

[DESCRIPTION]

[Title of Invention]

FERMENTED MILK CONTAINING ADDED INGREDIENT, MANUFACTURING METHOD
AND METHOD OF USE THEREFOR, ACIDIC WATER CONTAINING ADDED
INGREDIENT AND METHOD OF USE THEREFOR, FERMENTED MILK
MANUFACTURING METHOD AND FERMENTED MILK STORAGE METHOD

[Technical Field]

[0001] The present invention relates to a fermented milk containing an added ingredient, and to a manufacturing method and method of use therefor. The present invention also relates to an acidic water containing an added ingredient, and to a method of use therefor, which can be used to manufacture a fermented milk containing an added ingredient. The present invention also relates to a fermented milk manufacturing method suitable for manufacturing a fermented milk containing an added ingredient. Furthermore, the present invention relates to a fermented milk storage method.

[Background Art]

[0002] The market for breakfast cereal has been growing in recent years due to increased health concerns and the like. As the market for breakfast cereal grows, cereal is more likely to be eaten together with fermented milk (yogurt). One example of this is a fermented milk product sold by Nippon Luna, Inc., which

contains a separately packaged cereal (see for example Non Patent Literature 1).

[Citation List]

[Non Patent Literature]

[0003]

[NPL 1] Nippon Luna Açai Yogurt Bowl, [search 07/16/2014],
internet

(http://www.nipponluna.co.jp/products/other/acai_bowl.html)

[Summary of Invention]

[Technical Problem]

[0004] With such a fermented milk product containing a separately packaged cereal, however, the separate containers must be opened individually and the cereal mixed with the fermented milk before the product can be eaten. Thus, such a fermented milk product containing a separately packaged cereal requires the consumer to take the trouble to "open the cereal container" and "mix the cereal with the fermented milk" - operations that are not required with ordinary fermented milk products.

[0005] It is an object of the present invention to provide a fermented milk product containing a cereal or other added ingredient, which can be consumed without imposing an undue burden on the consumer, along with a manufacturing method therefor.

[Solution to Problem]

[0006] The method for manufacturing a fermented milk containing an added ingredient of the first aspect of the invention comprises a sterilization step and an addition step. In the sterilization step, the ingredient is sterilized. In the addition step, the ingredient is added to the fermented milk. "Fermented milk" here is as defined under the Japanese "Ministerial Ordinance on Milk and Milk Products Concerning Compositional Standards, etc.", and specifically is fermented milk having a non-fat milk solids content of at least 8%. An "ingredient" here may be a (dried) cereal, (dried) vegetable, (dried) fruit and the like. A fermented milk containing an added ingredient ultimately obtained by this method for manufacturing a fermented milk containing an added ingredient preferably has a viable bacterial count of at least 1×10^7 cfu/g. The maximum of viable bacterial count is not particularly limited, and is preferably as high as possible.

[0007] A fermented milk containing an added ingredient is manufactured by this method for manufacturing a fermented milk containing an added ingredient. Therefore, this fermented milk containing an added ingredient can be eaten without imposing an undue burden on the consumer. Moreover, in this fermented milk containing an added ingredient the ingredient is literally contained as an added ingredient in the fermented milk from the completion of manufacture. Consequently, when a consumer eats

this fermented milk containing an added ingredient the ingredient is already soft, and the consumer can enjoy a new mouthfeel that was not experienced previously. When the ingredient in this fermented milk containing an added ingredient is a cereal, a synbiotic effect is anticipated from the combination of the probiotic effect of the fermented milk component and the prebiotic effect of the dietary fiber component of the cereal. When the ingredient in the fermented milk containing an added ingredient is a vegetable or fruit, on the other hand, a biogenic effect is anticipated from the plant polyphenols and the like in the vegetable or fruit in addition to the probiotic effect of the fermented milk component. It can be expected that the fermented milk containing an added ingredient of the present invention will have a positive effect on the health of a host by improving the balance of intestinal bacterial flora, and will also selectively increase the number of useful bacteria resident in the digestive tract or inhibit the growth of harmful bacterial. Specially, intestinal regulation, immune stimulation, anti-allergy effects, cholesterol lowering effects, blood pressure lowering effects, anti-tumor effects, antithrombotic effects, hematopoietic effects and other forms of biological regulation as well as skin improvement, biological defense, disease prevention and recovery, aging control and life extension are anticipated from the

fermented milk containing an added ingredient of the present invention.

[0008] Normally, however, when an ingredient such as a cereal and the like is simply added to fermented milk, the water activity of the ingredient increases, and microorganisms originating in the ingredient may increase as a result, potentially causing problems of hygiene and quality control when the resulting product is distributed and sold. With the present method for manufacturing a fermented milk containing an added ingredient, however, the ingredient is sterilized before being added to the fermented milk. As a result, there is no risk of an increase in microorganisms originating in the ingredient in a fermented milk containing an added ingredient obtained by this method for manufacturing a fermented milk containing an added ingredient, and there is very little risk of problems of hygiene or quality control.

[0009] In the sterilization step of this method for manufacturing a fermented milk containing an added ingredient, water containing the ingredient is preferably heated. In this case, the water containing the ingredient is then added to the fermented milk in the addition step. The "water containing the ingredient" may be either purchased or prepared by adding the (dried) ingredient to water. The water may be distilled water, ion-exchange water, or acidic water. This water preferably also

contains whey. This not only allows the ingredient to be sterilized efficiently while better maintaining the flavor of the ingredient, but also facilitates blending with the flavor of the fermented milk, and helps to stabilize the flavor and physical properties of the fermented milk containing the added ingredient. "Whey" here means an aqueous solution obtained by removing the milk fat, casein and the like from milk, and is sometimes called milk serum. The ingredient is preferably contained in the water in the amount of 25 mass% to 50 mass% as solids. This allows the ingredient to be uniformly moistened by the water, enabling efficient sterilization in the sterilization step, and also allows for the manufacture of fermented milk products containing large quantities of ingredients, opening up a potential market for new fermented milk products.

