

DESCRIPTION

NUTRITION COMPOSITION

Technical Field

5 [0001]

The present invention relates to a nutrition composition. In particular, the present invention relates to a nutrition composition having a high unit energy amount and a low viscosity, and a method for producing the same.

10 Background Art

[0002]

Various nutrition compositions as pharmaceuticals and nutrition foods (fluid diet) have been disclosed (Patent Documents 1 to 5, for example). In most conventional nutrition compositions, the unit energy amount is adjusted to be 1 to 2 kcal/mL. Therefore, in order to ingest a large amount of energy, it is necessary to ingest the fluid diet itself in a large volume. When a fluid diet is ingested in a large volume, problems arise that not only a heavy burden is imposed on the stomach, but also a longer period of time is required for ingestion of the fluid diet, etc.

[0003]

20 On the other hand, if the unit energy amount of the nutrition composition is adjusted to be high, e.g. 1.5 kcal/mL or more, the fluidity or thermal stability (heat resistance) thereof is deteriorated, resulting in poor practicality such as aptitude for use or aptitude for production. In an example in which casein sodium is used as a protein source, while the thermal stability of a protein is high, the viscosity of a nutrition composition is increased, whereby the fluidity remains deteriorated (Patent Document 6). When a total milk protein is used as a protein source, it is reported that agglomeration or precipitation occurs by a sterilization treatment with heating (Patent Documents 6 and 7).

[0004]

30 Further, in an example where a milk protein concentrate (hereinafter often referred to as the "MPC". It has almost the same meaning as that of "total milk protein") is used with a casein hydrolysate as a protein source, agglomeration or precipitation occurs unless the amount of MPC used is less than about 60 wt% of the total protein (Patent Document 7).

Related Art Documents

35 Patent Documents

[0005]

Patent Document 1 JP-T-2013-530722

Patent Document 2 JP-T-2007-532534

Patent Document 3 JP-T-2012-504971

Patent Document 4 JP-A-2012-144531

5 Patent Document 5 JP-A-2003-289830

Patent Document 6 JP-A-H08-196236

Patent Document 7 JP-A-H10-210951

Summary of the Invention

10 [0006]

An object of the present invention is to provide a novel nutrition composition having a high unit energy amount and a low viscosity.

[0007]

15 According to the present invention, the following nutrition composition or the like are provided.

1. A nutrition composition comprising a protein, a lipid, a carbohydrate, a vitamin, a mineral and water, wherein the nutrition composition comprises, as the protein, a milk protein concentrate having a reduced calcium content, has a unit energy amount of 2.0 kcal/mL or more and has a viscosity of 400 Pa·s or less.
- 20 2. The nutrition composition according to 1, wherein the unit energy amount is more than 2.0 kcal/mL.
3. The nutrition composition according to 1 or 2, wherein the content of the milk protein concentrate having a reduced calcium content is 60 wt% or more relative to the total weight of the protein contained in the nutrition composition.
- 25 4. The nutrition composition according to any one of 1 to 3, wherein the milk protein concentrate having a reduced calcium content is obtained by subjecting an untreated milk protein concentrate to a cation exchange treatment.
5. The nutrition composition according to any one of 1 to 3, wherein the milk protein concentrate having a reduced calcium content is obtained by subjecting an untreated milk protein concentrate to dialysis and/or ultrafiltration in acidic conditions.
- 30 6. The nutrition composition according to any one of 1 to 3, wherein the milk protein concentrate having a reduced calcium content is obtained by subjecting an untreated milk protein concentrate to a treatment with a chelating agent.
7. The nutrition composition according to any one of 1 to 6, wherein the calcium content of the milk protein concentrate having a reduced calcium content is 15 to 45 wt% relative to the calcium content of an untreated protein concentrate used to prepare the milk
- 35

protein concentrate having a reduced calcium content.

8. A method for preparing the nutrition composition according to any one of 1 to 7, wherein a raw material mixture of the nutrition composition is homogenized at a pressure of 20 MPa or more.

5 9. A high-caloric nutrition agent comprising the nutrition composition according to any one of 1 to 7 and a container accommodating the nutrition composition, wherein the nutrition composition is sterilized by heating.

[0008]

According to the present invention, it is possible to provide a novel nutrition
10 composition having a high unit energy amount and a low viscosity.

Mode for Carrying out the Invention

[0009]

[Nutrition Composition]

15 The nutrition composition of the present invention is a nutrition composition comprising a protein, a lipid, a carbohydrate, a vitamin, a mineral and water, and it comprises, as the protein, a milk protein concentrate having a reduced calcium content, has a unit energy amount of 2.0 kcal/mL or more, and has a viscosity of 400 mPa · s or less.

