1. A viscous nutritional composition comprising a water-absorbing dietary fiber, wherein the composition has a property such that viscosity thereof is increased by heat treatment.

[0015]

2. The nutritional composition according to 1, wherein the water-absorbing dietary fiber has a property such that its water absorbency is increased by heat treatment.

[0016]

3. The viscous nutritional composition according to 1 or 2, wherein the composition comprises 0.1 to 3.0% by weight of the water-absorbing dietary fiber relative to the nutritional composition and has a property such that viscosity of said composition is increased by heat treatment.

[0017]

4. The nutritional composition according to any of 1 to 3, wherein the water-absorbing dietary fiber is an insoluble dietary fiber.

[0018]

5. The nutritional composition according to any of 1 to 4, wherein the water-absorbing dietary fiber is an insoluble fiber of soybean dietary fiber and/or soybean *fusuma* bran.

[0019]

6. The nutritional composition according to any of 1 to 5, comprising one or more from the group consisting of protein, lipid, and sugar, wherein the specific gravity~~weight~~ of the composition is 1.06 to 1.5.

[0020]

7. The nutritional composition according to any of 1 to 6, comprising one or more from the group consisting of a thickening agent and an emulsifier.

[0021]

8. The nutritional composition according to any of 1 to 7, wherein the viscosity of the composition is 5 to 300 mPa·s, wherein the viscosity of the composition is measured at 45 to 85°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer.

[0022]

9. The nutritional composition according to any of 1 to 8, wherein homogenization treatment is performed by adjusting the homogenization treatment pressure to 10 to 100 MPa.

[0023]

10. The nutritional composition according to any of 1 to 9, wherein the viscosity of the composition reaches 300 to 6700 mPa·s by subjecting the composition to heat treatment and then storing the composition at a temperature equal to or below normal temperature for 1 to 90 days, wherein the viscosity of the composition that has been subjected to heat treatment and then stored at a temperature equal to or below normal temperature for 1 to 90 days is measured at 20°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer.

[0024]

11. A method for producing a viscous nutritional composition, comprising the steps of:

i) preparing 0.1 to 3.0% by weight of a water-absorbing dietary fiber relative to the nutritional composition,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,

wherein the viscosity of the composition before the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition before the heat treatment is measured at 45 to 85°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer, and the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature for 1 to 90 days is 300 to 6700 mPa·s, wherein the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature for 1 to 90 days is measured at 20°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer.

[0025]

12. A method for producing a viscous nutritional composition, comprising the steps of:

i) preparing a water-absorbing dietary fiber at an amount of 0.1 to 3.0% by weight relative to the nutritional composition,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,

wherein the viscosity of the composition before the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition before the heat treatment is measured at 45 to 85°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer, and the homogenization treatment pressure in the step of applying pressure treatment for homogenization is 10 to 100 MPa, and the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature for 1 to 90 days is 300 to 6700 mPa·s, wherein the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature for 1 to 90 days is measured at 20°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer.

[0026]

13. A viscous nutritional composition comprising a starch not having been subjected to pregelatinization treatment in advance, wherein the composition has a property such that viscosity thereof is increased by heat treatment.

[0027]

14. The viscous nutritional composition according to 13, wherein the composition comprises 0.1 to 3.0% by weight of the starch not having been subjected to pregelatinization treatment in advance relative to the nutritional composition and has a property such that viscosity thereof is increased by heat treatment.

[0028]

15. The nutritional composition according to 13 or 14, comprising one or more from the group consisting of protein, lipid, and sugar, and wherein the specific ~~weight~~ gravity of the composition is 1.06 to 1.5.

[0029]

16. The nutritional composition according to any of 13 to 15, comprising one or more from the group consisting of a thickening agent and an emulsifier.

[0030]

17. The nutritional composition according to any of 13 to 16, wherein the viscosity of the composition is 5 to 300 mPa·s, wherein the viscosity of the composition is measured at 45 to 85°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer.

[0031]

18. The nutritional composition according to any of 13 to 17, wherein homogenization treatment is performed by adjusting the homogenization treatment pressure to 10 to 100 MPa.

[0032]

19. The nutritional composition according to any of 13 to 18, wherein the viscosity of the composition reaches 300 to 6700 mPa·s by subjecting the composition to heat treatment and then storing the composition at a temperature equal to or below normal temperature for 1 to 90 days, wherein the viscosity of the composition that has been subjected to heat treatment and then stored at a temperature equal to or below normal temperature for 1 to 90 days is measured at 20°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer.

[0033]

20. A method for producing a viscous nutritional composition, comprising the steps of:

i) preparing 0.1 to 3.0% by weight of a starch not having been subjected to pregelatinization treatment in advance relative to the nutritional composition,,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,

wherein the viscosity of the composition before the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition before the heat treatment is measured at 45 to 85°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer, and the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature for 1 to 90 days is 300 to 6700 mPa·s, wherein the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature for 1 to 90 days is measured at 20°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer.

[0034]

21. A method for producing a viscous nutritional composition, comprising the steps of:

i) preparing 0.1 to 3.0% by weight of a starch not having been subjected to pregelatinization treatment in advance relative to the nutritional composition,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,

wherein the viscosity of the composition before the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition before the heat treatment is measured at 45 to 85°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer, and the homogenization treatment pressure in the step of applying pressure treatment for homogenization is 10 to 100 MPa, and the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature for 1 to 90 days is 300 to 6700 mPa·s, wherein the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature for 1 to 90 days is measured at 20°C and 12 rpm using a spindle type rotational ~~B-type~~ viscometer.

[0035]

The present application encompasses the contents described in the specification and/or drawings of JP Patent Application No. 2011-108854 and JP Patent Application No. 2011-108857, based on which the priority of the present application is claimed.