[0010] Moreover, in the sterilization step of this method for manufacturing a fermented milk containing an added ingredient, the ingredient is preferably added to acidic water. In this case, acidic water containing the ingredient is added to the fermented milk in the addition step. The "acidic water containing the ingredient" may be purchased or prepared by adding the (dried) ingredient to acidic water. The acidic water preferably also contains whey. This not only allows the ingredient to be sterilized efficiently while better maintaining the flavor of the ingredient, but also facilitates blending with

the flavor of the fermented milk, and helps to stabilize the flavor and physical properties of the fermented milk containing the added ingredient. The ingredient is preferably contained in the acidic water in the amount of 25 mass% to 50 mass% as solids. This allows the ingredient to be uniformly moistened by the acidic water, enabling efficient sterilization in the sterilization step, and also allows for the manufacture of fermented milk products containing large quantities of ingredients, opening up a potential market for new fermented milk products.

[0011] Moreover, in the method for manufacturing a fermented milk containing an added ingredient described above, the fermented milk preferably has a non-fat milk solids content in the range of 10 mass% to 26 mass%, more preferably 14 mass% to 26 mass%, still more preferably 16 mass% to 26 mass%, yet more preferably 20 mass% to 26 mass%, even more preferably 20 mass% to 25 mass%, especially 20 mass% to 24 mass%. This serves to increase the viscosity of the fermented milk, making it intermingle more easily with the added ingredient so that the consumer can enjoy the mouthfeel of the ingredient and the flavor of the fermented milk and the like together.

[0012] The fermented milk is preferably obtained from start milk material with a non-fat milk solids content adjusted to 10 mass% to 26 mass%. The non-fat milk solids content of the start

milk material is more preferably in the range of 14 mass% to 26 mass%, still more preferably 16 mass% to 26 mass%, yet more preferably 20 mass% to 26 mass%, even more preferably 20 mass% to 25 mass%, especially 20 mass% to 24 mass%.

[0013] A known raw material of fermented milk, such as cow's milk or soy milk, may be used as the start milk material of the fermented milk, but milk from cow's milk is preferred from the standpoint of flavor. Moreover, raw milk (unpasteurized milk), sterilized milk (pasteurized milk), defatted milk, whole concentrated milk, defatted concentrated milk, whole powdered milk, defatted powdered milk, sweetened condensed milk, sweetened defatted condensed milk, unsweetened condensed milk, unsweetened defatted condensed milk, glycomacropeptide may be compounded appropriately with the start milk material. This helps the fermented milk with the added ingredient to maintain a viable bacterial count. Depending on the actual type of fermented milk being manufactured, butter, cultured butter, buttermilk, buttermilk powder, butter oil, cream, cultured cream, compound cream, cream powder, whey, whey powder, desalted whey, desalted whey powder, whey protein concentrate, whey protein isolate, alpha-lactalbumin, beta-lactoglobulin, milk protein concentrate, casein, sodium caseinate, calcium caseinate may also be added to the start milk material. These additional components may be used individually, or two or more may be used together. In this case,

raw milk (unpasteurized milk) and processed raw milk are preferred as the start milk material from the standpoint of good flavor and the like.

[0014] In addition to milk and soy milk, foods and food additives such as sweetening additives such as table sugar and other sugars and sweeteners, spices, vitamins, minerals, oils and fats, gelatin, collagen, milk phospholipids, polyphenols may be added (compounded) as necessary in the start milk material of the fermented milk. Lactic acid bacteria survivability improvers such as oleic acid, guava leaf extract and other may also be added as necessary. Sweetening agents and spices can also be heated as necessary when dissolving them in the start milk material. Moreover, stabilizing agents (gelling agents) such as gelatin, agar, carrageenan, guar gum, low-methoxyl pectin, high-methoxyl pectin, carboxymethyl cellulose, gums and the like may also be added as necessary to the start milk material. Gum arabic may also be added to improve the survivability of Bifidus bacteria.

[0015] A raw material mix containing start milk material, sugars, additives and the like is preferably homogenized and heat sterilized. An ordinary temperature (in the range of 55°C to 70°C) and homogenization pressure (in the range of 150 kg/cm² to 250 kg/cm²) for manufacturing fermented milk may be use for the homogenization conditions, but in the case of a high-SNF mix, the mix may be homogenized at medium pressure with the principal aim

of preventing creaming. When smoothness is a desirable property of the fermented milk, homogenization may be performed at 180 kg/cm² to 800 kg/cm².

[0016] The heat sterilization conditions may be for example a sterilization temperature in the range of 80°C to 100°C and a sterilization time in the range of 1 minute to 1 hour. Another example of sterilization conditions is a sterilization temperature of 100°C to 140°C and a sterilization time of 1 second to 1 minute. A preferred sterilization temperature in the present invention is a temperature in the range of 85°C to 97°C, or a temperature in the range of 90°C to 96°C. In this case, a preferred sterilization time is in the range of 2 minutes to 10 minutes. A more preferred example of a sterilization temperature in the present invention is a temperature in the range of 115°C to 150°C. In this case, a preferred sterilization time is in the range of 1 second to 30 seconds.

[0017] The start milk material of the fermented milk may also be deoxidized before being fermented. If the start milk material is fermented under these conditions, the fermented milk can be manufactured more efficiently with a shorter fermentation time. When a deoxidizing step is included in the fermented milk manufacturing process, for example a known apparatus for exchanging an inactive gas for the dissolved oxygen in the start

milk material may be used appropriately. Examples of this apparatus include those disclosed in Published unexamined Japanese Patent Application No. 2001-78665, Published unexamined Japanese Patent Application No. 2001-9206 and Published unexamined Japanese Patent Application No. 2005-110527 for example (these documents are incorporated by reference in this Description). Such an apparatus uses an inactive gas to expel the dissolved oxygen from the start milk material. An "inactive gas" here is a chemically inactive gas, and may be a noble gas such as helium, neon, argon and xenon, and a gas such as nitrogen. In place of such inactive gas mixing methods, the oxygen dissolved in the start milk material may also be removed by a method using deaeration. Examples of such deaeration apparatuses include those disclosed in Published unexamined Japanese Patent Application No. 2002-370006 and Published unexamined Japanese Patent Application No. 2005-304390 (these documents are incorporated by reference in this Description). In the deoxygenizing step, deoxygenizing is preferably performed until the amount of dissolved oxygen in the start milk material (dissolved oxygen concentration) is 5 ppm or less, preferably 3 ppm or less, more preferably about 2 ppm or less for example.