[0010]

20 The nutrition composition of the present invention is stable with a low viscosity in spite of a high unit energy amount of 2.0 kcal/mL or more. Since the unit energy amount is high and the viscosity is low, the nutrition composition may only have to be taken in a small volume in order to ensure a required amount of energy. As a result, a burden imposed on a patient's stomach can be reduced, and the time required for taking the composition can be
25 shortened.

[0011]

The nutrition composition of the present invention comprises, as a protein, a milk protein concentrate having a reduced calcium content (hereinbelow, also referred to as the "Ca-reduced MPC"). The "milk protein concentrate having a reduced calcium content (Ca-reduced MPC)" is one obtained by reducing the content of calcium of the milk protein concentrate (MPC). The Ca-reduced MPC is available from Fonterra (Japan) Limited, for example.

[0012]

35 The Ca-reduced MPC used in the present invention can be prepared by a method described in WO2001/041578 (JP-T-2003-515352). Specifically, the content of calcium is reduced by removing calcium of the "untreated milk protein concentrate (untreated MPC)"

obtained by concentrating skim milk by means of a ultrafine filtration (UF) membrane, a microfiltration (MF) membrane or the like, followed by drying, etc. Removal of calcium can be conducted by, for example: (1) a cation exchange on an ion exchanger in the form of sodium and/or potassium; (2) dialysis and/or ultrafine filtration under acidic conditions; (3) treatment with a chelating agent; or the like. The details of the methods (1) to (3) are as disclosed in the WO2001/041578 (JP-T-2003-515352).

[0013]

In the Ca-reduced MPC used in the present invention, the content of calcium (Ca) is reduced as compared with untreated MPC used for preparing Ca-reduced MPC. The content of calcium in the Ca-reduced MPC is preferably 5 to 75 wt%, more preferably 15 to 45 wt% and further preferably 25 to 35 wt%, relative to the content of calcium in the untreated MPC used for preparing Ca-reduced MPC.

In the Ca-reduced MPC, as compared with untreated MPC, the total content of sodium (Na) and potassium (K) as ion exchangers are increased. The total content of sodium and potassium in the Ca-reduced MPC is increased relative to the total content of sodium and potassium in the untreated MPC, preferably by 0.5 to 1.5 wt%, more preferably 0.6 to 1.3 wt%, and further preferably 0.7 to 1 wt%, etc.

[0014]

Due to inclusion of the Ca-reduced MPC as the protein, as in the examples disclosed in JP-A-H10-210951, the protein used in combination with MPC is not limited to casein hydrolysates. Further, if MPC is used in an amount of 60 wt% or more relative to the total weight of the protein, no agglomeration or precipitation occurs, whereby a low-viscous nutrition composition can be obtained.

The content of the Ca-reduced MPC is preferably 60 wt% or more, more preferably 80 wt% or more, and further preferably 100 wt%, relative to the total weight of the protein contained in the nutrition composition.

[0015]

The unit energy amount of the nutrition composition of the present invention is 2.0 kcal/mL or more, and preferably more than 2.0 kcal/mL (an amount exceeding 2.0 kcal/mL). The upper limit of the unit energy amount is not particularly restricted, but it is 3.0 kcal/mL, for example. Therefore, the unit energy amount of the nutrition composition of the present invention is 2.0 kcal/mL or more and 3.0 kcal/mL or less, or more than 2.0 kcal/mL and 3.0 kcal/mL or less.

The unit energy amount of the nutrition composition is a theoretical value calculated from the composition of the nutrition composition, and the method for calculation is described in the "Overview of Dietary Reference Intakes for Japanese (2010)" formulated by the

Ministry of Health, Labor and Welfare of Japan.

[0016]

The nutrition composition of the present invention is liquid or a liquid-like product, and has fluidity enabling oral administration or tubal administration.

5 The viscosity of the nutrition composition of the present invention is 400 mPa·s or less, preferably 300 mPa·s or less, more preferably 200 mPa·s or less and further more preferably 100 mPa·s or less. The lower limit of the viscosity is not particularly limited, but is 1 mPa·s, for example.

[0017]

10 In the present invention, the “viscosity” means a value obtained by means of a single cylindrical rotating viscometer (B-type viscometer), and by actually measuring at a temperature of 20°C after setting the shape and the number of rotation of a rotor such that a person skilled in the art can measure a viscosity in a range of 1 mPa·s or more and 700 mPa·s or less.

15 [0018]

As for a protein other than the Ca-reduced MPC, a lipid, a carbohydrate, a vitamin, a mineral or the like to be blended with the nutrition composition of the present invention, no specific restrictions are imposed as long as they are normally used in the fields of food, drinks and pharmaceuticals. However, it is preferable to use those approved by the Ministry of Health, Labor and Welfare of Japan as the raw materials or additives of food or pharmaceuticals. Further, the amount of each nutrient to be blended can be determined by “Overview of Dietary Reference Intakes for Japanese (2010)” formulated by the Ministry of Health, Labor and Welfare of Japan. Specific examples of each nutrient to be blended with the nutrition composition of the present invention are given below.