Advantageous Effects of Invention

[0036]

The use of a water-absorbing dietary fiber enables the provision of a nutritional composition which maintains a viscosity at which the production thereof is facilitated from the step of mixing raw materials to the step of filling a container with the resulting mixture, and which, after heat treatment, has a viscosity suitable for tube feeding by free fall. Further, the use of a starch not having been subjected to pregelatinization treatment in advance enables the provision of a nutritional composition which maintains a viscosity at which the production thereof is facilitated from the step of mixing raw materials to the step of filling a container with the resulting mixture, and which, after heat treatment, has a viscosity suitable for tube feeding by free fall. In other words, the nutritional composition of the present invention can be easily produced and administered by tube. Further, compared to a composition in which the viscosity is increased primarily by a thickening agent, the viscosity of the nutritional composition of the present invention before heat treatment can be kept low, whereby the production thereof is facilitated. Further, when a water-absorbing dietary fiber is used, free

water in the nutritional composition of the present invention is reduced by virtue of the water-absorbing action of the aforementioned water-absorbing dietary fiber, whereby it is made possible to reduce the contents of a thickening agent and the like necessary for imparting a certain viscosity to less than conventional products. Further, when a starch not having been subjected to pregelatinization treatment in advance is used, the nutritional composition of the present invention achieves an appropriate viscosity even without adding a thickening agent, whereby it is made possible to reduce the contents of a thickening agent and the like necessary for imparting a certain viscosity to less than conventional products. In view of the above, also when a composition having the same degree of viscosity as a conventional product is produced, the steps from mixing raw materials before heat treatment to homogenization can be conducted more easily, and also, there are economic advantages that some of the raw materials used can be cut down. Moreover, the nutritional composition of the present invention can attain a sufficient viscosity by virtue of, for example, the composition of a starch not having been subjected to pregelatinization treatment in advance or a water-absorbing dietary fiber used, whereby the nutritional composition can also be used for a flexible container with an outlet (so-called cheer pack, etc.) to be used for oral feeding. Further, the amount of a thickening agent used in the nutritional composition of the present invention can be kept low, and in connection with this, the nutritional composition can be prepared with higher calories than conventional products without excessively increasing the viscosity of the composition before heat treatment.

Brief Description of Drawings

[0037]

[Figure 1] Figure 1 shows the changes in the viscosity of a composition containing certain amounts of a water-absorbing dietary fiber and an emulsifier after retort sterilization when the amount of a thickening agent added was changed.

[Figure 2] Figure 2 shows the changes in the viscosity of a composition after retort sterilization when homogenization pressure was changed in the presence of certain amounts of a water-absorbing dietary fiber, a thickening agent, and an emulsifier.

[0066]

The heat quantity(calorie) of the nutritional composition of the present invention can be adjusted by appropriately adding protein, lipid, and carbohydrate. The nutritional composition of the present invention can contain, for example, protein in an amount of 3 to 10 g/100g, preferably 4 to 8 g/100 g, and more preferably 5 to 7 g/100 g in terms of protein equivalent. The nutritional composition of the present invention can contain, for example, lipid in an amount equivalent to 2 to 10 g/100 g, preferably 3 to 8 g/100 g, and more preferably 3 to 6 g/100 g. The nutritional composition of the present invention can contain, for example, carbohydrate in an amount equivalent to 13 to 30 g/100 g, preferably 15 to 27 g/100 g, and more preferably 20 to 25 g/100 g. The nutritional composition of the present invention can contain the aforementioned amounts of protein, lipid, and carbohydrate while retaining certain fluidization characteristics as described above.

[0067]

The specific gravity~~weight~~ of the nutritional composition of the present invention can be adjusted according to the usage. The specific gravity~~weight~~ of the nutritional composition of the present invention can be set at, for example, 1.06 or more, 1.07 or more, 1.08 or more, 1.09 or more, 1.1 or more, less than 1.5, less than 1.4, less than 1.3, and less than 1.2, for example, 1.06 to 1.5, 1.07 to 1.5, 1.08 to 1.4, 1.09 to 1.3, 1.1 to 1.2, 1.1 to 1.15, 1.12 to 1.15, 1.13 to 1.15, preferably 1.135 to 1.145. Those skilled in the art can determine the specific gravity~~weight~~ of the composition by appropriately adjusting each component. Although the specific gravity~~weight~~ may vary depending on the temperature, for the sake of convenience, the specific gravity~~weight~~ refers to a value obtained at 20°C in the present specification. The specific gravity~~weight~~ of the composition can be calculated from the weight and volume of each component or by a conventional method, for example by using a density and specific gravity~~weight~~ meter.

[0068]

In the present specification, a nutritional composition refers to a composition that appropriately contains protein, lipid, carbohydrate, and the like and has a specific gravity~~weight~~ of 1.06 or more, for example 1.06 to 1.5, for example 1.07 to 1.5, for example

1.08 to 1.4, for example 1.09 to 1.3, for example 1.1 to 1.2, for example 1.1 to 1.15, for example 1.12 to 1.15, for example 1.13 to 1.15, and 1.135 to 1.145.