[0018] In the method for manufacturing a fermented milk containing an added ingredient of the present invention, moreover, the start milk material may be fermented by mixing it

with a starter. A known starter may be used appropriately as the starter. Examples of preferred starters include lactic acid bacterial starters. Examples of lactic acid bacterial starters include *Lactobacillus bulgaricus*, *Streptococcus thermophilus*, *L. lactis*, *L. cremoris*, *L. gasseri*, *L. casei*, *Bifidobacteria*, as well as other lactic acid bacteria and yeasts commonly used in the manufacture of fermented milk. These lactic acid bacterial starters may be used individually, or two or more may be mixed and used together. Out of these lactic acid bacterial starters, it is especially desirable to use a starter based on a mixed starter of *L. bulgaricus* and *S. thermophilus*, which is a standardized yogurt starter according to the standards of the Codex Alimentarius. Depending on the kind of fermented milk to be obtained, a *Bifidobacterium* species such as *Bifidobacterium breve*, *B. longum*, *B. bifidum*, *B. animalis*, *B. suis*, *B. infantis*, *B. adolescentis*, *B. catenulatum*, *B. pseudocatenulatum*, *B. lactis*, *B. globosum*, a *Lactobacillus* species such as *Lactobacillus casei*, *L. acidophilus*, *L. buchneri*, *L. gallinarum*, *L. amylovorus*, *L. brevis*, *L. rhamnosus*, *L. kefir*, *L. paracasei*, *L. crispatus*, *L. zeae*, *L. helveticus*, *L. salivarius*, *L. fermentum*, *L. reuteri*, *L. johnsonii*, *L. pentosus*, *L. paraplantarum*, an *Enterococcus* species such as *Enterococcus faecalis*, *E. faecium*, a *Bacillus* species such as *Bacillus subtilis*, a yeast in the *Saccharomyces*, *Torulaspora*, *Candida* genus such as *Saccharomyces cerevisiae*,

Torulaspora delbrueckii, *Candida kefir* and the like may also be added to this mixed starter. The added amounts used in known fermented milk manufacturing methods may be consulted to determine the added amount of the starter, which may be in the range of 0.1 mass% to 10 mass%, preferably 0.2 mass% to 5 mass%, more preferably 0.5 mass% to 4 mass%, still more preferably 1 mass% to 3 mass% of the start milk material for example. Starter inoculation may be accomplished by known methods used in the manufacture of fermented milk. Examples of such known methods include a method of adding the starter under sterile conditions to the start milk material in a tank, or a method adding the starter in-line to the start milk material as it flows through a pipe. The fermentation methods and fermentation equipment for manufacturing start milk material are not limited to the fermentation methods and fermentation equipment described above, and any known methods and equipment may be used.

[0019] The fermentation condition such as fermentation temperature and the like can be determined appropriately after considering the type of lactic acid bacteria added to the start milk material, the desired flavor of the fermented milk and the like. In general, the temperature inside the fermentation chamber (fermentation temperature) is preferably maintained in the range of 30°C to 50°C, more preferably 35°C to 45°C, still more preferably 37°C to 44°C. Keeping the fermentation temperature

within this range normally facilitates the activity of the lactic acid bacteria, promoting effective fermentation.

[0020] The fermented milk containing an added ingredient of the second aspect of the present invention contains an ingredient. This fermented milk containing an added ingredient has a viable bacterial count of at least 1×10^7 cfu/g. Such a fermented milk containing an added ingredient can be manufactured by the method for manufacturing a fermented milk containing an added ingredient described above. This fermented milk containing an added ingredient may also be packaged in a container.

[0021] This fermented milk containing an added ingredient is literally a fermented milk containing an ingredient. Consequently, this fermented milk containing an added ingredient can be eaten without imposing an undue burden on the consumer. Moreover, because the ingredient is already soft when the consumer eats the fermented milk with the added ingredient, the consumer can enjoy a new mouthfeel that was never experienced previously.

[0022] In this fermented milk containing an added ingredient, the non-fat milk solids content of the fermented milk excluding the added ingredient is preferably in the range of 8 mass% to 21 mass%, more preferably 14 mass% to 21 mass%, still more preferably 16 mass% to 21 mass%. This allows the fermented milk to permeate the product, increasing the viscosity of the

fermented milk and making it intermingle more easily with the added ingredient so that the consumer can enjoy the mouthfeel of the ingredient and the flavor of the fermented milk and the like together. Moreover, in this fermented milk containing an added ingredient, the ingredient is preferably contained in the amount of at least 10 mass% or more preferably at least 20 mass% as solids. Because at present no fermented milk products containing such large quantities of ingredients are available on the fermented milk market, this opens the potential for creating a market for new fermented milk products. Moreover, the viable bacterial count of this fermented milk containing the added ingredient when stored for 25 days at 20°C in a sealed condition is preferably at least 1×10^7 cfu/g, and is more preferably at least 1×10^7 cfu/g when stored for 45 days at 20°C in a sealed condition, still more preferably at least 1×10^7 cfu/g when stored for 60 days at 20°C in a sealed condition. In addition to the advantage of not requiring refrigeration (low-temperature) control or refrigeration facilities during distribution or at a distribution location, this fermented milk containing an added ingredient also does not require refrigeration control or refrigeration facilities during sale or at the point of sale, allowing the purchaser to carry it around at normal temperature.