25 [0019]

As the water to be used in the nutrition composition of the present invention, tap water, well water, pure water, purified water, ion exchange water or the like can be given.

[0020]

30 As the protein other than Ca-reduced MPC to be blended with the nutrition composition of the present invention, a vegetable protein such as a soybean protein, an animal protein such as casein and a whey protein or the like can be given. A soybean protein, casein, a whey protein or the like can preferably be given. Further, it is also possible to use hydrolyzed products or the like of these proteins. These proteins or the hydrolyzed products thereof may be used singly or in combination of two or more.

35 The amount of protein (total protein including Ca-reduced MPC) is preferably in a range of 5 to 25 wt%, and more preferably 7 to 20 wt%, relative to the total weight of the

nutrition composition. Further, in respect of the average intake of a healthy Japanese, the amount of a protein is preferably in a range of 10 to 30%, more preferably 15 to 25%, relative to the unit energy amount of the nutrition composition.

[0021]

As the lipid to be blended in the nutrition composition of the present invention, vegetable oil such as soybean oil, palm oil, fractionated palm oil and olive oil; an animal fat such as milk fat, lard and fish oil; as well as a free fatty acid such as oleic acid, linolenic acid and γ -linolenic acid; and the like can be given. Soybean oil, palm oil or the like can be preferably given. These lipids may be used singly or in combination of two or more.

The amount of the lipids to be blended in the nutrition composition of the present invention is preferably in a range of 3 to 12 wt%, more preferably 4 to 10 wt%, relative to the total weight of the nutrition composition. Further, in respect of the average intake of a healthy Japanese, the amount of a lipid is preferably in a range of 15 to 35%, more preferably 20 to 30%, relative to the unit energy amount of the nutrition composition.

[0022]

As the carbohydrate to be blended with the nutrition composition of the present invention, dextrin, sucrose, lactose and oligosaccharide or the like can be given. Dextrin, sucrose, palatinose or the like can preferably be given. Hydrolyzed products of these carbohydrates or the like may be used. These carbohydrates and hydrolyzed products may be used singly or in combination of two or more.

The amount of a carbohydrate in the nutrition composition of the present invention is preferably in a range of 20 to 55 wt%, more preferably 25 to 50 wt%, relative to the total weight of the nutrition composition. Further, in respect of the average intake of a healthy Japanese, the amount of a carbohydrate is preferably in a range of 35 to 75%, more preferably 45 to 70%, relative to the unit energy amount of the nutrition composition.

[0023]

As the vitamin to be blended with the nutrition composition of the present invention, vitamin A, vitamin D, vitamin E, vitamin B₁, vitamin B₂, niacin, vitamin B₆, folic acid, vitamin B₁₂, pantothenic acid and vitamin C or the like can be given. Vitamin B₁, vitamin B₂, niacin, vitamin B₆, folic acid, vitamin B₁₂, pantothenic acid, vitamin C or the like can preferably be given. These vitamins may be used singly or in combination of two or more.

[0024]

As the mineral to be blended with the nutrition composition of the present invention, calcium, iron, phosphorus, magnesium, potassium, copper, zinc or the like can be given. Calcium, phosphorous, magnesium, potassium or the like can preferably be given. These minerals may be used singly or in combination of two or more.

[0025]

In the nutrition composition of the present invention, a milk protein concentrate having a reduced calcium content is used as the protein. Having a reduced calcium content means that, in the milk protein concentrate before mixing with other components constituting the nutrition composition, the content of calcium is reduced as compared with an untreated protein. Therefore, the calcium content of the nutrition composition may not necessarily be reduced as compared with the standard value of the calcium content of conventional nutrition compositions. Further, an amount of calcium corresponding to the amount of calcium removed from the milk protein concentrate may additionally be blended with the nutrition composition as a mineral.

[0026]

The nutrition composition of the present invention may contain dietary fibers. As the water-soluble dietary fibers, indigestible dextrin and reduction indigestible dextrin or the like can be given. Further, as the non-water-soluble dietary fiber, cellulose or the like can be given. Further, the nutrition composition of the present invention may contain various flavoring agents, sweeteners, emulsifying agents and other additives.

[0027]

The content of each of a protein, a lipid, a carbohydrate, a vitamin and a mineral contained in the nutrition composition and the content of an optional component can be appropriately determined on the assumption that the unit energy amount of the nutrition composition is 2.0 kcal/mL or more and preferably more than 2.0 kcal/mL.