[0069]

After mixing some or all of the aforementioned raw materials, homogenization is performed as needed. Homogenization refers to homogenizing the mixed components by thorough mixing and mechanically miniaturizing fat globules and coarse particles of other components to prevent floatation and aggregation of fat and the like, while making the nutritional composition into a uniform emulsion. By increasing homogenization treatment pressure in homogenization process, viscosity after heat treatment can be reduced and generation of sediment (settling particles) can be reduced. That is, the viscosity of the nutritional composition and the generation of sediment can be controlled by adjusting the homogenization treatment pressure. Homogenization treatment is normally performed by shearing an adjusted solution using a conventional homogenizer under certain pressure. In the present invention, homogenization treatment can be preferably performed at a homogenization pressure of 10, 25, 40, 60, 100 MPa, and the like; however, treatment pressure is not limited to those exemplified above. That is, the viscosity (spindle type rotational ~~B-type~~ viscometer, 20°C, 12 rpm) of the composition after heat treatment and storage at a temperature equal to or below normal temperature for a certain period of time, for example 7 days, can also be adjusted to 300 to 6700 mPa·s, for example 400 to 6700 mPa·s by applying homogenization treatment at a homogenization treatment pressure of 10 to 100 MPa in addition to using the thickening agent and the emulsifier.

[0070]

Homogenization treatment after mixing the raw materials can be performed at any appropriate temperature. Homogenization treatment can be performed, for example, at room temperature of around 20°C. Homogenization treatment can also be performed at a temperature higher than this, for example at 20 to 85°C, for example at 45 to 80°C, preferably at 45 to 70°C, more preferably at around 50°C to 60°C. Homogenization treatment is preferably performed at around 50°C to 60°C. By doing so, the viscosity (spindle type rotational ~~B-type~~ viscometer, temperature of homogenization treatment , 12 rpm) of a

composition in the homogenization step can be suppressed to preferably approximately 5 to 300 mPa·s.

[0071]

In the production of the nutritional composition of the present invention, heat treatment or heat sterilization is performed. For heat sterilization conditions, sterilization conditions generally applied to food product can be used, and heat sterilization can be performed using a conventional device. For example, sterilization at 62 to 65°C for 30 minutes, 72°C or higher for 15 seconds or more, 72°C or higher for 15 minutes or more, or 120 to 150°C for 1 to 5 seconds, or disinfection at 121 to 124°C for 5 to 20 minutes, at 105 to 140°C, retort (autoclave) sterilization, high pressure steam disinfection, and the like can be used; however, heat sterilization is not limited to those exemplified above. Heat sterilization can be performed preferably under pressure. By applying heat sterilization treatment, the nutritional composition can be sterilized, while the viscosity of the composition can be increased. In the present specification, disinfection and sterilization can be used synonymously. Further, retort sterilization can be used as one aspect of heat sterilization.

[0072]

The viscosity of the nutritional composition of the present invention before mixing a water-absorbing dietary fiber and/or a starch not having been subjected to pregelatinization treatment in advance, a thickening agent, an emulsifier, food protein, and the like in the composition and applying heat treatment is preferably 5 to 810 mPa·s, preferably 5 to 300 mPa·s, preferably 10 to 200 mPa·s, and more preferably 20 to 100 mPa·s, and the nutritional composition can maintain a viscosity at which the production thereof is facilitated from the step of mixing raw materials to the step of filling a container with the resulting mixture. The aforementioned viscosity is the value obtained by measuring the viscosity under the conditions of 12 rpm at 45 to 85°C, preferably 45 to 70°C, and more preferably 50 to 60°C using a spindle type rotational ~~B-type~~ viscometer. Further, the viscosity (spindle type rotational ~~B-type~~ viscometer, 12 rpm) of a mixture before heat treatment at 20°C is 5 to 810 mPa·s, preferably 5 to 400 mPa·s, preferably 50 to 300 mPa·s, and more preferably 100 to 300 mPa·s. When the viscosity of a mixture before heat treatment is less than 5 mPa·s, there might be a

possibility of inconvenience such as sedimentation of the components of the mixture. On the other hand, when the viscosity (spindle type rotational ~~B-type~~ viscometer, 45 to 85°C, 12 rpm) of a mixture before heat treatment is more than 300 mPa·s, inconvenience is caused such that handling of solutions in homogenization step becomes difficult.

[0073]

In the present specification, when the viscosity before heat treatment is expressed as 5 to 300 mPa·s, it is intended to indicate a range from not lower than the lower limit to less than the upper limit. That is, "5 to 300 mPa·s" means 5 mPa·s or more to less than 300 mPa·s.

[0074]

The viscosity (spindle type rotational ~~B-type~~ viscometer, 20°C, 12 rpm) of the nutritional composition of the present invention gradually increases by storing the composition at a temperature equal to or below room temperature following heat treatment, and after the elapse of a certain period of time, the viscosity is almost stabilized. The storage period of the composition can be appropriately selected according to the desired viscosity, for example, several hours to half a day, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days, 10 days, 14 days, 20 days, 30 days, 40 days, 50 days, 60 days, 70 days, 80 days, and 90 days. That is, the storage period of the composition of the present invention after heat treatment can be, for example, 1 to 90 days, preferably 5 to 60 days, more preferably 7 to 30 days, and even more preferably 7 days. The viscosity (spindle type rotational ~~B-type~~ viscometer, 20°C, 12 rpm) of a nutritional composition according to a preferable embodiment of the present invention is almost stabilized approximately 7 days after (approximately one week after) storage at a temperature equal to or below normal temperature following heat treatment. Those skilled in the art can appropriately determine the time required for stabilization of a heat-treated composition by a conventional technique.