[0023] The acidic water containing an added ingredient of the third aspect of the invention is a water with acidic properties

containing an ingredient. As discussed above, this acidic water containing an added ingredient can be used as an additive in a fermented milk. An ingredient can be efficiently sterilized with this acidic water containing an added ingredient. Thus, the method for manufacturing fermented milk containing an added ingredient described above can be made more efficient by using this acidic water containing an added ingredient. This fermented milk containing an added ingredient can also be packed in a container.

[0024] The ingredient is preferably contained in this acidic water containing an added ingredient in the amount of 25 mass% to 50 mass% as solids. This allows the ingredient to be uniformly moistened by the acidic water, enabling efficient sterilization in the sterilization step, and also allows for the manufacture of fermented milk products containing large quantities of ingredients, opening up a potential market for new fermented milk products. Moreover, whey is preferably included in this acidic water containing an added ingredient. This not only allows the ingredient to be sterilized efficiently while better maintaining the flavor of the ingredient, but also facilitates blending with the flavor of the fermented milk, and helps to stabilize the flavor and physical properties of the fermented milk containing the added ingredient.

[0025] In the fermented milk manufacturing method of the fourth aspect of the invention, the non-fat milk solids content of the start milk material is adjusted to a range of 10 mass% to 26 mass%. Using this method for manufacturing fermented milk, it is possible to increase the viscosity of the fermented milk, so that the fermented milk intermingles more easily with the ingredient when the ingredient is added to the fermented milk, and the consumer can enjoy the mouthfeel of the ingredient and the flavor of the fermented milk and the like together. This non-fat milk solids content is more preferably in the range of 14 mass% to 26 mass%, still more preferably 16 mass% to 26 mass%, yet more preferably 20 mass% to 26 mass%, even more preferably 20 mass% to 25 mass%, especially 20 mass% to 24 mass%.

[0026] In the fermented milk storage method of the fifth aspect of the invention, the viable bacterial count of the fermented milk is maintained at 1×10^7 cfu/g or more when the fermented milk has been sealed after addition of the ingredient and stored for 60 days at 20°C. In this case, the ingredient is preferably added to the fermented milk so that ingredient is contained in the amount of at least 10 mass% as a percentage of the solids content of the fermented milk with the added ingredient.

[Brief Description of Drawings]

[0027]

[Fig. 1]

Fig. 1 is a graph showing the effect of the solids concentration of reconstituted skim milk (start milk material) on fermentation time.

[Fig. 2]

Fig. 2 is a graph showing the effect of storage time on the lactic acid bacterial count of a fermented milk containing an added cereal under refrigerated storage at 5°C.

[Fig. 3]

Fig. 3 is a graph showing the effect of storage time on the lactic acid bacterial count of a fermented milk containing an added cereal under room temperature storage at 20°C.

[Fig. 4]

Fig. 4 is a graph showing the effects of added ingredient amount and storage time on the lactic acid bacterial count of a fermented milk containing an added cereal under refrigerated storage at 5°C.

[Fig. 5]

Fig. 5 is a graph showing the effects of added ingredient amount and storage time on the lactic acid bacterial count of a fermented milk containing an added cereal under room temperature storage at 20°C.

[Description of Embodiments]

[0028] <Details of fermented milk containing an added ingredient>

The fermented milk containing an added ingredient of an embodiment of the invention is literally a fermented milk containing an added ingredient. The fermented milk and ingredient are explained in detail below first, and the method for manufacturing the fermented milk containing an added ingredient is then explained in detail.

[0029] (1) Fermented milk

The fermented milk of this embodiment is as defined in the Japanese "Ministerial Ordinance on Milk and Milk Products Concerning Compositional Standard, etc.", and specifically is fermented milk having a non-fat milk solids content of at least 8%. This fermented milk preferably has a non-fat milk solids content of at least 10 mass%, and the bacterial count thereof after 28 days of storage at 20°C in a sealed condition is preferably at least 1×10^7 cfu/g.

[0030] (2) Ingredient

The ingredient of this embodiment is a cereal, vegetable, fruit and the like. The term "cereal" here includes breakfast cereals. The material of the cereal may be wheat flour (roast flour RD, roast flour RM, alpha flour), whole rye flour (ALE mittel), puffed barley, puffed rye, puffed wheat, bread flour, finely ground rye flour, soy puffs (Soya Puff 40), puffed

soybeans, brown rice puffs, rye flakes, soybean protein (Fujinic 50, Prolina 800), wheat germ (Hi-Gy (registered trademark) A, Hi-Gy (registered trademark) WD), wheat bran and the like. This ingredient is preferably contained in the amount of at least 20 mass% as a percentage of the solids content of the fermented milk containing an added ingredient. Solids conversion of the added concentration of the ingredient in the fermented milk containing the added ingredient is performed as follows. First, the mass of the fermented milk containing the added ingredient is measured. Next, a sieve (1.4 mm to 4 mm mesh (12 mesh to 5 mesh) is used to separate the ingredient from the fermented milk containing the added ingredient. Next, the fermented milk on the surface of the ingredient is thoroughly wiped off with a Kim Towel or the like. After that, the ingredient is hot air dried (for 3 to 4 hours at 80°C), and left to cool in a dessicator until it reaches room temperature, and its mass is measured. Finally, the mass of the ingredient is divided by the mass of the fermented milk containing the added ingredient, and multiplied by 100 to calculate the added concentration as solids of the ingredient in the fermented milk containing the added ingredient.

[0031] <Method for manufacturing fermented milk containing added ingredient>

The fermented milk containing an added ingredient of this embodiment is primarily manufactured by a fermented milk

preparation step, an ingredient sterilization step and an addition step. A container packaging step may also be included as necessary. Each of these steps is explained in detail below.

(1) Fermented milk preparation step

A fermented milk is prepared by conventional methods in the fermented milk preparation step. However, because the actual fermented milk obtained here has a non-fat milk solids concentration of at least 10 mass%, the non-fat milk solids concentration of the start milk material is preferably adjusted to within the range of 10 mass% to 26 mass%, and more preferably to within a range of 14 mass% to 26 mass%, still more preferably to within a range of 16 mass% to 26 mass%, yet more preferably to within a range of 20 mass% to 26 mass%, even more preferably to within a range of 20 mass% to 25 mass%, especially to within a range of 20 mass% to 24 mass%.

