having a large number of bacteria for *Lactobacillus bulgaricus*, without having to add a growth accelerator for lactic acid bacteria. As a result, according to the present invention, it is possible to prevent occurrence of the off-flavor, bitter taste, acid taste or the like derived from the growth accelerator, and produce fermented milk without damaging the original flavor of milk.

[0026]

In the present invention, the fermentation step may be a step of obtaining

fermented milk by filling the fermented milk base material in a container, followed by fermentation. By performing a so-called post-fermentation treatment, it is possible to produce a so-called set type yogurt or plain type yogurt.

[0027]

A second aspect of the present invention relates to a fermented milk.

The fermented milk of the present invention is obtained by adding a lactic acid bacteria starter containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus* to the starting milk in order to obtain the fermented milk base material, and then fermenting the fermented milk base material. Here, it is assumed that the value of the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk base material to the number of bacteria for *Streptococcus thermophilus* contained therein is α . Moreover, it is assumed that the value of the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk to the number of bacteria for *Streptococcus thermophilus* contained therein is β . In this case, the fermented milk of the present invention has a numerical value of β/α of 1.1 or higher.

[0028]

As mentioned above, in the present invention, it is possible to increase the yield of polysaccharide derived from *Lactobacillus bulgaricus* by raising the ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus*. In particular, in the present invention, it is preferable to raise the ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus* without adding a growth accelerator of lactic acid bacteria.

[0029]

It is preferable for the fermented milk of the present invention to have a lactic

acid acidity (acidity) of 0.9% or lower.

[0030]

As mentioned above, in the present invention, it is possible to raise the ratio of the number of bacteria for *Lactobacillus bulgaricus*, while maintaining the mildness of the flavor, smoothness of the texture, or the like of the fermented milk, at a moderate lactic acid acidity of the fermented milk of 0.9% or lower, without lengthening the fermentation time. In general, it is considered that lengthening the fermentation time and raising the lactic acid acidity until the lactic acid acidity of the fermented milk is above 0.9% may sufficiently enrich the yield of polysaccharide derived from *Lactobacillus bulgaricus*. Note that, lengthening the fermentation time and raising the lactic acid acidity of the fermented milk may damage the mildness of the flavor and smoothness of the texture. Accordingly, it is preferable for the fermented milk of the present invention to have a numerical value of β/α of 1.1 or higher in condition where the lactic acid acidity is 0.9% or lower.

[0031]

It is preferable for the fermented milk of the present invention to have a concentration of polysaccharide of 5 mg/100 g or higher.

[0032]

As mentioned above, in the present invention, it is possible to raise the concentration of polysaccharide derived from *Lactobacillus bulgaricus* by raising the ratio of the number of bacteria for *Lactobacillus bulgaricus*. In the present invention, raising the concentration of polysaccharide derived from *Lactobacillus bulgaricus* increases the smoothness more, in comparison with a case where polysaccharide derived from *Streptococcus thermophilus* rises.

Advantageous Effects of Invention

[0033]

According to the present invention, it is possible to enhance the growth of *Lactobacillus bulgaricus* and minimize the growth of *Streptococcus thermophilus* relative to each other in a fermented milk containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, without using additives such as a growth accelerator for lactic acid bacteria.

Brief Description of Drawings

[0034]

Fig. 1 is a flow chart that illustrates one embodiment of a producing method of the present invention.

Description of Embodiments

[0035]

Hereinafter, a description is made of embodiments of the present invention, with reference to drawings. Note that the present invention is not only limited to embodiments described below, but also includes those modified as appropriate within the obvious scope from the embodiments below by a person skilled in the art.

[0036]

Herein, a "starting milk (yogurt mixture)" means a material for fermented milk, which is composed of a raw milk alone, or prepared by mixing a raw milk with skim milk powder, cream, water or the like, and has not yet undergone a starter addition step. In addition, a "fermented milk base material (yogurt base)" means a material for fermented milk, which is prepared by adding a lactic acid bacteria starter to the starting

milk, and has not yet undergone a fermentation step. In addition, the "fermented milk" means a resultant product having undergone the fermentation step, which is obtained by fermenting the fermented milk base material.

Note that "A to B" herein means between "A or more and B or less".

[0037]

The present invention relates to a fermented milk and a method for producing the same. An example of the fermented milk is yogurt. The yogurt may be plain type, hard type or stirred type one, or may be drink type one. In addition, it is possible to use the fermented milk which has been produced according to the present invention as a material for a frozen yogurt. In addition, it is also possible to use the fermented milk which has been produced according to the present invention as a material for cheese. In the present invention, the fermented milk may be the "fermented milk", "dairy product lactic acid bacteria beverage", "lactic acid bacteria beverage" or the like, defined in the Ministerial Ordinance on Milk, etc.

[0038]

Fig. 1 is a flow chart that illustrates respective steps in a producing method according to one embodiment of the present invention. As shown in Fig. 1, it is preferable that the method for producing fermented milk according to the present invention include a starting milk preparation step (step S1), a sterilization step (step S2), cooling step (step S3), a starter addition step (step S4), a low temperature holding step (step S5), a heating step (step S6), a fermentation step (step S7), and a re-cooling step (step S8). In addition, it is preferable that the producing method of the present invention further include an anaerobic step (step S9).

[0039]

As shown in Fig. 1, in order to produce the fermented milk, the starting milk

preparation step (step S1) is firstly performed. The starting milk preparation step is a step of preparing a starting milk that is a material for fermented milk. The starting milk is also referred to as a yogurt mixture. In the present invention, as the starting milk, publicly known one may be used. For example, the starting milk may be one composed of a raw milk alone (100% of raw milk). The starting milk may be one prepared by mixing a raw milk with skim milk powder, cream, water, or the like. To the starting milk, sterilized milk, whole milk, skim milk, concentrated whole milk, concentrated skim milk, whole milk powder, butter milk, salted butter, salt-free butter, whey, whey powder, whey protein condensate (WPC), whey protein isolate (WPI), α -La (alpha-lactalbumin), β -Lg (beta-lactoglobulin), lactose, or the like may be added. To the starting milk, preheated gelatin, agar, a thickener, a gelling agent, a stabilizing agent, an emulsifier, sucrose, a sweetening agent, fragrance, vitamin, mineral or the like may also be added. In the starting milk preparation step, it is preferable to atomize (pulverize) lipid globules and the like contained in the starting milk through a homogenization step of homogenizing starting milk. Through the homogenization step, in the producing process of fermented milk or after production thereof, it is possible to inhibit or prevent the fat content in the starting milk, fermented milk base material, or fermented milk from separating or surfacing.

