That is, the present invention enables a reduction in the amount of substance that imparts a shear thinning characteristic necessary for imparting a certain degree of viscosity (such as a thickening agent) by using a water-absorbing adjuvant that imparts a viscous property but not a shear thinning characteristic, which reduces free water in a composition. Alternatively, the present invention enables an increase in the viscosity of a nutritional composition while maintaining a characteristic close to a Newtonian fluid by using, among the aforementioned adjuvants, one that imparts viscosity to an aqueous solution while having a characteristic closer to a Newtonian fluid. By doing so, a shear thinning characteristic (also called pseudoplastic fluidity) attributable to a thickening agent and the like contained in a composition can be suppressed, whereby the provision of a nutritional composition having a low shear thinning characteristic was made possible. It is also possible to adjust the viscosity of the aforementioned composition post heat treatment by adjusting the homogenization treatment pressure.

[0022]

~~Thus, the present invention is as follows.~~

Thus, in a first aspect, the present invention refers to a nutritional composition having a fluidization characteristic comprising a water-absorbing dietary fiber in an amount of 0.10 to 1.50% by weight of the nutritional composition, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate 0.1/s to 1000/s are expressed by the following viscous property formula:

$$P = \mu D^n$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), $\mu$ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.3 to 1.0 and the viscosity at a shear rate of 10/s (25°C) is 150 mPa·s or more, wherein the water-absorbing dietary fiber is an insoluble dietary fiber.

In a second aspect, the present invention refers to a nutritional composition having a fluidization characteristic comprising a water-absorbing dietary fiber in an amount of 0.10 to 1.50% by weight of the nutritional composition, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate of 0.1/s to 100/s are expressed by the following viscous property formula:

$$P = \mu D^{n}$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), $\mu$ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.4 to 0.8 and the viscosity at a shear rate of 10/s (25°C) is 150 to 1000 mPa·s or more, wherein the water-absorbing dietary fiber is an insoluble dietary fiber.

In a third aspect, the present invention refers to a nutritional composition having a fluidization characteristic comprising an adjuvant selected from the group consisting of a water-absorbing dietary fiber in an amount of 0.10 to 1.50% by weight of the nutritional composition, a thickening agent that does not have a network structure in an aqueous solution in an amount of 0.10 to 1.50% by weight of the nutritional composition, and a starch not having been subjected to pregelatinization treatment in advance in an amount of 0.10 to 1.50% by weight of the nutritional composition, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate 0.1/s to 1000/s are expressed by the following viscous property formula:

$$P = \mu D^{n}$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), $\mu$ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.3 to 1.0 and the viscosity at a shear rate of 10/s (25°C) is 150 mPa·s or more,

wherein a homogenization treatment is performed prior to a heat treatment by adjusting the homogenization treatment pressure to 10 to 100 MPa, and wherein said heat treatment is used to produce the nutritional composition.

In a fourth aspect, the present invention refers to a nutritional composition having a fluidization characteristic comprising an adjuvant selected from the group consisting of a water-absorbing dietary fiber in an amount of 0.10 to 1.50% by weight of the nutritional composition, a thickening agent that does not have a network structure in an aqueous solution in an amount of 0.10 to 1.50% by weight of the nutritional composition, and a starch not having been subjected to pregelatinization treatment in advance in an amount of 0.10 to 1.50% by weight of the nutritional composition, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate of 0.1/s to 100/s are expressed by the following viscous property formula:

$$P = \mu D^n$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), $\mu$ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.4 to 0.8 and the viscosity at a shear rate of 10/s (25°C) is 150 to 1000 mPa·s or more,

wherein a homogenization treatment is performed prior to a heat treatment by adjusting the homogenization treatment pressure to 10 to 100 MPa, and wherein said heat treatment is used to produce the nutritional composition.

In a fifth aspect, the present invention refers to a method for producing a nutritional composition having a fluidization characteristic comprising an adjuvant, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate of 0.1/s to 1000/s are expressed by the following viscous property formula:

$$P = \mu D^n$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), μ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.3 to 1.0 and the viscosity at a shear rate of 10/s (25°C) is 150 mPa·s or more, comprising the steps of:

i) preparing an adjuvant selected from the group consisting of a water-absorbing dietary fiber, a thickening agent that does not have a network structure in an aqueous solution, and a starch not having been subjected to pregelatinization treatment in advance, wherein said adjuvant is 0.10 to 5.00% by weight relative to the nutritional composition,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,

wherein the viscosity of the composition prior to the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition prior to 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 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 of 15 to 25°C for 1 to 90 days is 300 to 3000 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.