[0032] (2) Ingredient sterilization step

In the ingredient sterilization step, the ingredient is sterilized by any of methods (2-1), (2-2) and (2-3) below. The "ingredient" here is preferably a dried food such as dried cereal, dried vegetable, dried fruit.

[0033] (2-1) Method of heat sterilization in water

In this method of heat sterilization in water, the ingredient is sterilized by being heated while in pure water such as ion-exchange water and distilled water. The ingredient here

is preferably contained in the amount of at least 25 mass% as solids. In this method, microwave heating is preferably adopted as the heating means. This is because surface temperature of the ingredient can thus be easily raised to 90°C or more, allowing efficient sterilization of the ingredient. It is also desirable to add whey, whey concentrate or whey powder to the pure water such as ion-exchange water, distilled water before heating the ingredient. It is thus possible to efficiently sterilize the ingredient without sacrificing the flavor of the ingredient. This method of heat sterilization in water is particularly effective when the ingredient is puffed barley, wheat germ and the like.

[0034] When whey has been added to the water containing the ingredient, the method of detecting the whey in the water containing the ingredient is a method of detecting alpha-LA (lactoalbumin) or beta-Lg (lactoglobulin). For example, these can be detected either by obtaining a target band by SDS-PAGE (electrophoresis), or by obtaining a target peak by HPLC (gel filtration).

[0035] (2-2) Acidic water sterilization method

In this acidic water sterilization method, the ingredient is sterilized by placing it in acidic water. The pH of the acidic liquid is preferably 4.3 or less, more preferably 3.5 or less, still more preferably 3.0 or less. The acid for preparing the

acidic water is one that can be added to foodstuffs, such as lactic acid, succinic acid, fumaric acid and citric acid. In this case as well the ingredient is preferably included in the amount of at least 25 mass% as solids. It is also desirable to add whey (here and below, including whey concentrate and whey powder) to the acidic water. This makes it possible to efficiently sterilize the ingredient without sacrificing the flavor of the ingredient. This acidic water sterilization method is particularly effective when the ingredient is wheat germ, rye flakes and the like. When the ingredient is wheat germ, the pH of the acidic water may be 4.3 or less, while when the ingredient is rye flakes the pH of the acidic water is preferably 3.5 or less.

[0036] (2-3) Method of sterilization by heating in acidic water

In this method of sterilization by heating in acidic water, the ingredient is sterilized by heating after being added to acidic water. In this case as well, the ingredient is preferably contained in the amount of 25 mass% as solids. The acidic water explained under (2-2) above is preferably adopted here as the "acidic water". In this method as well, microwave heating is preferably adopted as the heating means. It is also desirable to add whey, whey concentrate or whey powder to the pure water such as ion-exchange water, distilled water before heating the

ingredient. This makes it possible to efficiently sterilize the ingredient without sacrificing the flavor of the ingredient.

This method of sterilization by heating in acidic water is particularly effective when the ingredient is puffed barley, rye flakes, wheat bran or the like. When the ingredient is puffed barley the pH of the acidic water may be 4.3 or less, while when the ingredient is rye flakes or wheat bran the pH of the acidic water is preferably 3.5 or less.

[0037] The acidic water containing the sterilized ingredient can then be packaged in a container to obtain a packaged acidic water containing an ingredient. Such containers include all containers capable of holding acidic water. For example, the acidic water containing the added ingredient may be packed in a paper or plastic container, or it may be packed in a soft pack or pouch made from polyethylene, polypropylene, polystyrene or other. When the acidic water containing the added ingredient is to be distributed in a refrigerated or frozen state, the container is preferably combined with a carton to form a packaging assembly in order to protect against shock, light deterioration and the like.

[0038] (3) Addition step

In the addition step, the ingredient that was sterilized in the ingredient sterilization step of (2) above, which is contained in water or acidic water, is added and mixed with the

fermented milk prepared in the fermented milk preparation step of (1) above. The method of adding and mixing the ingredient with the fermented milk is not particularly limited, and a method known to those skilled in the art may be used.

[0039] (4) Container packaging step

In the container packaging step, the fermented milk containing an added ingredient obtained in the addition step is packaged in a container. Examples of such containers include all containers that can be packaged with fermented milk containing added ingredients. Examples of such containers include containers made of plastic, paper, glass, metal and composite materials and the like, but a container with light-blocking properties is preferred for preventing flavor deterioration of the fermented milk containing an added ingredient due to light transmission or oxygen permeation. Examples of such containers with light blocking properties include paper containers and red, brown and orange containers and the like. A transparent container may also be used as the container, but in this case this container is preferably covered with a light-blocking film in order to prevent flavor deterioration of the fermented milk containing an added ingredient due to light transmission or oxygen permeation. Examples of light-blocking films include metallic foil laminated films, metallic foil layered films, and black and dark-colored films and the like. Multiple containers

may also be wrapped together in plastic shrink film to facilitate shipment. It is also possible to combine two or more kinds of container, film or the like. When the fermented milk containing an added ingredient is packaged in a container having an opening at the top, the container is preferably sealed after completion of packaging by covering the container with a lid. In this case, the container is preferably sealed with a lid as soon as possible after the fermented milk containing an added ingredient is packaged in the container, in order to prevent flavor deterioration of the fermented milk containing an added ingredient due to light transmission or oxygen permeation.

[0040] <Features of fermented milk containing added ingredient and manufacturing method therefor>

(1)

The fermented milk containing an added ingredient of this embodiment is literally a fermented milk containing an ingredient. Consequently, this fermented milk containing an added ingredient can be eaten without imposing an undue burden on the consumer. Moreover, because the ingredient is already soft when the consumer eats the fermented milk with the added ingredient, the consumer can enjoy a new mouthfeel that was never experienced previously.