[0040]

The sterilization step (step S2) is performed after the starting milk preparation step. The sterilization step is a step of sterilizing the starting milk by a heating treatment or the like. For example, in the sterilization step, a heating treatment may be performed such that the heating temperature and the heating period are adjusted enough to kill various bacteria in the starting milk. In the present invention, as the sterilization step, a publicly known method may be used. For example, in the sterilization step, a

heating treatment may be performed using a plate type heat exchanger, tube-type heat exchanger, steam injection type heater, steam infusion type heater, electrification type heater, or the like, or a heating treatment may be performed using a jacketed tank. Moreover, in the sterilization step, in case where, for example, yogurt is plain type, hard type or stirred type one, a heating treatment including high temperature and short time sterilization treatment (HTST) may be performed, and in case where, for example, the yogurt is a drink type one, a heating treatment including ultrahigh temperature sterilization treatment (UHT) may be performed. Furthermore, for example, in the sterilization step, the high temperature and short time sterilization treatment (HTST) should be a treatment to heat the starting milk to 80°C to 100°C for around 3 minutes to around 15 minutes, and the ultrahigh temperature sterilization treatment (UHT) should be a treatment to heat it to 110°C to 150°C for around 1 second to around 30 seconds. [0041]

The cooling step (step S3) is performed after the sterilization step. The cooling step is a step of, for example, cooling the starting milk that has undergone the heating treatment or the like to a predetermined temperature. In the cooling step, the starting milk is cooled to a temperature that is lower than a fermentation promotion temperature (e.g., 30°C to 50°C). In the present invention, as the cooling step, a publicly known method may be used. For example, in the cooling step, a cooling treatment may be performed using a plate type heat exchanger, tube type heat exchanger, or vacuum (pressure-reducing) evaporative cooler, or a cooling treatment may be performed using a jacketed tank. Note that, in the cooling step, it is preferable for the starting milk to be specifically cooled to 15°C or lower. Moreover, in the cooling step, it is preferable for the starting milk to be cooled to 1°C to 15°C, more preferable to be cooled to 3°C to 10°C, and further preferable to be cooled to 5°C to 8°C.

[0042]

In the cooling step, in case where the sterilization step is a heating treatment, it is preferable to rapidly cool the starting milk having a temperature of around 100°C, the temperature having been raised through the sterilization step, to lower temperatures (15°C or lower). Moreover, for example, in the cooling step, in case where the sterilization step is a heating treatment, the time for which the starting milk having a temperature of around 100°C, the temperature having been raised through the sterilization step, is cooled to 15°C is preferably within 10 minutes, more preferably within 5 minutes, further preferably within 1 minute, or particularly preferably within 30 seconds. The cooling step may inhibit or prevent protein from denaturing, or carbohydrate from browning in the starting milk.

[0043]

The starter addition step (step S4) is performed after the cooling step or during the cooling step. The starter addition step is a step of adding (mixing) a lactic acid bacteria starter to (with) the starting milk in order to obtain the fermented milk base material. That is, the lactic acid bacteria starter may be added after the starting milk has been cooled to a predetermined temperature after the sterilization step, or the lactic acid bacteria starter may be added while the starting milk is being cooled to a predetermined temperature after the sterilization step. In the present invention, as the starter addition step, a publicly known method may be used. Note that, in the present invention, the lactic acid bacteria starter contains at least *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. That is, "*Lactobacillus bulgaricus*" is *L. bulgaricus*, and "*Streptococcus thermophilus*" is *S. thermophilus*. In addition, in the starter addition step of the present invention, a publicly known lactic acid bacterium may be added (mixed) in addition to *L. bulgaricus* and *S. thermophilus*. For example, in the starter

addition step, *L. gasseri*, *Lactococcus lactis*, *Lactococcus cremoris*, or bifidobacteria (*Bifidobacterium* or the like) may be added (mixed). Note that the lactic acid bacteria starter is preferably one composed of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* alone as lactic acid bacteria. Meanwhile, the added amount of the lactic acid bacteria starter may be an amount that is adopted in a publicly known method for producing fermented milk, and, for example, is preferably 0.1 to 5 wt%, more preferably 0.5 to 4 wt%, and further preferably 1 to 3 wt%.

[0044]

In the starter addition step, the number of bacteria (the number of living bacteria) of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* contained in the lactic acid bacteria starter may be a numerical value that is adopted in a publicly known method for producing fermented milk. Moreover, for example, the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the lactic acid bacteria starter to the number of bacteria for *Streptococcus thermophilus* contained therein is generally 1 : 4 to 1 : 5. Note that, specifically, in the starter addition step, the ratio of the number of bacteria for *Lactobacillus bulgaricus* (the number of bacteria for *Lactobacillus bulgaricus*/the number of bacteria for *Streptococcus thermophilus*) when it is assumed that the number of bacteria for *Streptococcus thermophilus* contained in the lactic acid bacteria starter is 1 (reference) may be 0.01 to 0.8, preferably 0.05 to 0.7, more preferably 0.1 to 0.5, and further preferably 0.2 to 0.4. In the starter addition step, as to the number of bacteria (the number of living bacteria) for *Lactobacillus bulgaricus* and *Streptococcus thermophilus* contained in the lactic acid bacteria starter, the number of bacteria for *Lactobacillus bulgaricus* contained may also be preliminarily more than the number of bacteria for *Streptococcus thermophilus*. For example, the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the lactic acid bacteria

starter to the number of bacteria for *Streptococcus thermophilus* contained therein may be 1.0 to 5.0, 1.5 to 4.0, or the like. Note that the number of bacteria for lactic acid bacteria may be measured according to a publicly known method.

[0045]

The low temperature holding step (step S5) is performed after the starter addition step. The low temperature holding step is a step of holding the fermented milk base material, to which the lactic acid bacteria starter has been added, at a temperature that is lower than a fermentation promotion temperature (e.g., 30°C to 50°C) for a predetermined period. For example, in the cooling step, the fermented milk base material is cooled to 15°C or lower. Accordingly, in the low temperature holding step, it should be held as it is at 15°C or lower. Note that even when the temperature of the fermented milk base material rises from the cooling step to the low temperature holding step, there is no problem as long as the raised temperature is held at a temperature lower than a fermentation promotion temperature (e.g., 30°C to 50°C). In the present invention, as the low temperature holding step, a publicly known method may be used. For example, in the low temperature holding step, a low temperature holding treatment may be performed using a jacketed tank. Note that, in the low temperature holding step, it is preferable for the fermented milk base material to be specifically held at low temperatures of 15°C or lower. Moreover, in the low temperature holding step, it is preferable for the fermented milk base material to be held at low temperatures of 1°C to 20°C, more preferable to be held at low temperatures of 3°C to 15°C, and further preferable to be held at low temperatures of 5°C to 10°C. In addition, it is preferable for the fermented milk base material in the low temperature holding step to be specifically held for 1 day or longer at the low temperature state. Moreover, in the low temperature holding step, it is preferable for a period of holding

the fermented milk base material to be for 1 day (24 hours) to 10 days (240 hours), more preferable to be for 2 days (48 hours) to 8 days (192 hours), further preferable to be for 3 days (72 hours) to 6 days (144 hours).

[0046]

The heating step (step S6) is performed after the low temperature holding step. The heating step is a step of heating the fermented milk base material having undergone the low temperature holding treatment to a fermentation promotion temperature (e.g., 30°C to 50°C). Here, the fermentation promotion temperature means a temperature at which microorganisms (lactic acid bacteria or the like) are activated, and the fermentation of the fermented milk base material progresses or is promoted. In the present invention, as the heating step, a publicly known method may be used. For example, in the heating step, a heating treatment may be performed using a plate type heat exchanger, tube type heat exchanger, or the like, or a heating treatment may be performed using a jacketed tank. Moreover, for example, the fermentation promotion temperature of lactic acid bacteria is 30°C to 50°C in general. Note that, in the heating step, it is preferable for the fermented milk base material to be specifically heated to 30°C or higher. Furthermore, in the heating step, it is preferable for the fermented milk base material to be heated to 30°C to 50°C, more preferable to be heated to 33°C to 47°C, and further preferable to be heated to 35°C to 44°C.