[0075]

Further, preferably, the viscosity (spindle type rotational ~~B-type~~ viscometer, 20°C, 12 rpm) of the nutritional composition of the present invention that has been subjected to heat treatment and then stored at normal temperature (15 to 25°C) or below for a certain period of time, for example 7 days, can be 300 mPa·s or more, 400 mPa·s or more, 500 mPa·s or more,

600 mPa·s or more, 700 mPa·s or more, 800 mPa·s or more, 900 mPa·s or more, 1000 mPa·s or more, 1200 mPa·s or more, less than 6700 mPa·s, less than 6000 mPa·s, less than 5000 mPa·s, less than 4000 mPa·s, less than 3000 mPa·s, less than 2000 mPa·s, and less than 1500 mPa·s. The viscosity of the nutritional composition of the present invention that has been subjected to heat treatment and then stored at a temperature equal to or below normal temperature for a certain period of time can be, for example, 300 to 6700 mPa·s, preferably 400 to 6700 mPa·s, preferably 400 to 2000 mPa·s, and more preferably 500 to 1500 mPa·s. The heat-treated nutritional composition of the present invention is preferably stored at 0°C to normal temperature or below. By adjusting the viscosity to the aforementioned values, conventional free-fall tube feeding can be employed for feeding a liquid nutritional composition to those who consume it. As a result, gastroesophageal reflux, which is a problem associated with tube feeding of a low-viscosity nutritional composition, and cumbersome operation such as injection by syringe, which is a problem associated with feeding of a semi-solid nutritional composition with high viscosity (for example 7000 to 20000 mPa·s), are solved, whereby simple feeding is made possible. Alternatively, a composition having the same degree of viscosity (spindle type rotational ~~B-type~~ viscometer, 20°C, 12 rpm) as a semi-solid liquid food of 4000 mPa·s or more can be obtained by appropriately adjusting the types of an emulsifier, the contents of other ingredients such as a thickening agent, homogenization treatment pressure, and the like. This nutritional composition can be provided in a variety of containers used for liquid foods or for oral or tube feeding. As an example thereof, a flexible container with an outlet used for liquid foods or for oral or tube feeding (so-called soft bag, nutrition bag, etc.) can be used. Further, a nutritional composition to be used for a flexible container with an outlet used for oral feeding (so-called cheer pack) can also be obtained by appropriately adjusting the viscosity. By subjecting a composition to heat treatment and storing the composition at a temperature equal to or below normal temperature for a certain period of time, for example 7 days, the viscosity of the composition (measured with a spindle type rotational ~~B-type~~ viscometer, 20°C, 12 rpm at any time) will be 1.5 to 20 times, preferably 2 to 12 times, and more preferably 3 to 10 times as high as that before heat treatment.

[0076]

In the present specification, when the viscosity of the nutritional composition of the present invention that has been subjected to heat treatment and then stored for a certain period of time at a temperature equal to or below normal temperature is expressed as 300 to 6700 mPa·s, it is intended to indicate a range from not lower than the lower limit to less than the upper limit. That is, "300 to 6700 mPa·s" means 300 mPa·s or more to less than 6700 mPa·s.

[0077]

The viscosity of the nutritional composition of the present invention can be measured by a conventional method. As an example, the viscosity can be measured with a spindle type rotational ~~B-type~~ viscometer (20 to 85°C and 12 rpm).

[0078]

The measurement of the viscosity (20°C, 12 rpm) of the nutritional composition of the present invention can be performed in accordance with, for example, "Standard for labeling approval of foods for special dietary uses: Test method for foods for the elderly 3, Viscosity ("How to handle the labeling approval for foods for the elderly", (February 23, 1994, Notice No. 15 by the chief of the Office of Health Policy on Newly Developed Foods, Food Sanitation Division, Environmental Health Bureau, the Ministry of Health, Labour and Welfare of Japan)) ". Specifically, using a spindle type rotational ~~B-type~~ rotating viscometer, the reading is taken two minutes after rotating a rotor. Subsequently, the value thus obtained is multiplied by a coefficient corresponding to this value, and the resulting value is expressed as mPa·s. The measurement is performed at 20 ± 2°C.

[0079]

Further, as other examples, the viscosity can be measured properly or continuously during the production step using an inline viscometer such as a torsional vibration viscometer, an ultrasonic viscometer, and a rotating viscometer.

[0080]

The nutritional composition of the present invention achieves an increasing effect on the viscosity of the composition after heat treatment and storage at a temperature equal to or below normal temperature for a certain period of time, for example 1 to 90 days, for example 7 days due to the effect of a water-absorbing dietary fiber and/or a starch not having been

subjected to pregelatinization treatment in advance. In light of the above, the viscosity of the nutritional composition of the present invention before heat treatment can be kept lower that of a composition in which the viscosity is increased primarily by a thickening agent. That is, the present invention provides a nutritional composition that can be easily produced and fed by tube. Meanwhile, as will be demonstrated in, for example, Comparative Example 1 in Example 3 to be described later, the viscosity of a nutritional composition produced by adding an emulsifier without containing a water-absorbing dietary fiber and a starch not having been subjected to pregelatinization treatment in advance, did not increase even after heat treatment and further storage at a temperature equal to or below normal temperature for 7 days, in comparison with the viscosity (spindle type rotational ~~B-type~~ viscometer, 20°C, 12 rpm) before heat treatment.

[0081]

Here, the effect of a water-absorbing dietary fiber and/or a starch not having been subjected to pregelatinization treatment in advance means that, in the production of a nutritional composition having a viscosity (spindle type rotational ~~B-type~~ viscometer, 20°C, 12 rpm) of 300 to 6700 mPa·s after heat treatment and then storage at a temperature equal to or below normal temperature for a certain period of time, for example 1 to 90 days, for example 7 days, regardless of the fact that the viscosity of the composition before heat treatment is markedly lower than the viscosity of a composition in which the viscosity is increased primarily by a thickening agent, the viscosity of the composition can be brought to equal to or more than the viscosity of the nutritional formulation in which the viscosity is increased primarily by a thickening agent by heat treatment and further storage at a temperature equal to or below normal temperature for a certain period of time, for example 1 to 90 days, for example 7 days.