In a sixth aspect, the present invention refers to a method for producing a nutritional composition having a fluidization characteristic, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate of 0.1/s to 100/s are expressed by the following viscous property formula:

$$P = \mu D^n$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), μ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.4 to 0.8 and the viscosity at a shear rate of 10/s (25°C) is 150 to 1000 mPa·s, comprising the steps of:

i) preparing an adjuvant selected from the group consisting of a water-absorbing dietary fiber, a thickening agent that does not have a network structure in an aqueous solution, and a starch not having been subjected to pregelatinization treatment in advance, wherein said adjuvant is 0.10 to 5.00% by weight relative to the nutritional composition,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,

wherein the viscosity of the composition prior to the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition prior to 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 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 of 15 to 25°C for 1 to 90 days is 300 to 3000 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.

[0023]

1. Also described herein is a nutritional composition having a fluidization characteristic comprising an adjuvant that imparts a viscous property but not a shear thinning characteristic, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate of 0.1/s to 1000/s are expressed by the following viscous property formula:

$$P = \mu D^n$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), μ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.3 to 1.0 and the viscosity at a shear rate of 10/s (25°C) is 150 mPa·s or more.

[0024]

2. Further described herein is a~~A~~ nutritional composition having a fluidization characteristic comprising an adjuvant that imparts a viscous property but not a shear thinning characteristic, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more

measurement points in a shear rate range of shear rate of 0.1/s to 100/s are expressed by the following viscous property formula:

$P = \mu D^n$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), $\mu$ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,
the value of n is 0.4 to 0.8 and the viscosity at a shear rate of 10/s (25°C) is 150 to 1000 mPa·s or more.

[0025]

3. Also described herein is t~~T~~he nutritional composition having a fluidization characteristic according to 1 or 2, wherein the adjuvant that imparts a viscous property but not a shear thinning characteristic is selected from the group consisting of a water-absorbing dietary fiber, a thickening agent that does not have a network structure in an aqueous solution, and a starch not having been subjected to pregelatinization treatment in advance.

[0026]

4. Also described herein is t~~T~~he nutritional composition having a fluidization characteristic according to any of 1 to 3, comprising the adjuvant that imparts a viscous property but not a shear thinning characteristic according to any of 1 to 3 in an amount of 0.10 to 5.00% by weight relative to the nutritional composition, and having a property such that viscosity thereof is increased by heat treatment.

[0027]

5. Also described herein is t~~T~~he nutritional composition having a fluidization characteristic according to any of 1 to 4, wherein the adjuvant that imparts a viscous property but not a shear thinning characteristic is a water-absorbing dietary fiber.

[0028]

6. Further described herein is t~~T~~he nutritional composition having a fluidization characteristic according to any of 3 to 5, wherein the water-absorbing dietary fiber is an insoluble dietary fiber.

[0029]

7. Also described herein is t~~T~~he nutritional composition having a fluidization characteristic according to any of 3 to 6, wherein the water-absorbing dietary fiber is an insoluble fiber of a *fusuma* bran dietary fiber of a cereal.

[0030]

8. Also described herein is tThe nutritional composition having a fluidization characteristic according to any of 3 to 7, wherein the water-absorbing dietary fiber is an insoluble fiber of soybean dietary fiber and/or soybean *fusuma* bran.

[0031]

9. Also described herein is tThe nutritional composition having a fluidization characteristic according to any of 1 to 4, wherein the adjuvant that imparts a viscous property but not a shear thinning characteristic is a thickening agent that does not have a network structure in an aqueous solution.

[0032]

10. Also described herein is tThe nutritional composition having a fluidization characteristic according to 9, wherein the thickening agent that does not have a network structure in an aqueous solution is a thickening agent selected from the group consisting of ι-carrageenan, λ-carrageenan, locust bean gum, guar gum, psyllium seed gum, and tamarind seed gum.

[0033]

11. Also described herein is tThe nutritional composition having a fluidization characteristic according to any of 1 to 4, wherein the adjuvant that imparts a viscous property but not a shear thinning characteristic is a starch not having been subjected to pregelatinization treatment in advance.

[0034]

12. Also described herein is tThe nutritional composition having a fluidization characteristic according to any of 1 to 11, 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.

[0035]

13. Also described herein is tThe nutritional composition having a fluidization characteristic according to any of 1 to 12, comprising one or more from the group consisting of a thickening agent and an emulsifier.

[0036]

14. Also described herein is tThe nutritional composition having a fluidization characteristic according to any of 1 to 13, 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 viscometer.

[0037]

15. Also described herein is t~~T~~he nutritional composition having a fluidization characteristic according to any of 1 to 14, wherein homogenization treatment is performed by adjusting the homogenization treatment pressure to 10 to 100 MPa.