[0047]

In the heating step, it is preferable to heat the fermented milk base material having a temperature lowered through the low temperature holding step to around 10°C to a fermentation promotion temperature (e.g., 30°C to 50°C) for a predetermined time (in a relatively short time). Moreover, for example, in the heating step, the time for which the fermented milk base material having a temperature lowered through the low

temperature holding step to around 10°C is heated to a fermentation promotion temperature (e.g., 30°C to 50°C) is preferably within 1 hour, preferably within 30 minutes, further preferably within 10 minutes, or particularly preferably within 1 minute. The heating step may effectively minimize the growth of *Streptococcus thermophilus* in the fermented milk base material, while effectively enhancing the growth of *Lactobacillus bulgaricus*. Note that, in the heating step, the fermented milk base material having a temperature lowered through the low temperature holding step to around 10°C may also be transferred as it is, to a fermenting room having a room temperature set to around 30°C to around 50°C, in order to gradually raise the temperature while performing a heating treatment in the fermenting room. Note that, as a result, the time required for the heating step may be greatly extended, which makes it difficult to effectively produce the fermented milk in a short time.

[0048]

The fermentation step (step S7) is performed after the heating step. The fermentation step is a step of holding and fermenting the fermented milk base material that has been heated to a fermentation promotion temperature (e.g., 30°C to 50°C) at the fermentation promotion temperature (e.g., 30°C to 50°C), in order to obtain fermented milk. In the present invention, as the fermentation step, a publicly known method may be used. For example, in the fermentation step, a fermentation treatment may be performed using a fermenting room or the like, or a fermentation treatment may be performed using a jacketed tank. Moreover, in the fermentation step, in case where, for example, yogurt is plain type or hard type one, a post-fermentation treatment may be performed, and in case where, for example, yogurt is stirred type or drink type one, a pre-fermentation treatment may be performed. Furthermore, for example, the fermentation step may be a treatment to hold the temperature (fermentation

temperature) in a fermenting room at 30°C to 50°C and ferment the fermented milk base material in the fermenting room, or may be a treatment to hold the temperature (fermentation temperature) in a jacketed tank at 30°C to 50°C and ferment the fermented milk base material in the tank. Here, in the fermentation step, as to the condition under which the fermented milk base material ferments, the fermentation temperature, fermentation time, or the like should be appropriately adjusted in consideration of the type or amount of the starting milk or lactic acid bacteria, the flavor or texture of the fermented milk, or the like. Note that, in the fermentation step, it is preferable for the fermented milk base material to be specifically held at 30°C or higher. Furthermore, in the fermentation step, it is preferable for the fermented milk base material to be held at 30°C to 50°C, more preferable to be held at 33°C to 47°C, and further preferable to be held at 35°C to 44°C. In addition, it is preferable for the fermented milk base material in the fermentation step to be specifically held for 1 hour or longer at the fermentation promotion temperature. Moreover, in the fermentation step, it is preferable for a period of holding the fermented milk base material (fermentation time) to be for 1 hour to 12 hours, more preferable to be for 2 hours to 8 hours, further preferable to be for 3 hours to 5 hour.

[0049]

In the fermentation step, as to the condition under which the fermented milk base material ferments, the lactic acid acidity (acidity), pH, or the like may be appropriately adjusted in consideration of the type or amount of the starting milk or lactic acid bacteria, the flavor or texture of the fermented milk, or the like. Note that, in the fermentation step, it is preferable for the lactic acid acidity to specifically reach 0.7% or higher. Furthermore, in the fermentation step, in case where, for example, yogurt is plain type or hard type one, when the post-fermentation treatment is performed,

it is preferable for the lactic acid acidity to be 0.9% or lower (0.7% to 0.9%), more preferable to be 0.85% or lower (0.7% to 0.85%), and further preferable to be 0.8% or lower (0.7% to 0.8%), and in case, for example, where yogurt is stirred type or drink type one, when the pre-fermentation treatment is performed, it is preferable for the lactic acid acidity to be 1.2% or lower (0.7% to 1.2%), more preferable to be 1.1% or lower (0.7% to 1.1%), and further preferable to be 1.0% or lower (0.7% to 1.0%). Note that in doing so, it is preferable for the fermented milk base material to be held at a fermentation promotion temperature, as mentioned above.

[0050]

In the description of this application, the acidity (the lactic acid acidity) may be measured according to "Testing Methods of Compositional Standards of Milk, etc." in the Ministerial Ordinance on Milk, etc. Specifically, to 10 g of the sample is added 10 ml of ion exchanged water which does not contain carbon dioxide gas, and then is added 0.5 ml of a phenolphthalein solution as an indicator. Moreover, a sodium hydroxide solution (0.1 mol/L) is added to perform titration to a limit at which the pale red color does not disappear, and from the titration value of the sodium hydroxide solution, the content of lactic acid per 100 g of the sample is determined as the lactic acid acidity. Note that the phenolphthalein solution is prepared by dissolving 1 g of phenolphthalein in an ethanol solution (50%), followed by filling up to 100 ml.

[0051]

The fermentation step may be either post-fermentation treatment or pre-fermentation treatment. When the post-fermentation treatment is performed, the fermented milk base material is filled in a container for actual sale as a product, and then the fermented milk base material is fermented. For example, when the post-fermentation treatment is performed, a (sealed) container filled with the fermented

milk base material is subjected to fermentation by, for example, leaving the container at rest in a fermenting room, and a fermented milk (a fermented milk curd), which is a resultant intermediate product, may be cooled through a re-cooling step mentioned below to obtain fermented milk (set type yogurt, plain type yogurt) which is an end-product. In addition, when the pre-fermentation treatment is performed, before the fermented milk base material is filled in a container for actual sale as a product, the fermented milk base material is fermented. For example, when the pre-fermentation is performed, a jacketed tank filled with the fermented milk base material is subjected to fermentation by, for example, leaving the tank at rest, and a fermented milk (a fermented milk curd), which is a resultant intermediate product, may be subjected to crashing or atomizing, followed by cooling through a re-cooling step mentioned below, mixed with fruit pulp, vegetable, fruit juice, vegetable juice, jam, sauce, preparation, or the like, if necessary, and then filled in a (sealed) container, to obtain fermented milk (stirred type yogurt, drink type yogurt) which is an end-product.

[0052]

In this embodiment, the container for use in the post-fermentation treatment includes any receptacles capable of being filled with the fermented milk. For example, containers made of plastic, paper, glass, metal, ceramics, or composite materials thereof may be used for the fermented milk. In addition, the fermented milk may be filled in a container having an opening in the top surface, by which fermentation or clotting may occur, a lid may be attached to the container, or the whole container may be covered with a shrink film made of plastic, a light blocking film (e.g., a metal foil laminated film, metallic thin film, black color or dark color ink coated film). Two or more of the above-mentioned container(s), the above-mentioned film(s) and/or the like may be used in combination. From the viewpoint of inhibiting the fermented milk from the flavor

degradation due to light transmission or oxygen permeation, it is preferable to cover a filled PET bottle or bottle with a light blocking film, seal a filled container made of paper or a plastic container having a light blocking effect with a light blocking film, or use a light blocking lid after sealing with a shrink film made of plastic.