[0082]

By appropriately adjusting the formulation ratio of a water-absorbing dietary fiber and/or a starch not having been subjected to pregelatinization treatment in advance, a thickening agent, and an emulsifier to be contained in the nutritional composition of the present invention and subjecting the composition to heat treatment and then to storage at a

temperature equal to or below normal temperature for a certain period of time, for example 1 to 90 days, for example 7 days, a nutritional composition having a certain viscosity can be obtained. Since the viscosity of the composition is affected by factors such as the contents and types of protein and fat contained in the nutritional composition and particle diameter of fat globules before sterilization, the formulation ratio of a water-absorbing dietary fiber and/or a starch not having been subjected to pregelatinization treatment in advance, a thickening agent, and an emulsifier can be appropriately adjusted.

[0083]

The nutritional composition of the present invention attains a sufficient viscosity by, for example, adjusting the amount of a water-absorbing dietary fiber and/or a starch not having been subjected to pregelatinization treatment in advance to be used, and it is also possible to provide the nutritional composition in a flexible container with an outlet used for oral feeding. A flexible container with an outlet used for oral feeding refers to a so-called cheer pack, i.e., a flexible bag-like container provided with an outlet such as a flexible bag-like container with a tubular spout fixed thereto. Alternatively, a flexible container with an outlet used for oral feeding is called an aluminum pouch with an outlet, a spout of a flexible container, a flexible bag-like container with a capped opening, a pouch container with an outlet a plug, and the like.

[0084]

(Examples)

Example 1: The effect of the amount of a thickening agent added on the viscosity of a composition

After adding, to nutritional compositions, certain amounts of a water-absorbing dietary fiber and an emulsifier, and also a thickening agent at varied formulation ratios, the effect exerted on the viscosity of the nutritional compositions was examined. Raw materials were stirred and mixed in accordance with the recipe in Table 1 to formulate various nutritional compositions (Production Examples 1 to 3). The resulting nutritional compositions were subjected to homogenization treatment under the conditions of 50 to 60°C and a homogenization treatment pressure of 20 MPa, followed by homogenization treatment under the conditions of 50 to 60°C and a homogenization treatment pressure of 30 MPa. For

specific gravity~~weight~~, an actual measurement value obtained using a viscosity and specific gravity~~weight~~ meter at 20°C was recorded. After the viscosity of these nutritional compositions was measured [prior to retort sterilization], they were filled and sealed in containers and then subjected to retort sterilization under the conditions of 121 to 123.5°C for 5 to 20 minutes. The nutritional compositions after retort sterilization were stored at 15°C for one week, and the viscosity was measured again [post retort sterilization]. It should be noted that the viscosity was measured using a spindle type rotational ~~B-type~~ viscometer under the conditions of 12 rpm and 20°C. Further, the milk-derived protein used was a combination of 1.9% by weight of MPC, 3.8% by weight of casein sodium, and 1.5% of degradation products of milk protein, the water-absorbing dietary fiber used was an insoluble fiber of soybean dietary fiber, the emulsifier used was diacetyl tartaric (acid) ester of monoglyceride (DATEM), and the thickening agent used was carrageenan. Further, the composition of Production Examples 1 to 3 is shown in Table 1-2.

[Table 1]

	Production Example 1	Production Example 2	Production Example 3
Raw material	Formulation ratio (w/w%)	Formulation ratio (w/w%)	Formulation ratio (w/w%)
Milk-derived protein	7.2	7.2	7.2
Prepared fat	4.23	4.23	4.23
Sucrose	1.6	1.6	1.6
Dextrin	22.5	22.5	22.5
Indigestible dextrin	1.08	1.08	1.08
Insoluble soybean dietary fiber	1.08	1.08	1.08
Mineral mixture	1.3	1.3	1.3
pH Adjuster	0.16	0.16	0.16
Vitamin mixture	0.18	0.18	0.18
Fragrance	0.18	0.18	0.18
Diacetyl tartaric (acid) ester of monoglyceride (DATEM)	0.64	0.64	0.64
Carrageenan	0	0.03	0.06
Water	59.85	59.82	59.79
Total	100.0	100.0	100.0
Specific weight	1.14	1.14	1.14

[Table 1-2]

Composition	Production Examples 1-3
Protein	6.3g/100g
Lipid	4.4g/100g
Carbohydrate	24.6g/100g
Detail Sugar	22.7g/100g
Dietary fiber	1.9g/100g

[0085]

(Results)

The results are shown in Figure 1. Even in absence of a thickening agent (Production Example 1), in the presence of a certain amount of a water-absorbing dietary fiber, the viscosity after retort sterilization of the composition to which an emulsifier was added

increased to approximately 4.4 times higher than that prior to retort sterilization. Further, in the presence of a certain amount of a water-absorbing dietary fiber, the viscosity after retort sterilization of the compositions to which an emulsifier and a thickening agent were added increased approximately 8.4 to 13.4 times higher than that prior to retort sterilization, with the composition containing a thickening agent at a higher formulation ratio showing a higher viscosity value after retort sterilization. Meanwhile, there was no major difference in the viscosity before retort sterilization depending on the formulation ratio of a thickening agent.

[0086]

From the above results, it was found that by using a water-absorbing dietary fiber in the nutritional composition of the present invention, the viscosity of the composition after retort sterilization could be dramatically increased even in the absence of a thickening agent or in the presence of only a small amount of a thickening agent.