[0028]

In respect of flavor or physical properties, the pH of the nutrition composition of the present invention is preferably in a range of 3 to 11, more preferably 4 to 10, and further preferably 5 to 9. It may substantially be 7. In order to adjust the pH of the nutrition composition of the present invention, a pH adjuster such as citric acid may be contained.

[0029]

The osmotic pressure of the nutrition composition of the present invention is preferably in a range of 200 to 800 mOsm/L, more preferably 300 to 750 mOsm/L in respect of prevention of digestive disorders such as diarrhea and abdominal pain.

[0030]

[Method for producing nutrition composition]

The method for producing a nutrition composition of the present invention comprises homogenizing a raw material mixture of the nutrition composition at a pressure of 20 MPa (204 kg/cm²) or more. More specifically, prescribed amounts of raw material components are mixed to obtain a raw material mixture, and this raw material mixture is

subjected to preliminary emulsification to obtain a preliminary emulsified product. Then, the preliminary emulsified product is homogenized at a pressure of 20 MPa or more, whereby the nutrition composition of the present invention can be produced.

[0031]

5 The raw material components are as explained above with reference to the nutrition composition of the present invention.

Mixing and preliminary emulsification can be appropriately conducted by a method known in this technical field. For example, it can be conducted appropriately by a "TK homomixer" (Primix Corporation), a multifunctional tank ("Turbo Mixer" (Scanima Company),
10 "Dinex" (Romaco Fryma Koruma GmBH), "Flex Mix" (APV Corporation), etc.) or the like.

[0032]

Homogenizing can be conducted appropriately by a method known in this technical field. For example, homogenizing can be appropriately conducted by using a homogenizer (Nano Valve (GEA Niro Soavi), Micro Gap (APV Corporation), etc.), or the like. The
15 pressure at the time of homogenization is 20 MPa or more and 55 MPa or less, preferably 20 MPa or more and 50 MPa or less, more preferably 20 MPa or more and 40 MPa or less, and further preferably 20 MPa or more and 35 MPa or less.

Homogenizing may be conducted in a single stage or in multiple stages. As for the pressure when homogenizing is conducted in a single stage, the pressure may
20 necessarily be 20 MPa or more, and as for the pressure when homogenizing is conducted in multiple stages, the total of the pressures at each stage may necessarily be 20 MPa or more.

Homogenizing may necessary be conducted after preliminary emulsification. When sterilization by heating is conducted as an optional step, homogenizing may be conducted after preliminary emulsification and before sterilization by heating. Alternatively,
25 homogenizing may be conducted after preliminary emulsification and sterilization by heating.

[0033]

In the example described in JP-A-H08-196236, by using a high-pressure type homogenizer, and by conducting four sets of homogenizing, with two stages of homogenizing of pressure (first stage: 9.8 MPa (100 kg/cm²), second stage 29 MPa (100 kg/cm²)) being
30 one set, a nutrition composition having fluidity was obtained. On the other hand, in the present invention, an intended low viscous nutrition composition can be obtained by conducting homogenizing one time at a pressure of 20 MPa or more by using a normal homogenizer. In this regard, the present invention is practically advantageous in respect of production facility or production processes, and is very efficient as a method for producing a
35 nutrition composition.

[0034]

The nutrition composition of the present invention may be subjected to sterilization by heating, according to need. Sterilization by heating can be appropriately conducted by methods known in this technical field. For example, sterilization is conducted by means of an indirect heating type sterilizer (a plate-type sterilizer, a tube-type sterilizer, etc.), a direct heating type sterilizer (a steam injection type sterilizer, a steam infusion type sterilizer, etc.), an electrical heating type sterilizer, a tank provided with stirring function, a retort sterilizer, an autoclave or the like. Sterilization by heating may be conducted between preliminary emulsification and homogenizing, or may be conducted after homogenizing.

The method or conditions for sterilization by heating are not particularly restricted. However, when an indirect heating type sterilizer, a direct heating type sterilizer or an electrical heating type sterilizer is used, sterilization by heating may be conducted at 110 to 150°C for 1 to 30 seconds, for example. When a tank with stirring function is used together with a retort sterilizer, sterilization by heating is conducted at 110 to 140°C for 1 to 30 minutes or 90 to 99°C for 15 to 60 minutes, for example. When an autoclave is used, sterilization by heating may be conducted at 110 to 120°C for 10 to 30 minutes, for example.

[0035]

[High-caloric nutrition agent]

The high-caloric nutrition agent of the present invention is composed of the nutrition composition of the present invention as explained above and a container accommodating the nutrition composition, in which the nutrition composition is sterilized by heating. The high-caloric nutrition agent of the present invention can be easily stored and transported, and can readily be used without being subjected to a specific treatment.