[0053]

In the fermentation step, the growth of *Streptococcus thermophilus* may be minimized, while the growth of *Lactobacillus bulgaricus* producing functional polysaccharide may be enhanced, allowing for production of a lot of polysaccharide. That is, in the fermentation step of the present invention, it is possible to produce a polysaccharide-rich fermented milk having no off-flavor, by relatively increasing the number of bacteria for *Lactobacillus bulgaricus*, without using additives such as a growth accelerator for lactic acid bacteria. In doing so, when the lactic acid acidity is 0.9% or lower (any of 0.7% to 0.9%), it is preferable for the concentration of polysaccharide in the fermented milk to be 5 mg/100 g or higher, more preferable to be 5.5 mg/100 g or higher, further preferable to be 6 mg/100 g or higher. In addition, for example, when the lactic acid acidity is 0.85% or lower (any of 0.7% to 0.85%), it is preferable for the concentration of polysaccharide in the fermented milk to be 5 mg/100 g or higher, more preferable to be 5.5 mg/100 g or higher, further preferable to be 6 mg/100 g or higher. In addition, for example, when the lactic acid acidity is 0.8% or lower (any of 0.7% to 0.8%), it is preferable for the concentration of polysaccharide in the fermented milk to be 5 mg/100 g or higher, more preferable to be 5.5 mg/100 g or higher, further preferable to be 6 mg/100 g or higher.

[0054]

The re-cooling step (step S8) is performed after the fermentation step. The re-cooling step is a step of cooling the fermented milk obtained in the fermentation step.

In the re-cooling step, progress of the fermentation is inhibited. In doing so, in the re-cooling step, the fermented milk is cooled to a temperature that is lower than a fermentation promotion temperature (e.g., 30°C to 50°C). In the present invention, as the re-cooling step, a publicly known method may be used. For example, in the re-cooling step, a re-cooling treatment may be performed using a cold room or freezing room, or a re-cooling treatment may be performed using a plate type heat exchanger, tube type heat exchanger, or jacketed tank. Note that, in the re-cooling step, it is preferable for the fermented milk to be specifically cooled to 15°C or lower. Moreover, in the re-cooling step, it is preferable for the fermented milk to be cooled to 1°C to 15°C, more preferable to be cooled to 3°C to 10°C, and further preferable to be cooled to 5°C to 8°C. The re-cooling step cools the fermented milk to a temperature suitable for eating, making it possible to inhibit or prevent the flavor (acid taste or the like), texture (feeling on the tongue or the like), or physical property (hardness or the like) of the fermented milk from changing.

[0055]

The anaerobic step (step S9) is an optional step. The anaerobic step is a step of bringing about an anaerobic condition by mixing the starting milk, fermented milk base material, or fermented milk with an inert gas such as nitrogen. In the present invention, as the anaerobic step, a publicly known method may be used. For example, in the anaerobic step, performing an anaerobic treatment by mixing (injecting) an inert gas into the starting milk or fermented milk base material, or performing an anaerobic treatment by charging (filling) an inert gas in the head space inside a container filled with the fermented milk, or the head space inside a tank filled with the fermented milk removes or reduces oxygen existing therein. The anaerobic step removes or reduces oxygen contained in the starting milk or the like, and thus inhibits or prevents oxidation

of lipid or protein contained in the starting milk or the like, or promotes the activity of lactic acid bacteria. Moreover, for example, as the inert gas, in addition to nitrogen, a rare gas such as helium, neon, argon or xenon may be used. In the anaerobic step, it is preferable for the dissolved oxygen concentration (DO) in the starting milk, fermented milk base material, or fermented milk to be specifically reduced to 5 ppm or lower, more preferable to be reduced to 4 ppm or lower, further preferable to be reduced to 3 ppm or lower, or particularly preferable to be reduced to 2 ppm or lower.

[0056]

The anaerobic step may be performed in any stage of the steps including the starting milk preparation step and sterilization step, or may be performed in any stage of the steps after the heat sterilization step as shown in Fig. 1. In addition, the anaerobic step may also be performed continuously at a plurality of stages in the steps. In the present invention, it is preferable to perform the anaerobic step in at least the low temperature holding step and/or starter addition step. In addition, in the present invention, it is preferable to perform the anaerobic step in the heating step and/or fermentation step. Moreover, it is more preferable to mix an inert gas such as nitrogen into the fermented milk base material (that has undergone the low temperature holding treatment) in the low temperature holding step and/or starter addition step in order to reduce the dissolved oxygen concentration in the fermented milk base material, along with mix an inert gas such as nitrogen into the fermented milk base material (that has undergone the heating treatment) in the heating step and/or fermentation step in order to reduce the dissolved oxygen concentration in the fermented milk base material, and further charge an inert gas in the head space inside a (sealed) container filled with the fermented milk base material. As mentioned above, in the present invention, the fermented milk base material is held at low temperatures in a relatively long term (e.g.,

for 1 day or longer). In doing so, performing the anaerobic treatment makes it possible to satisfactorily maintain the flavor and quality of the fermented milk base material, as well as appropriately control the activity of *Lactobacillus bulgaricus* contained in the fermented milk base material and the activity of *Streptococcus thermophilus* contained therein. When the fermented milk base material is fermented after the low temperature holding, the anaerobic step may suitably activate *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, in particular *Lactobacillus bulgaricus*, thereby obtaining a polysaccharide-rich fermented milk.

[0057]

As mentioned above, in the present invention, the number of bacteria (the number of living bacteria) for *Lactobacillus bulgaricus* in the fermented milk produced via each of the treatment steps is relatively large. That is, in the producing method of the present invention, the fermented milk base material to which the lactic acid bacteria starter containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus* has been added is designed so as to be purposely held at low temperatures for a long time (a predetermined period). The fermented milk base material held at low temperatures for this predetermined period is subjected to a heating treatment to promote the fermentation. In this way, in the process of producing fermented milk, a standing situation has been unexpectedly confirmed where once operation to hold the fermented milk base material at low temperatures is purposely performed, the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk increases. That is, if the fermented milk having undergone the low temperature holding step (low temperature holding treatment) compared with that not having undergone the low temperature holding step (low temperature holding treatment), the former has a larger number of bacteria for *Lactobacillus bulgaricus* than the latter, whereas the former has a smaller

number of bacteria for *Streptococcus thermophilus* than the latter. Thus, it may be said that, by performing the low temperature holding step, minimizing the growth of *Streptococcus thermophilus* was successful, while enhancing the growth of *Lactobacillus bulgaricus*. Moreover, some *Lactobacillus bulgaricus* produces functional polysaccharide (EPS: Exopolysaccharide). Therefore, according to the present invention, it is possible to produce a polysaccharide-rich fermented milk having no off-flavor by relatively increasing the number of bacteria for *Lactobacillus bulgaricus*, without using additives such as a growth accelerator for lactic acid bacteria. [0058]