[0087]

Example 2: The effect of homogenization treatment pressure on the viscosity of a composition

After adding certain amounts of a water-absorbing dietary fiber and an emulsifier to nutritional compositions and performing homogenization treatment at varied levels of homogenization treatment pressure, the effect exerted on the viscosity of the nutritional compositions was examined. Raw materials were stirred and mixed in accordance with the recipe in Table 2 to formulate nutritional compositions (Production Example 4). The resulting nutritional compositions were subjected to homogenization treatment under the conditions of 50 to 60°C and a homogenization treatment pressure of 20, 40, or 60 MPa. For specific gravity~~weight~~, an actual measurement value obtained using a viscosity and specific gravity~~weight~~ meter at 20°C was recorded. Subsequently, the resulting nutritional compositions were filled and sealed in containers and subjected to retort sterilization under the conditions of 121 to 123.5°C for 5 to 20 minutes. After storing the nutritional compositions having been subjected to retort sterilization at 15°C for one week, the viscosity was measured again [after retort sterilization]. It should be noted that the viscosity was measured using a spindle type rotational ~~B-type~~ viscometer under the conditions of 12 rpm and 20°C. Further, the milk-derived protein used was a combination of 1.9% by weight of MPC, 3.8% by weight

of casein sodium, and 1.5% of degradation products of milk protein, and the thickening agent used was carrageenan. Further, the composition of Production Example 4 is shown in Table 2-2.

[Table 2]

	Production Example 4
Raw material	Formulation ratio (w/w%)
Milk-derived protein	7.2
Prepared fat	4.23
Sucrose	1.6
Dextrin	22.5
Indigestible dextrin	1.73
Insoluble soybean dietary fiber	0.43
Mineral mixture	1.3
pH Adjuster	0.16
Vitamin mixture	0.18
Fragrance	0.18
Diacetyl tartaric (acid) ester of monoglyceride (DATEM)	0.64
Carrageenan	0.053
Water	59.80
Total	100.0
Specific weight	1.14

[Table 2-2]

Composition		Production Example 4
Protein		6.3g/100g
Lipid		4.4g/100g
Carbohydrate		24.6g/100g
Detail	Sugar	22.7g/100g
	Dietary fiber	1.9g/100g

[0088]

(Results)

Results are shown in Figure 2. The viscosity of the composition after retort sterilization decreased with an increase in homogenization treatment pressure. From this, it was found that the viscosity of a composition after retort sterilization can be adjusted by adjusting homogenization treatment pressure.

[0089]

Example 3: The effect of the amount of a water-absorbing dietary fiber added on the viscosity of a composition

After adding, to nutritional compositions, a certain amount of an emulsifier, and a water-absorbing dietary fiber at varied formulation ratios, without using a thickening agent, the effect exerted on the viscosity of nutritional compositions was examined. Raw materials were stirred and mixed in accordance with the recipe in Table 3 to formulate various nutritional compositions (Production Example 1, Examples 1 to 4, and Comparative Example 1). The resulting nutritional compositions were subjected to homogenization treatment under the conditions of 50 to 60°C and a homogenization treatment pressure of 20 MPa, followed by homogenization treatment under the conditions of 50 to 60°C and a homogenization treatment pressure of 30 MPa. For specific gravity~~weight~~, an actual measurement value obtained using a viscosity and specific gravity~~weight~~ meter at 20°C was recorded. After the viscosity of these nutritional compositions was measured [prior to retort sterilization], they were filled and sealed in containers and then subjected to retort sterilization under the conditions of 121 to 123.5°C for 5 to 20 minutes. The nutritional compositions after retort sterilization were stored at 15°C for one week, and the viscosity was measured again [post retort sterilization]. It should be noted that the viscosity was measured using a spindle type rotational ~~B-type~~ viscometer under the conditions of 12 rpm and 20°C or 50°C. Further, the milk-derived protein used was a combination of 1.9% by weight of MPC, 3.8% by weight of casein sodium, and 1.5% of degradation products of milk protein, the water-absorbing dietary fiber used was an insoluble fiber of soybean dietary fiber, and the emulsifier used was diacetyl tartaric (acid) ester of monoglyceride (DATEM). Further, the composition of Examples 1 to 4 and Comparative Example 1 is shown in Table 3-2.

[Table 3-1]

	Example 1	Example 2	Example 3	Example 4	Comparative Example 1
Raw material	Formulation ratio (w/w%)	Formulation ratio (w/w%)	Formulation ratio (w/w%)	Formulation ratio (w/w%)	Formulation ratio (w/w%)
Milk-derived protein	7.2	7.2	7.2	7.2	7.2
Prepared fat	4.23	4.23	4.23	4.23	4.23
Sucrose	1.6	1.6	1.6	1.6	1.6
Dextrin	22.5	22.5	22.5	22.5	22.5
Indigestible dextrin	0	0.37	0.73	1.1	0
Insoluble soybean dietary fiber	2.2	1.83	1.47	1.1	0
Mineral mixture	1.3	1.3	1.3	1.3	1.3
pH Adjuster	0.16	0.16	0.16	0.16	0.16
Vitamin mixture	0.18	0.18	0.18	0.18	0.18
Fragrance	0.18	0.18	0.18	0.18	0.18
Diacetyl tartaric (acid) ester of monoglyceride (DATEM)	0.64	0.64	0.64	0.64	0.64
Thickening agent	0	0	0	0	0
Water	59.81	59.81	59.81	59.81	62.01
Total	100.0	100.0	100.0	100.0	100.0
Specific weight	1.1365	1.1365	1.1365	1.1365	1.1365

[Table 3-2]

Composition	Examples 1-4	Comparative Example 1
Protein	6.3g/100g	6.3g/100g
Lipid	4.4g/100g	4.4g/100g
Carbohydrate	24.6g/100g	22.7g/100g
Detail Sugar	22.7g/100g	22.7g/100g
Dietary fiber	1.9g/100g	0g/100g

[0090]

(Results)