[0041]

(2)

In the method for manufacturing a fermented milk containing an added ingredient of this embodiment, the ingredient is sterilized before being added to the fermented milk. Consequently, a fermented milk containing an added ingredient obtained by this method for manufacturing a fermented milk containing an added ingredient is not liable to proliferation of microorganisms from the ingredient, and there is little risk of problems of hygiene and product quality.

Examples

[0042] The present invention is explained in detail below using examples and comparative examples, but the present invention is not limited by these examples.

[0043] <Example 1>

In the example explained below, preparation of a rich fermented milk was attempted.

(1) Preparation of lactic acid bacterial starter

Skim milk power (Meiji Co., Ltd.) was dissolved in roughly 60°C warm water to a concentration of 10 mass% as solids, to prepare a reconstituted skim milk. Next, this reconstituted skim milk was heat sterilized for 10 minutes at 95°C, and then cooled to about 40°C. Meanwhile, lactic acid bacteria were isolated from commercial yogurt (Meiji Bulgaria Yogurt LB 81 Plain, manufactured by Meiji Co., Ltd.). The sterilized reconstituted skim milk was then inoculated (compounded) with the isolated

lactic acid bacteria, and the reconstituted skim milk inoculated with the lactic acid bacteria was left standing for 6 hours at 37°C to prepare a lactic acid bacterial starter. The lactic acid bacteria were inoculated to a concentration of 0.15 mass% of the total.

[0044] (2) Preparation of start milk materials having various solids concentrations

Skim milk powder (Meiji Co., Ltd.) was dissolved in roughly 60°C warm water to concentrations of 10, 20, 22, 24, 26, 28 and 30 mass% as solids, to prepare reconstituted skim milks having various solids concentrations. Next, these reconstituted skim milks were each heat sterilized for 10 minutes at 95°C, and then cooled (to about 40°C) to prepare start milk materials having various solids concentrations.

[0045] (3) Preparation of fermented milk

The start milk materials having the various solids concentrations described above were each inoculated (compounded) with the lactic acid bacterial starter described above to a content of 1 mass% of the starter, and left standing at 37°C. The time required for the pH of each start milk material to reach 4.3 (fermentation time) was measured to test the fermentation ability of the lactic acid bacterial starter. Fig. 1 is a graph showing the effect of the solids concentration of the reconstituted skim

milk (start milk material) on fermentation time. This graph shows that stable production of a rich fermented milk is possible if the solids concentration of the reconstituted skim milk is about 26 mass%, and fermentation can be completed within 18 hours. Especially stable preparation of a rich fermented milk is possible if the solids concentration is about 24 mass%, and fermentation can be completed within about 12 hours.

[0046] (Example 2)

In the example explained below, methods of sterilizing cereals were investigated.

(1) Preparation of reconstituted whey containing cereal

Whey powder (Meiji Co., Ltd.) was dissolved in roughly 60°C warm water to a concentration of 5 mass% as solids to prepare reconstituted whey. Next, this reconstituted whey was uniformly distributed into four containers. After that, lactic acid was added (compounded) in the reconstituted whey in three of the four containers, adjusting the pH of each reconstituted whey to 3.0, 3.5, 4.3, to obtain four kinds of reconstituted whey with different pH values. Next, 10 g to 30 g of each kind of reconstituted whey was added (compounded) in 10 g each of various cereal materials (puffed barley, wheat germ (Hi-Gy (registered trademark) A), rye flakes and wheat bran) to prepare various kinds of reconstituted whey containing added cereals, making allowances for the specific volume of each cereal (that is, the

added amount (compounded amount) of the reconstituted whey was increased relatively to compensate for increased specific volume).

[0047] (2) Sterilization of cereal

Each of the reconstituted wheys containing the various cereals described above was heated for 1 minute in a microwave heating unit (600 W microwave oven) to obtain a cereal immersion solution. When the general bacterial populations of each reconstituted whey containing added cereal (before heat sterilization) and each cereal immersion solution (after heat sterilization) were measured, it was found that when the cereal material was puffed barley or wheat germ (Hi-Gy (registered trademark) A), adequate sterilization was achieved by heating regardless of the pH of the reconstituted whey. When the cereal material was rye flakes, adequate sterilization was achieved if the pH of the reconstituted whey was 3.5 or less, even before microwave heating. When the cereal material was wheat bran, adequate sterilization was only achieved when the cereal was heated in the reconstituted whey at a pH of 3.5 or less.

[0048] The general bacterial populations of the cereal immersion solutions described above were measured as follows in a facility capable of sterile operations. First, 3 g of the cereal immersion solution was placed in a Stomacher bag, 27 g of sterilized saline was added to the Stomacher bag, and the liquids

were mixed for 30 seconds in the Stomacher. Next, a 10x dilution of this liquid was prepared. This 10x dilution was then diluted so that the bacterial count (colony count) was 300/mL or less, to obtain a sample solution. Two sterile petri dishes were prepared for each sample, and 1 mL of sample solution was added to each of these sterile petri dishes. Meanwhile, standard agar medium (for example, Eiken Chemical Pearlcore normal agar medium) was prepared to a specific concentration and sterilized in accordance with the manual, to prepare a conditioned medium. 10 to 15 mL of the conditioned medium adjusted to a temperature of 43°C to 45°C was then added to each of the previous petri dishes, and the aforementioned sample liquid was distributed (mixed) in the conditioned medium. The conditioned medium containing the sample solution was then cooled to coagulate it. Once the conditioned medium containing the sample solution had coagulated, each petri dish was inverted, and the surface of the medium was dried. Each petri dish was then stored for 48 hours at 30°C, and the colonies were counted. Finally, the average number of colonies per two dishes of each sample was multiplied by the dilution rate to calculate the general bacterial population.

[0049] (Example 3)

In the example explained below, a fermented milk containing an added cereal was prepared.

(1) Preparation of fermented milk

(1-1) Preparation of lactic acid bacterial starter

A lactic acid bacterial starter was prepared in the same way as the lactic acid bacterial starter in (1) of Example 1.