[0036]

The high-caloric nutrition agent of the present invention can be produced by a method in which a nutrition composition is sterilized by heating in advance, and aseptically filled in a container (for example, a method combining a high temperature short time (HTST) sterilization method, a ultrahigh temperature (UHT) sterilization method with an aseptic wrapping method), or a method in which, after filling the nutrition composition in a container, the nutrition composition is sterilized by heating with the container (for example, a retort sterilization method, an autoclave sterilization method). Meanwhile, as for the HTST sterilization method or the UHT sterilization method, since an object to be sterilized is a liquid-like product, the object is appropriately treated by an indirect heating type sterilizer (plate type sterilizer, tube type sterilizer, etc.), a direct heating type sterilizer (steam injection type sterilizer, steam infusion type sterilizer, etc.), or an electrically heating type sterilizer.

As the container, any container known in this technical field can be used. For example, a gable bag, a brick pack, a PET bottle, a glass bottle, a steel can, an aluminum

can, a soft bag (retort pouch) or the like can be used. As for a container that is used when the nutrition composition is sterilized by heating with the container, one composed of a material that is sterilized by heating can be used.

Although no specific restrictions are imposed on the method or conditions of sterilization by heating, equivalent methods or conditions as those for sterilizing the nutrition composition of the present invention can be applied.

EXAMPLES

[0037]

Specific examples of the present invention will be described below. The present invention is not restricted to the following examples.

[0038]

In these examples, use was made of Ca-reduced MPC (manufactured by Fonterra (Japan) Limited) prepared in accordance with the method described in WO2001/041578 (JP-T-2003-515352). The composition of MPC used for preparing Ca-reduced MPC (protein content: 80 wt%, manufactured by Fonterra (Japan) Limited) and the composition of the Ca-reduced MPC are shown in Table 1. In the table, the unit “%” marked for the protein to the solid matters means the weight percentage of each component relative to the total weight of MPC or Ca-reduced MPC. The unit “mg/100g” marked for Ca to Fe means the content of each component relative to 100g of MPC or Ca-reduced MPC.

[0039]

Table 1

Nutrition components	MPC	Ca-reduced MPC
Protein (%)	80	83
Lipid (%)	2	2
Carbohydrate (%)	6	3
Ash (%)	8	7
Solid matters (%)	95	94
Ca (mg/100g)	2300	1570
Mg (mg/100g)	100	75.8
Na (mg/100g)	100	1000
K (mg/100g)	200	180
P (mg/100g)	1400	1400
Cl (mg/100g)	50	126
Fe (mg/100g)	0.4	0.4

[0040]

Example 1

To 1200 mL of hot water of about 60°C, 326g of a milk protein concentrate having a reduced calcium content (manufactured by Fonterra (Japan) Limited, the composition thereof is shown in Table 1 as “Ca-reduced MPC”), 235g of rapeseed oil, 15g of monoglyceryl fatty

acid ester, 924g of powder dextrin and a mixture of a mineral and a vitamin shown below were blended (added) in weights shown below. The mixture was subjected to preliminary emulsification by means of a TK homomixer (manufactured by Tokushu Kika Kogyo Kabushiki Kasha). Water was further blended (added), whereby the total amount was adjusted to be 3L, and a preliminary emulsified product was obtained.

[0041]

The mixture of a mineral and a vitamin contained 100 µg RE (retinol equivalent) of vitamin A, 40 µg of vitamin D, 230 µg of vitamin E, 17 mg of vitamin B1, 17 mg of vitamin B2, 140 mg of nicotinic acid amide, 25 mg of vitamin B6, 50 mg of folic acid, 28 mg of vitamin B12, 50 mg of calcium pantothenate, 2g of vitamin C, 6.7 g of potassium chloride, 1.4 g of potassium hydroxide, 1.86g of magnesium carbonate, and 0.26g of ferrous sulfate.

[0042]

This preliminary emulsified product was homogenized in two stages by means of a high-pressure homogenizer (manufactured by GEA Process Engineering Ltd.) with the pressure at the first stage being set at 50 kg/cm² (4.9 MPa) and the pressure at the second stage being set at 350 kg/cm² (34.3 MPa) to conduct homogenizing in two stages, whereby a liquid nutrition composition was obtained.

[0043]

The amount of each component blended with the nutrition composition relative to the total weight of the nutrition composition was as follows: Protein (Ca-reduced MPC): 9.4 wt%, lipid (rapeseed oil): 6.8 wt% and carbohydrate (powder dextrin): 26.6 wt%.

[0044]

As for this nutrition composition, the unit energy amount was 2.4 kcal/mL, the viscosity was 228 mPa·s (20°C), the concentration of the protein was 90 mg/mL (the content of the milk protein concentrate was 100 wt% relative to the total weight of the protein contained in the nutrition composition), the concentration of the lipid was 90 mg/mL and the concentration of the carbohydrate was 330 mg/mL. The concentration of each of the protein, the lipid and the carbohydrate was a calculated value based on the blending composition.