In the present invention, when it is assumed that the number of bacteria for *Streptococcus thermophilus* contained in the fermented milk base material prior to the low temperature holding step (step S5) is 1 (reference), it is assumed that the numerical value of the ratio of numbers of bacteria for *Lactobacillus bulgaricus* (the number of bacteria for *Lactobacillus bulgaricus*/the number of bacteria for *Streptococcus thermophilus*) is α . Here, it is preferable for the numerical value of α to be calculated from the numbers of bacteria for *Streptococcus thermophilus* contained just after the starter addition step (step S4) (specifically, the fermented milk base material within 1 hour after the lactic acid bacteria starter is added to the starting milk) and the number of bacteria for *Lactobacillus bulgaricus* contained therein. In addition, when it is assumed that the number of bacteria for *Streptococcus thermophilus* contained in the fermented milk after the fermentation step (step S7) is 1 (reference), it is assumed that the numerical value of the ratio of numbers of bacteria for *Lactobacillus bulgaricus* (the number of bacteria for *Lactobacillus bulgaricus*/the number of bacteria for *Streptococcus thermophilus*) is β . Here, it is preferable for the numerical value of β to be calculated from the number of bacteria for *Streptococcus thermophilus* contained in

the fermented milk just after the re-cooling step (step S8) (specifically, the fermented milk within 1 hour after the re-cooling) and the number of bacteria for *Lactobacillus bulgaricus* contained therein. In this case, according to the present invention, the numerical value of β/α may become 1.1 or higher. Moreover, in this case, according to the present invention, it is preferable for the numerical value of β/α to become 1.2 or higher, more preferable to become 1.5 or higher, further preferable to become 2.0 or higher, particularly preferable to become 2.5 or higher, or most preferable to become 3.0 or higher. Note that, in this case, according to the present invention, the upper limit value of β/α is not limited in particular, but should, for example, be 20.0. In this way, according to the present invention, the ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus* may be drastically increased. That is, according to the present invention, the growth of *Lactobacillus bulgaricus* may be enhanced and the growth of *Streptococcus thermophilus* may be minimized relative to each other.

[0059]

In the present invention, for example, when the ratio (α) of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk base material prior to the low temperature holding step to the number of bacteria for *Streptococcus thermophilus* contained therein is 0.01 to 0.5, according to the present invention, the ratio (β) of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk after the fermentation step to the number of bacteria for *Streptococcus thermophilus* contained therein may become 0.6 or higher. Here, it is preferable for the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk base material prior to the low temperature holding step to the number of bacteria for *Streptococcus thermophilus* contained therein to be calculated from the

number of bacteria for *Streptococcus thermophilus* contained in the fermented milk base material just after the starter addition step (specifically, the fermented milk base material within 1 hour after the lactic acid bacteria starter is added to the starting milk) and the number of bacteria for *Lactobacillus bulgaricus* contained therein. In addition, it is preferable for the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk after the fermentation step to the number of bacteria for *Streptococcus thermophilus* contained therein to be calculated from the number of bacteria for *Streptococcus thermophilus* contained in the fermented milk just after the re-cooling step (step S8) (specifically, the fermented milk within 1 hour after the re-cooling) and the number of bacteria for *Lactobacillus bulgaricus* contained therein. Moreover, in this case, according to the present invention, it is preferable for the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk to the number of bacteria for *Streptococcus thermophilus* contained therein to become 0.65 or higher, more preferable to become 0.7 or higher, further preferable to become 0.8 or higher, particularly preferable to become 0.9 or higher, or most preferable to become 1.0 or higher. In this case, according to the present invention, the upper limit value of the ratio of the number of bacteria for *Lactobacillus bulgaricus* contained in the fermented milk to the number of bacteria for *Streptococcus thermophilus* contained therein is not limited in particular, but should, for example, be 5.0. In this way, according to the present invention, in the stage of fermented milk base material, even when the number of bacteria for *Lactobacillus bulgaricus* is half or less than the number of bacteria for *Streptococcus thermophilus*, in the stage of the fermented milk, it is possible to obtain the fermented milk having the number of bacteria for *Lactobacillus bulgaricus* finally enriched to be equal to or higher than the number of bacteria for *Streptococcus thermophilus*.

[0060]

The present invention also relates to a method for enhancing the growth of *Lactobacillus bulgaricus*, a method for minimizing the growth of *Streptococcus thermophilus*, a method for increasing the ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus*, or the like. That is, the present invention also relates to a method for enhancing the growth of *Lactobacillus bulgaricus*, a method for minimizing the growth of *Streptococcus thermophilus*, a method for increasing the ratio of the number of bacteria for *Lactobacillus bulgaricus* to the number of bacteria for *Streptococcus thermophilus*, or the like, including a sterilization step of sterilizing a starting milk, a cooling step of cooling the starting milk after the sterilization step, a starter addition step of adding a lactic acid bacteria starter containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus* to the starting milk during the cooling step or after the cooling step in order to obtain a fermented milk base material, a low temperature holding step of holding the fermented milk base material after the starter addition step at a temperature that is lower than a fermentation promotion temperature, a heating step of heating the fermented milk base material after the low temperature holding step to a fermentation promotion temperature, and a fermentation step of fermenting the fermented milk base material after the heating step in order to obtain fermented milk. Note that these details shall follow the method for producing fermented milk, or the like of the present invention.

Examples

[0061]

Hereinafter, a specific description is made of the present invention with the use

of Examples. However, the present invention is not limited to the following Examples, but various improvements may be added based on a publicly known approach.

[0062]

<Example 1> Low temperature holding of fermented milk base material: done

Fresh milk: 500 g, skim milk powder: 76 g, fresh cream: 23 g, tap water: 401 g were mixed to prepare a starting milk (a yogurt mixture, solid-not-fat (SNF): 9.5 wt%, milk fat: 3.0 wt%). The preparation was subjected to heat sterilization at 95°C for 5 minutes, and then cooled to approximately 10°C (8°C to 12°C). To the cooled starting milk, 2 wt% lactic acid bacteria starter (lactic acid bacteria separated from Meiji Bulgaria Yogurt LB81 made by Meiji Co., Ltd.) was added (inoculated) to obtain a fermented milk base material (a yogurt base). In order to confirm the reproducibility of the experiment, operation to produce the fermented milk base material was performed twice. For each of the first and second fermented milk base materials, the number of bacteria for *Lactobacillus bulgaricus* and the number of bacteria for *Streptococcus thermophilus* were measured.

[0063]

For the first fermented milk base material, the number of bacteria for *Lactobacillus bulgaricus* was 0.1×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 1.5×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.067.

For the second fermented milk base material, the number of bacteria for *Lactobacillus bulgaricus* was 0.3×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 1.1×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.273.

[0064]

Moreover, the fermented milk base material was held at low temperatures at 5°C to 10°C for 3 days (72 hours). In addition, nitrogen gas (N₂) was injected into the fermented milk base material to bring about an anaerobic condition, while the fermented milk base material was held at low temperatures. Subsequently, the fermented milk base material was heated to 40°C, and then nitrogen gas (N₂) was injected to reduce the dissolved oxygen concentration (DO) in the fermented milk base material to 5 ppm. Subsequently, the fermented milk base material was filled in a cup container (volume: 100 g, made of plastic), left at rest in a fermenting room (40°C) for approximately 3 hours until the lactic acid acidity reached 0.8%, and then cooled in a cold room (10°C or lower) to produce fermented milk (a set type yogurt) [Example 1]. With the use of the above-mentioned first fermented milk base material and second fermented milk base material, operation to produce the fermented milk of Example 1 was performed twice. For each of first and second Examples 1, the number of bacteria for *Lactobacillus bulgaricus* and the number of bacteria for *Streptococcus thermophilus* were measured.