[0050] (1-2) Preparation of start milk material

Skim milk powder (Meiji Co., Inc.) was dissolved in roughly 60°C warm water to a concentration of 24 mass% as solids, to prepare a reconstituted skim milk. Next, this reconstituted skim milk was heat sterilized for 10 minutes at 95°C, and then cooled (to about 40°C) to prepare a start milk material.

[0051] (1-3) Preparation of fermented milk

This start milk material was inoculated (compounded) with the lactic acid bacterial starter described above to a concentration of 1 mass% of the starter. This was then left standing at 37°C, and the start milk material was fermented until the pH reached 4.3 to obtain a rich fermented milk.

[0052] (2) Sterilization of cereal

(2-1) Preparation of aqueous whey solution containing cereal

First, whey powder was diluted with distilled water to a concentration of about 5 mass% as solids. Lactic acid was then added (compounded) in the diluted whey solution to adjust the pH of the diluted whey solution to about 4. Next, the acidic diluted whey solution was heat sterilized by heating it to 90°C in a microwave heating unit (600 W microwave oven), to prepare an

aqueous acidic solution. The various cereal materials, completely roast flour RM, puffed rye, soybean protein (Fujinic (registered trademark) 50), rye flakes and wheat germ (Hi-Gy (registered trademark) A) were each then added (compounded) in this aqueous acidic solution to prepare aqueous whey solutions containing these various cereals.

[0053] (2-2) Sterilization of cereals

The aqueous whey solutions containing the cereals described above were each heat sterilized for 2 minutes in a microwave heating unit (600 W microwave oven) to obtain cereal immersion solutions. The content of the cereal material contained in the cereal immersion solution was 25 to 50 mass% in each case.

[0054] (3) Preparation of fermented milk containing cereal

30 g of the aforementioned fermented milk was mixed (compounded) with 60 g of the each of the various kinds of cereal immersion solutions described above to prepare various kinds of fermented milk containing added cereal. The non-fat milk solids content of the fermented milk containing the added cereal was at least 8 mass% in each case. The lactic acid bacterial counts in each of the fermented milks containing added cereal were then measured. These fermented milks containing added cereal were also sealed and stored in different temperature environments (5°C and 20°C), and the lactic acid bacterial counts in each of the fermented milks containing added cereal were measured 2 weeks and

4 weeks after completion of fermentation in the case of 5°C storage, and 1 week, 2 weeks and 4 weeks after completion of fermentation in the case of 20°C storage. The results are as shown in the graphs of Fig. 2 and Fig. 3.

[0055] When the fermented milks containing the various kinds of added cereal were stored at 5°C (Fig. 2), the lactic acid bacterial counts in the fermented milks containing added cereal were maintained at about the same levels as in the fermented milk without added cereal (control). This means that the refrigerated storability of the fermented milk in the fermented milks containing the various kinds of added cereal was at least as good as in the fermented milk without added cereal (control).

[0056] When the fermented milks containing added cereal and the fermented milk without added cereal were stored for 4 weeks at 5°C, both the fermented milks containing added cereal and the fermented milk without added cereal complied with the standards for fermented milk (lactic acid bacterial count = 1×10^7 cfu/g or more). That is, the fermented milk containing added cereal exhibited excellent refrigerated storability.

[0057] When the fermented milks containing the various kinds of added cereal were stored at 20°C (Fig. 3), moreover, the room temperature storability of the fermented milks containing added

cereals was at least as good as that of the fermented milk without added cereal (control).

[0058] When the fermented milks containing added cereal and the fermented milk without added cereal were stored for 4 weeks at 20°C, the fermented milk without added cereal did not comply with the standards for fermented milk, but the fermented milks containing added cereal complied with the standards for fermented milk. That is, the fermented milks containing added cereal exhibited excellent room-temperature storability.

[0059] The lactic acid bacterial counts of the fermented milks containing added cereal described above were measured as follows in a facility capable of sterile operations. First, 3 g of the fermented milk containing added cereal was placed in a Stomacher bag, 27 g of sterilized saline was added to the Stomacher bag, and the liquids were mixed for 30 seconds in the Stomacher. Next, a 10x dilution of this liquid was prepared. This 10x dilution was then diluted so that the bacterial count (colony count) was 300/mL or less, to obtain a sample solution. Two sterile petri dishes (for example, Iwaki SH 90-15 sterile plastic petri dishes) were prepared for each sample, and 1 mL of sample liquid was added to each of these sterile petri dishes. Then, 10 to 15 mL of BCP medium (for example, Eiken Chemical plate count agar medium with BCP, prepared according to the manual) was added to each of the petri dishes, and mixed with the sample liquid.

The BCP medium containing the sample liquid was then cooled to coagulate it. Once the BCP medium containing the sample liquid had coagulated, each petri dish was inverted, and the surface of the medium was dried. Next, the yellowed colonies were counted. Finally, the average number of colonies per two dishes of each sample was multiplied by the dilution rate to calculate the lactic acid bacterial count.

[0060] The coliform counts and mold and yeast counts in each fermented milk containing added cereal were also measured 2 weeks and 4 weeks after completion of fermentation of the fermented milks containing the various added cereals described above. The coliform groups were tested after 20 hours of storage at 30°C in desoxycholate agar medium (Eiken). The molds and yeasts were tested after 72 hours of storage at 25°C in medium obtained by preparing desoxycholate agar medium according to the manufacturer's recipe, and then adding 100 µg of chloramphenicol per 1 mL of medium before sterilization. As a result, all of the fermented milks containing added cereal tested negative for coliform groups, and the mold and yeast counts were less than 10 cfu/g.

[0061] The coliform counts and mold and yeast counts in the aforementioned fermented milks containing added cereal were measured as follows in a facility capable of sterile operations. First, 3 g of the cereal immersion solution was placed in a

Stomacher bag, 27 g of sterilized saline was added to the Stomacher bag, and the liquids were mixed for 30 seconds in the Stomacher to obtain a sample liquid. Two sterile petri dishes were prepared for each sample, and 1 mL of sample liquid was added to each of these sterile petri dishes. 10 to 15 mL of conditioned medium adjusted to a temperature of 43°C to 45°C was then added to each of the previous petri dishes, and the aforementioned sample liquid was distributed (mixed) in the conditioned medium. The conditioned medium containing the sample liquid was then cooled to coagulate it. Once the conditioned medium containing the sample liquid had coagulated, each petri dish was inverted, and the surface of the medium was dried. The colonies were then counted, and the coliform counts and mold and yeast counts were obtained.