Results are shown in Figure 3. The viscosity of the nutritional composition of Example 1 was 804 mPa·s (20°C) before retort sterilization, whereas it was markedly increased to 6610 mPa·s (20°C) after retort sterilization. The viscosity of Comparative Example 1 without insoluble soybean dietary fiber was 65 mPa·s (20°C) before retort sterilization, and after retort sterilization, it was only slightly changed to 52 mPa·s (20°C). That is, even in the absence of a thickening agent, the viscosity after retort sterilization of a composition to which a water-absorbing dietary fiber was added was approximately 5.9 to 8.2 times as high as that before retort sterilization. Further, the higher the formulation ratio of a water-absorbing dietary fiber, the higher the viscosity value of the composition after retort sterilization. As shown above, by using a water-absorbing dietary fiber in the nutritional composition of the present invention, a composition having such a high viscosity as 6610 mPa·s (20°C) after retort sterilization was obtained even without using a thickening agent at all. It is to be noted that the viscosity (50°C) of Examples 1 and 2 before retort sterilization was 300 mPa·s (50°C) and 160 mPa·s (50°C), respectively.

[0091]

Example 4: Starch not having been pregelatinized in advance

The effect of a starch not having been pregelatinized in advance on the viscosity of a nutritional composition was tested by adding a certain amount of a starch not having been pregelatinized in advance to the composition. Raw materials were stirred and mixed in accordance with the recipe in Table 4-1 to formulate various nutritional compositions (Formulations 3 and 4), and the resulting nutritional compositions were subjected to homogenization treatment under the conditions of 50 to 60°C and a homogenization treatment pressure of 20 MPa, followed by homogenization treatment at 50 to 60°C and 30 MPa. For specific gravity~~weight~~, an actual measurement value obtained using a viscosity and specific gravity~~weight~~ meter at 20°C was recorded. After the viscosity of these nutritional compositions was measured [prior to retort sterilization], they were filled and sealed in containers and then subjected to retort sterilization under the conditions of 121 to 123.5°C for 5 to 20 minutes. The nutritional compositions after retort sterilization were stored at 15°C

for three days, and the viscosity was measured again [post retort sterilization]. It should be noted that the viscosity was measured using a spindle type rotational ~~B-type~~ viscometer under the conditions of 12 rpm, 20°C or 50°C. Further, the starch not having been pregelatinized in advance used in the present Example was waxy corn starch (trade name "Suehiro 200", the product of OJI CORNSTARCH Co., Ltd.), the milk-derived protein used in the present Example was a combination of 1.9% by weight of MPC, 3.7% by weight of casein sodium, and 1.5% of degradation products of milk protein, and the emulsifier used in the present Example was diacetyl tartaric (acid) ester of monoglyceride (DATEM). A thickening agent was not used. Further, the composition of Formulations 3 and 4 is shown in Table 4-2.

[Table 4-1]

	Formulation 3	Formulation 4
Raw material	Formulation ratio (w/w%)	Formulation ratio (w/w%)
Milk-derived protein	7.1	7.1
Dextrin	22.2	22.1
Waxy corn starch	1.5	2.0
Sucrose	1.6	1.6
Mineral mixture	1.3	1.3
pH Adjuster	0.16	0.16
Prepared fat	4.17	4.15
Vitamin mixture	0.18	0.18
Fragrance	0.18	0.18
Emulsifier	Diacetyl tartaric (acid) ester of monoglyceride (DATEM)	Diacetyl tartaric (acid) ester of monoglyceride (DATEM)
	0.63	0.63
Thickening agent	None	None
Water	61.08	60.77

Viscosity prior to retort sterilization mPa·s	60(20°C)	66(20°C)
Viscosity post retort sterilization mPa·s	560(20°C)	1600(20°C)

[Table 4-2]

Composition		Formulation 3	Formulation 4
Protein		6.3g/100g	6.3g/100g
Lipid		4.4g/100g	4.4g/100g
Carbohydrate		24.2g/100g	24.5g/100g
Detail	Sugar	24.2g/100g	24.5g/100g
	Dietary fiber	0g/100g	0g/100g

[0092]

The results of measurement of viscosity before and after heat sterilization are shown in Table 4-1. After heat sterilization, the viscosity of Formulations 3 and 4 were dramatically increased compared to those before heat sterilization. Particularly, the viscosity of Formulation 4 post heat sterilization increased to approximately 24 times higher than the viscosity prior to heat sterilization.

[0093]

From the above results, it was found that the viscosity of the composition after retort sterilization could be dramatically increased even in absence of a thickening agent or in the presence of only a small amount of a thickening agent by using a starch not having been pregelatinized in advance in the nutritional composition of the present invention.

[0094]

All the publications, patents, and patent applications cited in the present specification are incorporated herein by reference in their entirety.

CLAIMS

[Claim 1]

A viscous nutritional composition comprising 0.1 to 1.0% by weight of a water-absorbing dietary fiber relative to the nutritional composition, wherein the composition has a property such that the viscosity thereof is increased by a heat treatment, wherein the viscosity of the composition prior to said heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition prior to said heat treatment is measured at 45 to 85°C and 12 rpm using a spindle type rotational viscometer, and wherein the viscosity of the composition reaches 300 to 6700 mPa·s by subjecting the composition to said heat treatment and then to storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days, wherein the viscosity of the composition that has been subjected to said heat treatment and then stored at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is measured at 20°C and 12 rpm using a spindle type rotational viscometer.

[Claim 2]

The nutritional composition according to claim 1, wherein the water-absorbing dietary fiber has a property such that water absorbency thereof is increased by heat treatment.

[Claim 3]

The nutritional composition according to claim 1, wherein the water-absorbing dietary fiber is an insoluble dietary fiber.