[0065]

For first Example 1 (fermented milk), the number of bacteria for *Lactobacillus bulgaricus* was 38.5×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 40.0×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.963.

For second Example 1 (fermented milk), the number of bacteria for *Lactobacillus bulgaricus* was 33.5×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 38.0×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.882.

[0066]

<Comparative Example 1> Low temperature holding of fermented milk base

material: not done

In order to confirm the effect of holding the fermented milk base material at low temperatures, fermented milk (a set type yogurt) [Comparative Example 1] was produced without low temperature holding. With the exception of the presence or absence of the low temperature holding, the producing condition for Comparative Example 1 was the same condition as that for above-mentioned Example 1.

[0067]

That is, fresh milk: 500 g, skim milk powder: 76 g, fresh cream: 23 g, tap water: 401 g were mixed to prepare a starting milk (a yogurt mixture, solid-not-fat (SNF): 9.5 wt%, milk fat: 3.0 wt%). The preparation was subjected to heat sterilization at 95°C for 5 minutes, and then cooled to approximately 10°C (8°C to 12°C). Moreover, to the cooled starting milk, 2 wt% lactic acid bacteria starter (lactic acid bacteria separated from Meiji Bulgaria Yogurt LB81 made by Meiji Co., Ltd.) was added (inoculated) to obtain a fermented milk base material (a yogurt base). In order to confirm the reproducibility of the experiment, operation to produce the fermented milk base material was performed twice. For each of the first and second fermented milk base materials, the number of bacteria for *Lactobacillus bulgaricus* and the number of bacteria for *Streptococcus thermophilus* were measured.

[0068]

For the first fermented milk base material, the number of bacteria for *Lactobacillus bulgaricus* was 0.6×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 2.0×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.300.

For the second fermented milk base material, the number of bacteria for *Lactobacillus bulgaricus* was 0.3×10^7 cfu/g, and the number of bacteria for

Streptococcus thermophilus was 2.2×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.136.

[0069]

Just after addition of the lactic acid bacteria starter, the fermented milk base material was heated to 40°C, and then nitrogen gas (N₂) was injected to reduce the dissolved oxygen concentration (DO) in the fermented milk base material to 5 ppm. Subsequently, the fermented milk base material was filled in a cup container (volume: 100 g, made of plastic), left at rest in a fermenting room (40°C) for approximately 3 hours until the lactic acid acidity reached 0.8%, and then cooled in a cold room (10°C or lower) to produce fermented milk (a set type yogurt) [Comparative Example 1]. With the use of the above-mentioned first fermented milk base material and second fermented milk base material, operation to produce the fermented milk of Comparative Example 1 was performed twice. For each of first and second Examples 1, the number of bacteria for *Lactobacillus bulgaricus* and the number of bacteria for *Streptococcus thermophilus* were measured.

[0070]

For first Comparative Example 1 (fermented milk), the number of bacteria for *Lactobacillus bulgaricus* was 16.5×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 91.5×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.180.

For second Comparative Example 1 (fermented milk), the number of bacteria for *Lactobacillus bulgaricus* was 10.0×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 86.0×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.116.

[0071]

[Comparison of numbers of bacteria in fermented milk base material]

Table 1 below shows comparison between the numbers of bacteria for *Lactobacillus bulgaricus* and *Streptococcus thermophilus* in the fermented milk base material used for Example 1 and the fermented milk base material used for Comparative Example 1.

[0072]

[Table 1]

Experiment result (the number of bacteria contained in the fermented milk base material(before low-temperature holding))				
Experiment1: lactic acid bacteria starter of Meiji Bulgaria Yogurt LB81				
the first time	the number of bacteria(*10 ⁻⁷) [cfu/g]		ratio of numbers of bacteria (Lactobacillus bulgaricus/ Streptococcus thermophilus) [-]	
	Lactobacillus bulgaricus	Streptococcus thermophilus	(α)	
Example 1 for cooling Eobtaining (10℃, 3days)	0.1	1.5	(α)	0.067
Comperative Example 1 for cooling Eobtaining (not done)	0.6	2.0		0.300
the second time	the number of bacteria(*10 ⁻⁷) [cfu/g]		ratio of numbers of bacteria (Lactobacillus bulgaricus/ eptococcus thermophilus) [-]	
	Lactobacillus bulgaricus	Streptococcus thermophilus	(α)	
Example1 for cooling obtaining(10℃, 3days)	0.3	1.1	(α)	0.273
Comperative Example 1 for cooling Eobtaining (not done)	0.3	2.2		0.136

[0073]

[Comparison of numbers of bacteria in fermented milk]

Table 2 below shows comparison between the numbers of bacteria for *Lactobacillus bulgaricus* and *Streptococcus thermophilus* in the fermented milk for Example 1 and the fermented milk for Comparative Example 1.

[0074]

[Table 2]

●Experiment result (the number of bacteria contained in the fermented milk base material)						
Experiment1: lactic acid bacteria starter of Meiji Bulgaria Yogurt LB81						
the first time	the number of bacteria(*10 ⁻⁷) [cfu/g]			ratio of numbers of bacteria (Lactobacillus bulgaricus/ Streptococcus thermophilus) [-]		
	Lactobacillus bulgaricus	Streptococcus thermophilus				
Example 1 for cooling•obtaining (10℃, 3days)	38.5	40.0		(β)		0.963
Comperative Example 1 for cooling•obtaining (not done)	16.5	91.5				0.180
the second time	the number of bacteria(*10 ⁻⁷) [cfu/g]			ratio of numbers of bacteria (Lactobacillus bulgaricus/ Streptococcus thermophilus) [-]		
	Lactobacillus bulgaricus	Streptococcus thermophilus				
Example 2 for cooling•obtaining (10℃, 3days)	33.5	38.0		(β)		0.882
Comperative Example 1 for cooling•obtaining (not done)	10.0	86.0				0.116

[0075]

In Example 1, comparing the ratio of numbers of bacteria (α) in the fermented milk base material to the ratio of numbers of bacteria (β) in the fermented milk base material, the ratio of numbers of bacteria (β) in the fermented milk base material has larger numerical value than that of the ratio of numbers of bacteria (α) in the fermented milk base material ($\beta > \alpha$). For first Example 1, the value of β/α was $0.963/0.067 = 14.373....$ For second Example 1, the value of β/α was $0.882/0.273 = 3.230....$

[0076]

<Example 2> Low temperature holding of fermented milk base material: done

Skim milk powder: 124 g, salt-free butter: 4, sugar: 54 g, tap water: 818 g were mixed to prepare a starting milk (a yogurt mixture, solid-not-fat (SNF): 9.5 wt%, milk fat: 3.0 wt%). The preparation was subjected to heat sterilization at 95°C for 5 minutes, and then cooled to approximately 10°C (8°C to 12°C). To the cooled starting milk, 2 wt% lactic acid bacteria starter (lactic acid bacteria separated from Meiji Yogurt R-1 made by Meiji Co., Ltd.) was added (inoculated) to obtain a fermented milk base material (a yogurt base). In order to confirm the reproducibility of the experiment, operation to produce the fermented milk base material was performed twice. For each of the first and second fermented milk base materials, the number of bacteria for

Lactobacillus bulgaricus and the number of bacteria for *Streptococcus thermophilus* were measured.

[0077]

For the first fermented milk base material, the number of bacteria for *Lactobacillus bulgaricus* was 0.4×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 1.1×10^7 cfu/g. This ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.364.