[0062] (Example 4)

A fermented milk containing an added vegetable was prepared as in Example 3 except that a dried vegetable (dried tomato) was substituted for the cereal, and refrigerated storability was confirmed as in Example 3. As a result, the lactic acid bacterial count was 6×10^8 cfu/g after 4 weeks of refrigerated storage of fermented milk using a vegetable (dried tomato) as the ingredient, indicating refrigerated storability equivalent to that of the fermented milk containing added cereal of Example 3.

[0063] (Example 5)

The effects of the added amount of cereal on lactic acid bacterial counts in fermented milk containing added cereal were tested. Fermented milk containing added cereal was prepared so that the amount of cereal (germ, bran) added to the fermented milk was 6 mass%, 13 mass% and 22 mass% (the non-fat milk solids content of the fermented milk containing the added cereal was at least 8 mass% in each case). These fermented milks containing added cereal were sealed, and storability was confirmed under refrigeration (5°C) and at room temperature (20°C). As shown in Fig. 4, when these fermented milks containing added cereal were stored under refrigeration, no differences occurred over time in the lactic acid bacterial counts depending on the added amount of the cereal. The refrigerated fermented milks containing added cereal maintained good lactic acid bacterial counts after 4 weeks regardless of the added amount of cereal (6 to 22 mass%). However, as shown in Fig. 5, when the fermented milks containing added cereal were stored at room temperature, there were differences over time in the lactic acid bacterial counts depending on the added amount of cereal. Fermented milk containing added cereal that was stored at room temperature was better able to maintain a lactic acid bacterial count over time when the added amount of the cereal was greater. Specifically, even when fermented milk containing added cereal was stored at room temperature, the lactic acid bacterial counts conformed to

the standards for fermented milk after 4 weeks when the added amount of the cereal was 13 mass% or 20 mass%.

[CLAIMS]

[Claim 1] A method for manufacturing a fermented milk containing an added ingredient, comprising a sterilization step of sterilizing an ingredient and an addition step of adding the ingredient to a fermented milk.

[Claim 2] The method for manufacturing a fermented milk containing an added ingredient according to claim 1, wherein a water containing the ingredient is heated in the sterilization step, and the water containing the ingredient is then added to the fermented milk in the addition step.

[Claim 3] The method for manufacturing a fermented milk containing an added ingredient according to claim 2, wherein the water contains whey.

[Claim 4] The method for manufacturing a fermented milk containing an added ingredient according to claim 2 or 3, wherein the ingredient is contained in the water in the amount of at least 25 mass% as solids.

[Claim 5] The method for manufacturing a fermented milk containing an added ingredient according to claim 1, wherein the ingredient is added to an acidic water in the sterilization step, and this acidic water containing the ingredient is added to the fermented milk in the addition step.

[Claim 6] The method for manufacturing a fermented milk containing an added ingredient according to claim 5, wherein the acidic water contains whey.

[Claim 7] The method for manufacturing a fermented milk containing an added ingredient according to claim 5 or 6, wherein the ingredient is contained in the acidic water solution in the amount of at least 25 mass% as solids.

[Claim 8] The method for manufacturing a fermented milk containing an added ingredient according to any of claims 1 to 7, wherein a non-fat milk solids content of the fermented milk is at least 10 mass%.

[Claim 9] The method for manufacturing a fermented milk containing an added ingredient according to any of claims 1 to 8, wherein the fermented milk is obtained with a non-fat milk solids content of a start milk material adjusted to within the range of 10 mass% to 26 mass%.

[Claim 10] A fermented milk containing an added ingredient, obtained by the method for manufacturing a fermented milk containing an added ingredient according to any of claims 1 to 9.

[Claim 11] A fermented milk containing an added ingredient, containing an ingredient and having a viable bacterial count of at least 1×10^7 cfu/g.

[Claim 12] The fermented milk containing an added ingredient according to claim 11, wherein a non-fat milk solids content of the fermented milk excluding the ingredient is at least 8 mass%.

[Claim 13] The fermented milk containing an added ingredient according to claim 11 or 12, wherein the ingredient is contained in the amount of at least 10 mass% as solids.

[Claim 14] The fermented milk containing an added ingredient according to any of claims 10 to 13, having a viable bacterial count of at least 1×10^7 cfu/g after 60 days of storage at 20°C in a sealed state.

[Claim 15] An acidic water containing an added ingredient.

[Claim 16] The acidic water containing an added ingredient according to claim 15, wherein the ingredient is contained in the amount of at least 25 mass% as solids.

[Claim 17] The acidic water containing an added ingredient according to claim 15 or 16, also containing whey.

[Claim 18] A method for using the acidic water containing an added ingredient according to any of claims 15 to 17 as an additive in a fermented milk.

[Claim 19] A method for manufacturing a fermented milk, wherein a non-fat milk solids content of a start milk material is adjusted to within the range of 10 mass% to 26 mass%.

[Claim 20] A fermented milk storage method in which a viable bacterial count in a fermented milk is maintained at 1×10^7 cfu/g

or more when the fermented milk is sealed after addition of an ingredient to the fermented milk and stored for 60 days at 20°C.

[Claim 21] The fermented milk storage method according to claim 20, wherein the ingredient is added to the fermented milk to a content of at least 10 mass% as solids.

[Claim 22] A fermented milk containing an added ingredient and packaged in a container, comprising the fermented milk containing an added ingredient according to any of claims 10 to 14 and a container packaged with the fermented milk containing an added ingredient.

[Claim 23] An acidic water containing an added ingredient and packaged in a container, comprising the acidic water containing an added ingredient according to any of claims 15 to 17 and a container packaged with the acidic water containing an added ingredient.