[Claim 4]

The nutritional composition according to claim 1, wherein the water-absorbing dietary fiber is an insoluble fiber of soybean dietary fiber and/or soybean *fusuma* bran.

[Claim 5]

The nutritional composition according to claim 1, comprising one or more from the group consisting of protein, lipid, and sugar, wherein the specific gravity of the composition is 1.06 to 1.5.

[Claim 6]

The nutritional composition according to claim 1, comprising one or more from the group consisting of a thickening agent and an emulsifier.

[Claim 7]

The nutritional composition according to claim 1, wherein a homogenization treatment is performed prior to said heat treatment by adjusting the homogenization treatment pressure to 10 to 100 MPa.

[Claim 8]

A method for producing a viscous nutritional composition, comprising the steps of:

i) preparing a water-absorbing dietary fiber at an amount of 0.1 to 1.0% by weight relative to the nutritional composition,

ii) applying a pressure treatment for homogenization, and

iii) applying a heat treatment,

wherein the viscosity of the composition before the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition before the heat treatment is measured at 45 to 85°C and 12 rpm using a spindle type rotational viscometer, and the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is 300 to 6700 mPa·s, wherein the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is measured at 20°C and 12 rpm using a spindle type rotational viscometer.

[Claim 9]

A method for producing a viscous nutritional composition, comprising the steps of:

i) preparing a water-absorbing dietary fiber at an amount of 0.1 to 1.0% by weight relative to the nutritional composition,

ii) applying a pressure treatment for homogenization, and

iii) applying a heat treatment,

wherein the viscosity of the composition before the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition before the heat treatment is measured at 45 to 85°C and 12 rpm using a spindle type rotational viscometer, and the homogenization treatment pressure in the step of applying the pressure treatment for homogenization is 10 to 100 MPa, and a viscosity (20°C) of the composition after the heat treatment and storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is 300 to 6700 mPa·s, wherein the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is measured at 20°C and 12 rpm using a spindle type rotational viscometer.

CLAIMS

[Claim 1]

A viscous nutritional composition comprising 0.1 or more to less than 1.5% by weight of a water-absorbing dietary fiber relative to the nutritional composition, wherein the composition has a property such that the viscosity thereof is increased by a heat treatment, wherein the viscosity of the composition prior to said heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition prior to said heat treatment is measured at 45 to 85°C and 12 rpm using a B-type viscometer, and wherein the viscosity of the composition reaches 300 to 6700 mPa·s by subjecting the composition to said heat treatment and then to storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days, wherein the viscosity of the composition that has been subjected to said heat treatment and then stored at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is measured at 20°C and 12 rpm using a B-type viscometer.

[Claim 2]

The nutritional composition according to claim 1, wherein the water-absorbing dietary fiber has a property such that water absorbency thereof is increased by heat treatment.

[Claim 3]

The nutritional composition according to claim 1, wherein the water-absorbing dietary fiber is an insoluble dietary fiber.

[Claim 4]

The nutritional composition according to claim 1, wherein the water-absorbing dietary fiber is an insoluble fiber of soybean dietary fiber and/or soybean *fusuma* bran.

[Claim 5]

The nutritional composition according to claim 1, comprising one or more from the group consisting of protein, lipid, and sugar, wherein the specific gravity of the composition is 1.06 to 1.5.

[Claim 6]

The nutritional composition according to claim 1, comprising one or more from the group consisting of a thickening agent and an emulsifier.

[Claim 7]

The nutritional composition according to claim 1, wherein a homogenization treatment is performed prior to said heat treatment by adjusting the homogenization treatment pressure to 10 to 100 MPa.

[Claim 8]

A method for producing a viscous nutritional composition, comprising the steps of:

i) preparing a water-absorbing dietary fiber at an amount of 0.1 or more to less than 1.5% by weight relative to the nutritional composition,

ii) applying a pressure treatment for homogenization, and

iii) applying a heat treatment,

wherein the viscosity of the composition before the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition before the heat treatment is measured at 45 to 85°C and 12 rpm using a B-type viscometer, and the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is 300 to 6700 mPa·s, wherein the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is measured at 20°C and 12 rpm using a B-type viscometer.

[Claim 9]

A method for producing a viscous nutritional composition, comprising the steps of:

i) preparing a water-absorbing dietary fiber at an amount of 0.1 or more to less than 1.5% by weight relative to the nutritional composition,

ii) applying a pressure treatment for homogenization, and

iii) applying a heat treatment,

wherein the viscosity of the composition before the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition before the heat treatment is measured at 45 to 85°C and 12 rpm using a B-type viscometer, and the homogenization treatment pressure in the step of applying the pressure treatment for homogenization is 10 to 100 MPa, and a viscosity (20°C) of the composition after the heat treatment and storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is 300 to 6700 mPa·s, wherein the viscosity of the composition after the heat treatment and storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days is measured at 20°C and 12 rpm using a B-type viscometer.

[Claim 10]

A viscous nutritional composition comprising 0.1% to 2.5% by weight of a starch not having been subjected to pregelatinization treatment in advance relative to the nutritional composition, wherein the composition has a property such that viscosity thereof is increased by a heat treatment, wherein the viscosity of the composition prior to said heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition prior to said heat treatment is measured at 45 to 85°C and 12 rpm using a B-type viscometer, and wherein the viscosity of the composition reaches 300 to 6700 mPa·s by subjecting the composition to said heat treatment and then to storage at a temperature equal to or below normal temperature of 15 to 25°C for 1 to 90 days, wherein the viscosity of the composition that has been subjected to said heat treatment and then stored at a temperature equal to or below normal temperature of

15 to 25°C for 1 to 90 days is measured at 20°C and 12 rpm using a B-type viscometer.