For the second fermented milk base material, the number of bacteria for *Lactobacillus bulgaricus* was 0.3×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 1.1×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.273.

[0078]

The fermented milk base material was held at low temperatures at 5 to 10°C for 2 days (48 hours). In addition, nitrogen gas (N₂) was injected into the fermented milk base material to bring about an anaerobic condition, while the fermented milk base material was held at the low temperatures. Subsequently, the fermented milk base material was heated to 38°C, and then nitrogen (N₂) was injected to reduce the dissolved oxygen concentration (DO) in the fermented milk base material to 3 ppm.

Subsequently, the resultant was filled in a small tray (volume: 2 kg, made of stainless steel), left at rest in a fermenting room (38°C) for approximately 4 hours until the lactic acid acidity reached 0.8%, and then the curd in the fermented milk was crushed.

Subsequently, the obtained fermented milk was filled in a cup container (volume: 100 g, made of plastic), and cooled in a cold room (10°C or lower) to produce fermented milk (a stirred type yogurt) [Example 2]. With the use of the above-mentioned first fermented milk base material and second fermented milk base material, operation to

produce the fermented milk of Example 2 was performed twice. For each of first and second Examples 2, the number of bacteria for *Lactobacillus bulgaricus* and the number of bacteria for *Streptococcus thermophilus* were measured.

[0079]

For first Example 2 (fermented milk), the number of bacteria for *Lactobacillus bulgaricus* was 43.0×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 51.0×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.843.

For second Example 2 (fermented milk), the number of bacteria for *Lactobacillus bulgaricus* was 41.0×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 46.5×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.882.

[0080]

<Comparative Example 2> Low temperature holding of fermented milk base material: not done

In order to confirm the effect of holding the fermented milk base material at low temperatures, fermented milk (a stirred type yogurt) [Comparative Example 2] was produced without low temperature holding. With the exception of the presence or absence of the low temperature holding, the producing condition for Comparative Example 2 was the same condition as that for above-mentioned Example 2.

[0081]

That is, skim milk powder: 124 g, salt-free butter: 4, sugar: 54 g, tap water: 818 g were mixed to prepare a starting milk (a yogurt mixture, solid-not-fat (SNF): 9.5 wt%, milk fat: 3.0 wt%). The preparation was subjected to heat sterilization at 95°C for 5 minutes, and then cooled to approximately 10°C (8°C to 12°C). To the cooled starting

milk, 2 wt% lactic acid bacteria starter (lactic acid bacteria separated from Meiji Yogurt R-1 made by Meiji Co., Ltd.) was added (inoculated) to obtain a fermented milk base material (a yogurt base). In order to confirm the reproducibility of the experiment, operation to produce the fermented milk base material was performed twice. For each of the first and second fermented milk base materials, the number of bacteria for *Lactobacillus bulgaricus* and the number of bacteria for *Streptococcus thermophilus* were measured.

[0082]

For the first fermented milk base material, the number of bacteria for *Lactobacillus bulgaricus* was 0.2×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 0.7×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.286.

For the second fermented milk base material, the number of bacteria for *Lactobacillus bulgaricus* was 0.3×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 1.3×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.231.

[0083]

Just after the addition of the lactic acid bacteria starter, the fermented milk base material was heated to 38°C, and then nitrogen (N₂) was injected to reduce the dissolved oxygen concentration (DO) in the fermented milk base material to 3 ppm.

Subsequently, the resultant was filled in a small tray (volume: 2 kg, made of stainless steel), left at rest in a fermenting room (38°C) for approximately 4 hours until the lactic acid acidity reached 0.8%, and then the curd in the fermented milk was crushed.

Subsequently, the obtained fermented milk was filled in a cup container (volume: 100 g, made of plastic), and cooled in a cold room (10°C or lower) to produce fermented milk

(a stirred yogurt) [Comparative Example 2]. With the use of the above-mentioned first fermented milk base material and second fermented milk base material, operation to produce the fermented milk of Comparative Example 2 was performed twice. For each of first and second Examples 2, the number of bacteria for *Lactobacillus bulgaricus* and the number of bacteria for *Streptococcus thermophilus* were measured.

[0084]

For first Comparative Example 2 (fermented milk), the number of bacteria for *Lactobacillus bulgaricus* was 28.0×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 73.5×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.381.

For second Comparative Example 2 (fermented milk), the number of bacteria for *Lactobacillus bulgaricus* was 21.5×10^7 cfu/g, and the number of bacteria for *Streptococcus thermophilus* was 111.5×10^7 cfu/g. Moreover, this ratio of numbers of bacteria (*Lactobacillus bulgaricus*/*Streptococcus thermophilus*) was 0.193.

[0085]

[Comparison of numbers of bacteria in fermented milk base material]

Table 3 below shows comparison between the numbers of bacteria for *Lactobacillus bulgaricus* and *Streptococcus thermophilus* in the fermented milk base material used for Example 2 and the fermented milk base material used for Comparative Example 2.

[0086]

[Table 3]

●Experiment result(the number of bacteria contained in the fermented milk base material(before low-temperature holding))					
Experiment2: lactic acid bacteria starter of Meiji Yogurt R-1					
the first time	the number of bacteria(*10 ⁻⁷) [cfu/g]			ratio of numbers of bacteria (Lactobacillus bulgaricus/ Streptococcus thermophilus) [-]	
	Lactobacillus bulgaricus	Streptococcus thermophilus			
Example 2 for cooling・obtaining (10℃, 2days)	0.4	1.1		(α)	0.364
Comperative Example 2 for cooling・obtaining (not done)	0.2	0.7			0.286
the second time	the number of bacteria(*10 ⁻⁷) [cfu/g]			ratio of numbers of bacteria (Lactobacillus bulgaricus/ Streptococcus thermophilus) [-]	
	Lactobacillus bulgaricus	Streptococcus thermophilus			
Example 2 for cooling・obtaining (10℃, 2days)	0.3	1.1		(α)	0.273
Comperative Example 2 for cooling・obtaining (not done)	0.3	1.3			0.231

[0087]

[Comparison of numbers of bacteria in fermented milk]

Table 4 below shows comparison between the numbers of bacteria for *Lactobacillus bulgaricus* and *Streptococcus thermophilus* in the fermented milk for Example 2 and the fermented milk for Comparative Example 2.

[0088]

[Table 4]

Experiment result (the number of bacteria contained in the fermented milk base material)					
Experiment2: lactic acid bacteria starter of Meiji Yogurt R-1					
the first time	the number of bacteria(*10 ⁻⁷) [cfu/g]			ratio of numbers of bacteria (Lactobacillus bulgaricus/ Streptococcus thermophilus) [-]	
Example 2 for cooling・obtaining (10℃, 2days)	43.0	51.0		(β)	0.843
Comperative Example 1 for cooling・obtaining (not done)	28.0	73.5			0.381
the second time	the number of bacteria(*10 ⁻⁷) [cfu/g]			ratio of numbers of bacteria (Lactobacillus bulgaricus/ Streptococcus thermophilus) [-]	
Example 2 for cooling・obtaining (10℃, 2days)	41.0	46.5		(β)	0.882
Comperative Example 2 for cooling・obtaining (not done)	21.5	111.5			0.193

[0089]

In Example 2, comparing the ratio of numbers of bacteria (α) in the fermented

milk base material to the ratio of numbers of bacteria (β) in the fermented milk base material, the ratio of numbers of bacteria (β) in the fermented milk base material has larger numerical value than that of the ratio of numbers of bacteria (α) in the fermented milk base material ($\beta > \alpha$). For first Example 2, the value of β/α was $0.843/0.364 = 2.315....$ For second Example 2, the value of β/α was $0.882/0.273 = 3.230....$

[0090]

[Comparison of concentration of polysaccharide in fermented milk]

Table 5 below shows comparison between the concentration (production) of polysaccharide contained in the fermented milk of Example 2 and the concentration (production) of polysaccharide contained in the fermented milk of Comparative Example 2.