[0038]

16. Also described herein is t~~T~~he nutritional composition having a fluidization characteristic according to any of 1 to 15, wherein the viscosity of the composition reaches 300 to 3000 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 is measured at 20°C and 12 rpm using a spindle type rotational viscometer.

[0039]

17. Also described herein is a~~A~~ nutritional composition having a fluidization characteristic comprising an adjuvant that imparts a viscous property but not a shear thinning characteristic, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate of 0.1/s to 1000/s are expressed by the following viscous property formula:

$$P = \mu D^n$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), μ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.3 to 1.0 and the viscosity at a shear rate of 10/s (25°C) is 150 mPa·s or more, and

wherein the composition has been subjected to heat treatment and then stored at a temperature equal to or below normal temperature for 1 to 90 days.

[0040]

18. Also described herein is a~~A~~ nutritional composition having a fluidization characteristic comprising an adjuvant that imparts a viscous property but not a shear thinning characteristic, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate of 0.1/s to 100/s are expressed by the following viscous property formula:

$P = \mu D^n$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), μ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.4 to 0.8 and the viscosity at a shear rate of 10/s (25°C) is 150 mPa·s or more, and

wherein the composition has been subjected to heat treatment and then stored at a temperature equal to or below normal temperature for 1 to 90 days.

[0041]

19. Also described herein is a~~A~~ method for producing a viscous nutritional composition, comprising the steps of:

i) preparing an adjuvant that imparts a viscous property but not a shear thinning characteristic selected from the group consisting of a water-absorbing dietary fiber, a thickening agent that does not have a network structure in an aqueous solution, and a starch not having been subjected to pregelatinization treatment in advance, wherein said adjuvant is 0.10 to 5.00% by weight relative to the nutritional composition,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,

wherein the viscosity of the composition prior to the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition prior to 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 for 1 to 90 days is 300 to 3000 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 viscometer.

[0042]

20. Also described herein is a~~A~~ method for producing a viscous nutritional composition, comprising the steps of:

i) preparing an adjuvant that imparts a viscous property but not a shear thinning characteristic selected from the group consisting of a water-absorbing dietary fiber, a thickening agent that does not have a network structure in an aqueous solution, and a starch not having been

subjected to pregelatinization treatment in advance, wherein said adjuvant is 0.10 to 5.00% by weight relative to the nutritional composition,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,

wherein the viscosity of the composition prior to the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition prior to 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 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 3000 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 viscometer.

[0043]

21. Also described herein is ~~a~~A method for producing a nutritional composition having a fluidization characteristic comprising an adjuvant that imparts a viscous property but not a shear thinning characteristic, wherein the composition is prepared so that when results of measurement of shear stress and shear rate at any two or more measurement points in a shear rate range of shear rate of 0.1/s to 1000/s are expressed by the following viscous property formula:

$$P = \mu D^n$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), μ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.3 to 1.0 and the viscosity at a shear rate of 10/s (25°C) is 150 mPa·s or more, comprising the steps of:

i) preparing an adjuvant that imparts a viscous property but not a shear thinning characteristic selected from the group consisting of a water-absorbing dietary fiber, a thickening agent that does not have a network structure in an aqueous solution, and a starch not having been subjected to pregelatinization treatment in advance, wherein said adjuvant is 0.10 to 5.00% by weight relative to the nutritional composition,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,

wherein the viscosity of the composition prior to the heat treatment is 5 to 300 mPa·s, wherein the viscosity of the composition prior to 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 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 3000 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 viscometer.

[0044]

22. Also described herein is aA method for producing a nutritional composition having a fluidization characteristic, wherein the composition is prepared so that when results of measurement of viscosity at any two or more measurement points in a shear rate range of shear rate of 0.1/s to 100/s are expressed by the following viscous property formula:

$$P = \mu D^n$$

wherein, P represents a shear stress (Pa), D represents a shear rate (1/s), $\mu$ represents a non-Newtonian viscosity coefficient, and n represents a non-Newtonian viscosity index,

the value of n is 0.4 to 0.8 and the viscosity at a shear rate of 10/s (25°C) is 150 to 1000 mPa·s, comprising the steps of:

i) preparing an adjuvant that imparts a viscous property but not a shear thinning characteristic selected from the group consisting of a water-absorbing dietary fiber, a thickening agent that does not have a network structure in an aqueous solution, and a starch not having been subjected to pregelatinization treatment in advance, wherein said adjuvant is 0.10 to 5.00% by weight relative to the nutritional composition,

ii) applying pressure treatment for homogenization, and

iii) applying heat treatment,