This nutrition composition had a high unit energy amount but had a low viscosity, and hence, exhibited very smooth feeling when passing through the throat.

[0045]

Example 2

To 25,000 mL of hot water of about 60°C, 7,000g of a milk protein concentrate having a reduced calcium content (manufactured by Fonterra (Japan) Limited, the composition was "Ca-reduced MPC" in Table 1), 3,400g of rapeseed oil, 300g of

monoglyceryl fatty acid ester, 21,300g of powder dextrin, a mixture of a mineral and a vitamin shown below were blended (added) in weights shown below. The mixture was subjected to preliminary emulsification by means of a TK homomixer (manufactured by Tokushu Kika Kogyo Kabushiki Kaisha), followed by further blending (addition) of water to adjust the total amount to be 60L, whereby a preliminary emulsified product was obtained.

[0046]

The mixture of a mineral and a vitamin contained 100,000 µg RE of vitamin A, 800 µg of vitamin D, 4.6 mg of vitamin E, 340 mg of vitamin B1, 340 mg of vitamin B2, 2.8g of nicotinic acid amide, 500 mg of vitamin B6, 1g of folic acid, 560 mg of vitamin B12, 1g of calcium pantothenate, 43g of vitamin C, 133g of potassium chloride, 28g of potassium hydroxide, 37g of magnesium carbonate and 5g of ferrous sulfate.

[0047]

The amount of each component blended with the nutrition composition relative to the total weight of the nutrition composition was as follows: Protein (Ca-reduced MPC): 9.9 wt%, lipid (rapeseed oil): 4.8 wt% and carbohydrate (powder dextrin): 30.2 wt%.

[0048]

As for this nutrition composition, the unit energy amount was 2.4 kcal/mL, the viscosity was 96 mPa·s (20°C), the concentration of the protein was 96 mg/mL (the content of the milk protein concentrate was 100 wt% relative to the total weight of the protein contained in the nutrition composition), the concentration of the lipid was 67 mg/mL and the concentration of the carbohydrate was 372 mg/mL. Concentration of each of the protein, the lipid and the carbohydrate was a calculated value based on the blending composition.

This nutrition composition had a high unit energy amount but had a low viscosity, and hence, exhibited very smooth feeling when passing through the throat.

[0049]

The preliminary emulsified product obtained in Example 2 was passed through a steam injection sterilizer (manufactured by SPX Corporation), and sterilized at 145°C for 5 seconds. Thereafter, by means of a high-pressure homogenizer (manufactured by Sanwa Engineering Co., Ltd.) with the pressure at the first stage being set at 50 kg/cm² (4.9 MPa) and the pressure at the second stage being set at 350 kg/cm² (34.3 MPa), homogenizing was conducted in two stages, whereby an emulsion type nutrition composition was obtained.

[0050]

In spite of a high concentration of 2.0 kcal/mL or more (more than 2.0 kcal/mL), this nutrition composition never got burned when it was sterilized continuously for 0.6 hours at a processing speed of 100L per hour. That is, as compared with a case where the milk protein concentrate which was not subjected to a "treatment for reducing the calcium content"

as disclosed in Patent Documents 6 and 7, which had apparently poor thermal stability, was used, the thermal stability was apparently improved.

[0051]

Example 3

130 mL of water was blended with (added to) 870 mL of the nutrition composition of Example 2, whereby an emulsion type nutrition composition was obtained.

[0052]

The amount of each component blended with the nutrition composition relative to the total weight of the nutrition composition was as follows: Protein (Ca-reduced MPC): 8.4 wt%, lipid (rapeseed oil): 4.1 wt% and carbohydrate (powder dextrin): 25.8 wt%.

[0053]

As for this nutrition composition, the unit energy amount was 2.0 kcal/mL, the viscosity was 33 mPa·s (20°C), the concentration of the protein was 80 mg/mL (the content of the milk protein concentrate was 100 wt% relative to the total weight of the protein contained in the nutrition composition), the concentration of the lipid was 56 mg/mL and the concentration of the carbohydrate was 310 mg/mL. Concentration of each of the protein, the lipid and the carbohydrate was a calculated value based on the blending composition.

This nutrition composition had a high energy amount but had a low viscosity, and hence, exhibited very smooth feeling when passing through the throat.

[0054]

Example 4

To 250L of hot water of about 60°C, 54kg of a milk protein concentrate having a reduced calcium content (manufactured by Fonterra (Japan) Limited, the composition was "Ca-reduced MPC" in Table 1), 42 kg of rapeseed oil, 2.4 kg of monoglyceryl fatty acid ester, 150 kg of powder dextrin and a mixture of a mineral and a vitamin shown below were blended (added) in weights shown below. The mixture was subjected to preliminary emulsification by means of a TK homomixer (manufactured by Primix Corporation). Water was further blended (added), whereby the total amount was adjusted to be 500L, and a preliminary emulsified product was obtained.