[Table 5]

Experiment result

(the number of bacteria contained in the fermented milk base material)	
Experiment2: lactic acid bacteria starter of Meiji Yogurt R-1	
the first	polysaccharide (EPS)
time	[mg/100g]
Example 2 for cooling • obtaining (10°C, 2days)	7.05
Comparative Example 2 for cooling • obtaining (not done)	4.01
the second	polysaccharide (EPS)
time	[mg/100g]
Example 2 for cooling • obtaining (10°C, 2days)	6.16
Comparative Example 2 for cooling • obtaining (not done)	4.31

[0091]

As shown in the above-mentioned Table 5, the fermented milk of Example 2 had higher concentration of polysaccharide than that in the fermented milk of Comparative Example 2. It is considered that, as shown in Table 4, the result is caused by the fact that the fermented milk of Example 2 has a larger number of bacteria for *Lactobacillus bulgaricus* than that in the fermented milk of Comparative Example 2.

[0092]

Note that when the concentration of polysaccharide contained in the fermented milk was measured, polysaccharide was separated from 100 g of the fermented milk, and the polysaccharide out of the bacterial cell was quantified by a phenol-sulfuric acid method. Note that, for a method for separating polysaccharide from fermented milk, the following steps a) to d) were performed.

- a) performing deproteinization using trichloroacetic acid.
- b) precipitating polysaccharide by ethanol precipitation.
- c) dialyzing an aqueous solution of the above-mentioned polysaccharide using a dialysis membrane.
- d) obtaining an aqueous solution containing higher polymers.

Note that, in the steps such as deproteinization, ethanol precipitation and dialysis, the operating condition or the like may be appropriately adjusted depending on the lactic acid bacterium, culture solution, culture condition or the like.

[0093]

As shown in the above-mentioned Tables 1 to 4, both of Examples 1 and 2 having the fermented milk base material having undergone the low temperature holding treatment before fermentation had a larger number of bacteria for *Lactobacillus bulgaricus* and a smaller number of bacteria for *Streptococcus thermophilus*, in comparison with Comparative Examples 1 and 2 having the fermented milk base material not having undergone the low temperature holding treatment before fermentation. From this, it has been confirmed that the growth of *Lactobacillus bulgaricus* is enhanced and the growth of *Streptococcus thermophilus* is minimized by holding the fermented milk base material at a temperature (e.g., 15°C or lower) that is lower than a fermentation promotion temperature (e.g., 30°C to 40°C) before

fermentation. In contrast, as shown in the above-mentioned Table 5, Example 2 having the fermented milk base material having undergone the low temperature holding treatment before fermentation had larger total amount of polysaccharide contained in the fermented milk, in comparison with Comparative Example 2 having the fermented milk base material not having undergone the low temperature holding treatment before fermentation. From this, it has been confirmed that it is possible to produce a fermented milk having polysaccharide derived from *Lactobacillus bulgaricus* enriched by holding the fermented milk base material at a temperature that is lower than a fermentation promotion temperature before fermentation, followed by fermentation.

Industrial Applicability

[0094]

The present invention relates to a method for producing fermented milk such as yogurt. Accordingly, the present invention may be suitably used in the production industry of fermented milk such as yogurt.

CLAIMS

1. A method for producing fermented milk, comprising:
 - a sterilization step of sterilizing a starting milk;
 - a cooling step of cooling the starting milk after the sterilization step;
 - a starter addition step of adding a lactic acid bacteria starter containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus* to the starting milk during the cooling step or after the cooling step to obtain a fermented milk base material;
 - a low temperature holding step of holding the fermented milk base material after the starter addition step at a temperature that is lower than a fermentation promotion temperature;
 - a heating step of heating the fermented milk base material after the low temperature holding step to the fermentation promotion temperature; and
 - a fermentation step of fermenting the fermented milk base material after the heating step to obtain the fermented milk.
2. The method for producing fermented milk according to claim 1,
 - wherein the cooling step is a step of cooling the starting milk to 15°C or lower,
 - and
 - wherein the low temperature holding step is a step of holding the fermented milk base material at 15°C or lower for 1 day or longer.
3. The method for producing fermented milk according to claim 1,
 - wherein the heating step is a step of heating the fermented milk base material to the fermentation promotion temperature of 30°C or higher and 50°C or lower.

4. The method for producing fermented milk according to claim 1,
whrein at least in the low temperature holding step, further comprising an
anaerobic step of bringing about an anaerobic condition by injecting an inert gas into
the fermented milk base material.
5. The method for producing fermented milk according to claim 1,
when it is assumed that a numerical value of a ratio of a number of bacteria for
the *Lactobacillus bulgaricus* contained in the fermented milk base material prior to the
low temperature holding step to a number of bacteria for the *Streptococcus thermophilus*
contained therein is α , and
a numerical value of a ratio of a number of bacteria for the *Lactobacillus*
bulgaricus contained in the fermented milk to a number of bacteria for the
Streptococcus thermophilus contained therein is β ,
wherein a numerical value of β/α is 1.1 or higher.
6. The method for producing fermented milk according to claim 1,
whrein the fermented milk base material prior to the low temperature holding
step has a ratio of a number of bacteria for the *Lactobacillus bulgaricus* to a number of
bacteria for the *Streptococcus thermophilus* of 0.01 or higher and 0.5 or lower, and
whrein the fermented milk has a ratio of a number of bacteria for the
Lactobacillus bulgaricus to a number of bacteria for the *Streptococcus thermophilus* of
0.6 or higher.
7. The method for producing fermented milk according to claim 1,

wherein a growth accelerator for lactic acid bacteria is not added.

8. The method for producing fermented milk according to claim 1,
wherein the fermentation step is a step of obtaining the fermented milk by filling the fermented milk base material in a container, followed by fermentation.
9. A fermented milk obtained by fermenting a fermented milk base material prepared by adding a lactic acid bacteria starter containing *Lactobacillus bulgaricus* and *Streptococcus thermophilus* to a starting milk,
when it is assumed that a numerical value of a ratio of a number of bacteria for the *Lactobacillus bulgaricus* contained in the fermented milk base material to a number of bacteria for the *Streptococcus thermophilus* contained therein is α , and
a numerical value of a ratio of a number of bacteria for the *Lactobacillus bulgaricus* contained in the fermented milk to a number of bacteria for the *Streptococcus thermophilus* contained therein is β ,
wherein the fermented milk has a numerical value of β/α of 1.1 or higher.
10. The fermented milk according to claim 9,
wherein a lactic acid acidity of the fermented milk is 0.9% or lower.
11. The fermented milk according to claim 9,
wherein a concentration of polysaccharide of the fermented milk is 5 mg/100 g or higher.