[0055]

The mixture of a mineral and a vitamin contained 830,000 µg RE of vitamin A, 6.7g of vitamin D, 38.3 mg of vitamin E, 2.8g of vitamin B1, 2.8g of vitamin B2, 23.3g of nicotinic acid amide, 4.2g of vitamin B6, 8.3g of folic acid, 4.7g of vitamin B12, 8.3g of calcium pantothenate, 360g of vitamin C, 233g of potassium chloride, 308g of magnesium carbonate and 42g of ferrous sulfate.

[0056]

This preliminary emulsified product was passed through a steam injection sterilizer (manufactured by SPX Corporation), and sterilized at 145°C for 5 seconds. Thereafter, by means of a high-pressure homogenizer (manufactured by Sanwa Engineering Co., Ltd.) with the pressure at the first stage being set at 50 kg/cm² (4.9 MPa) and the pressure at the second stage being set at 350 kg/cm² (34.3 MPa), homogenizing was conducted in two stages, whereby an emulsion type nutrition composition was obtained.

[0057]

The amount of each component blended with the nutrition composition relative to the total weight of the nutrition composition was as follows: Protein (Ca-reduced MPC): 9.4 wt%, lipid (rapeseed oil): 7.2 wt% and carbohydrate (powder dextrin): 25.7 wt%.

[0058]

As for this nutrition composition, the unit energy amount was 2.4 kcal/mL, the viscosity was 82 mPa·s (20°C), the concentration of the protein was 90 mg/mL (the content of the milk protein concentrate was 100 wt% relative to the total weight of the protein contained in the nutrition composition), the concentration of the lipid was 94 mg/mL and the concentration of the carbohydrate was 318 mg/mL. Concentration of each of the protein, the lipid and the carbohydrate was a calculated value based on the blending composition.

This nutrition composition had a high energy amount but had a low viscosity, and hence, and exhibited very smooth feeling when passing through the throat.

[0059]

In spite of a high concentration of 2.0 kcal/mL or more (more than 2.0 kcal/mL), this nutrition composition never got burned when it was sterilized continuously for 4 hours at a processing speed of 100L per hour. That is, as compared with a case where the milk protein concentrate which was not subjected to a "treatment for reducing the calcium content" as disclosed in Patent Documents 6 and 7, which had apparently poor thermal stability, was used, the thermal stability was apparently improved.

[0060]

This sterilization treated product was aseptically filled, in an amount of 200 mL each, in a container made of a laminate of paper, aluminum foil and polyethylene (laminated from the outer layer) by means of an aseptic wrapping apparatus (manufactured by Tetra Pak International S.A.), thereby to obtain specimens. The specimens were stored at 40°C for 2 months. Then, the specimens were opened to observe by naked eyes absence or presence of precipitated or agglomerated protein, or the like. As compared with a case where the "milk protein concentrate which was not subjected to a treatment for reducing the content of calcium" as disclosed in Patent Documents 6 and 7, which had apparently poor thermal stability, was used, or as compared with the Examples or the like of Patent

Documents 6 and 7, the amount of the agglomerate was apparently small, and the nutrition composition of the present invention was free from the problems of agglomeration associated with conventional technologies.

[0061]

5 Comparative Example 1

A nutrition composition was obtained in the same manner as in Example 1, except that, instead of the milk protein concentrate having a reduced content of calcium used in Example 1, 337g of a milk protein concentrate that was not subjected to a treatment for reducing the calcium content (protein content: 80 wt%, manufactured by Fonterra (Japan) Limited, the composition was the "MPC" in Table 1) was used.

[0062]

The amount of each component blended with the nutrition composition relative to the total weight of the nutrition composition was as follows: Protein (Ca-reduced MPC): 9.7 wt%, lipid (rapeseed oil): 6.8 wt% and carbohydrate (powder dextrin): 26.6 wt%.

[0063]

As for this nutrition composition, the unit energy amount was 2.4 kcal/mL, the viscosity was 428 mPa·s (25°C), the concentration of proteins was 90 mg/mL (the content of the milk protein concentrate was 100 wt% relative to the total weight of proteins contained in the nutrition composition), the concentration of the lipid was 90 mg/mL and the concentration of the carbohydrate was 330 mg/mL. Concentration of each of the protein, the lipid and the carbohydrate was a calculated value based on the blending composition.

This nutrition composition was highly viscous and exhibited uncomfortable feeling when passing through the throat.

[0064]

25 Comparative Example 2

A nutrition composition was obtained in the same manner as in Example 1, except that 169g of the milk protein concentrate having a reduced calcium content used in Example 1 (the composition was the "Ca-reduced MPC" in Table 1) was blended (added), and further, 150g of casein sodium (protein content: 90 wt%, manufactured by Fonterra (Japan) Limited) was blended (added).

[0065]

The amount of each component blended with the nutrition composition relative to the total weight of the nutrition composition was as follows. Protein: 9.2 wt% (Ca-reduced MPC: 4.9 wt%, casein sodium: 4.3 wt%), lipid (rapeseed oil): 6.8 wt% and carbohydrate (powder dextrin): 26.6 wt%.

[0066]

As for this nutrition composition, the unit energy amount was 2.4 kcal/mL, the viscosity was 557 mPa·s (25°C), the concentration of the protein was 90 mg/mL (the content of the milk protein concentrate was 50 wt% relative to the total weight of the protein contained in the nutrition composition), the concentration of the lipid was 90 mg/mL and the concentration of the carbohydrate was 330 mg/mL. Concentration of each of the protein, the lipid and the carbohydrate was a calculated value based on the blending composition.

This nutrition composition was highly viscous and exhibited uncomfortable feeling when passing through the throat.

[0067]

Comparative Example 3

A nutrition composition was obtained in the same manner as in Example 1, except that, instead of the milk protein concentrate having a reduced calcium content used in Example 1, 169g of a milk protein concentrate that was not subjected to a treatment for reducing the calcium content (protein content: 80 wt%, manufactured by Fonterra (Japan) Limited, the composition was the "MPC" in Table 1) was blended (added) and further, 150g of casein sodium (protein content: 90 wt%, manufactured by Fonterra (Japan) Limited) was blended (added).

[0068]

The amount of each component blended with the nutrition composition relative to the total weight of the nutrition composition was as follows: Protein: 9.2 wt% (Ca-reduced MPC was 4.9 wt%, casein sodium was 4.3 wt%), lipid (rapeseed oil): 6.8 wt% and carbohydrate (powder dextrin): 26.6 wt%.

[0069]

As for this nutrition composition, the unit energy amount was 2.4 kcal/mL, the viscosity was 470 mPa·s (25°C), the concentration of the protein was 90 mg/mL (the content of the milk protein concentrate was 50 wt% relative to the total weight of the protein contained in the nutrition composition), the concentration of the lipid was 90 mg/mL and the concentration of the carbohydrate was 330 mg/mL. Concentration of each of the protein, the lipid and the carbohydrate was a calculated value based on the blending composition.

This nutrition composition was highly viscous and exhibited uncomfortable feeling when passing through the throat.

Industrial Applicability

[0070]

The nutrition composition of the present invention is particularly effective for use in a medical institution such as hospitals and welfare facilities such as child-rearing facilities and

nursing homes.

[0071]

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

The specification of a Japanese application on the basis of which the present application claims Paris Convention priority is incorporated herein by reference in its entirety.

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CLAIMS

1. A nutrition composition comprising a protein, a lipid, a carbohydrate, a vitamin, a mineral and water, wherein the nutrition composition comprises, as the protein, a milk protein concentrate having a reduced calcium content, has a unit energy amount of 2.0 kcal/mL or more and has a viscosity of 400 Pa·s or less.
2. The nutrition composition according to claim 1, wherein the unit energy amount is more than 2.0 kcal/mL.
3. The nutrition composition according to claim 1 or 2, wherein the content of the milk protein concentrate having a reduced calcium content is 60 wt% or more relative to the total weight of the protein contained in the nutrition composition.
4. The nutrition composition according to any one of claims 1 to 3, wherein the milk protein concentrate having a reduced calcium content is obtained by subjecting an untreated milk protein concentrate to a cation exchange treatment.
5. The nutrition composition according to any one of claims 1 to 3, wherein the milk protein concentrate having a reduced calcium content is obtained by subjecting an untreated milk protein concentrate to dialysis and/or ultrafiltration in acidic conditions.
6. The nutrition composition according to any one of claims 1 to 3, wherein the milk protein concentrate having a reduced calcium content is obtained by subjecting an untreated milk protein concentrate to a treatment with a chelating agent.
7. The nutrition composition according to any one of claims 1 to 6, wherein the calcium content of the milk protein concentrate having a reduced calcium content is 15 to 45 wt% relative to the calcium content of an untreated protein concentrate used to prepare the milk protein concentrate having a reduced calcium content.
8. A method for preparing the nutrition composition according to any one of claims 1 to 7, wherein a raw material mixture of the nutrition composition is homogenized at a pressure of 20 MPa or more.

9. A high-caloric nutrition agent comprising the nutrition composition according to any one of claims 1 to 7 and a container accommodating the nutrition composition, wherein the nutrition composition is sterilized by heating.