

DESCRIPTION

Title of Invention:

NOODLES AND METHOD FOR PRODUCING SAME

Technical Field

[0001]

The present invention relates to noodles and a method for producing the noodles.

This application claims priority to Japanese Patent Application No. 2018-224956 filed November 30, 2018, the entire contents of which are incorporated herein by reference.

Background Art

[0002]

As demand for low-carb foods and high-protein foods increases, there is a growing demand for increasing the content of protein in noodles which are rich in carbohydrate. Therefore, it is a common practice to replace wheat flour with a raw material having a high protein content, such as soy flour.

However, the replacement of wheat flour with a raw material having a high protein content may cause problems such as a lowering of noodle-making properties and a reduction in flavor or texture.

To address such problems, there have been proposed a method which involves adding casein and albumen to wheat (PTL 1), and a method which uses a combination of dietary fibers and protein (PTL 2).

Citation List

Patent Literature

[0003]

PTL 1: Japanese Patent Laid-Open Publication No. S51-115942

PTL 2: Japanese Patent Laid-Open Publication No. 2010-81888

Summary of Invention

Technical Problem

[0004]

However, the methods of PTLs 1 and 2 still cause the problems, such as a lowering of noodle-making properties and a reduction in flavor or texture, when the protein content of noodles is made high. Therefore, the protein content of noodles cannot be made very high.

[0005]

It is therefore an object of the present invention to provide, in an embodiment, noodles which are excellent in flavor and texture and have good noodle-making properties

even when the noodles have a high protein content, and to provide a method for producing the noodles.

Solution to Problem

[0006]

[1] Noodles made from a raw material composition comprising wheat flour and a milk protein-containing raw material,

wherein a milk protein content of the milk protein-containing raw material is not less than 80% by mass on a solid content basis, and

wherein at least 60% by mass of the milk protein is micellar casein.

[2] The noodles as described in [1], wherein a percentage of the milk protein-containing raw material is 2 to 65% by mass based on 100% by mass of the total amount of the wheat flour and the milk protein-containing raw material.

[3] The noodles as described in [1] or [2], wherein a protein content of the noodles is 10 to 60% by mass on a solid content basis.

[4] The noodles as described in any one of [1] to [3], wherein the milk protein-containing raw material comprises at least one member selected from a group consisting of a milk protein concentrate, a milk protein isolate, a micellar casein concentrate, and a micellar casein isolate.

[5] A method for producing noodles, comprising subjecting a raw material composition, comprising wheat flour and a milk protein-containing raw material, to a noodle-making process,

wherein a milk protein content of the milk protein-containing raw material is not less than 80% by mass on a solid content basis, and

wherein at least 60% by mass of the milk protein is micellar casein.

[6] The method for producing noodles as described in [5], wherein a percentage of the milk protein-containing raw material is 2 to 65% by mass based on 100% by mass of a total amount of the wheat flour and the milk protein-containing raw material.

[7] The method for producing noodles as described in [5] or [6], wherein the milk protein-containing raw material comprises at least one member selected from a group consisting of a milk protein concentrate, a milk protein isolate, a micellar casein concentrate, and a micellar casein isolate.

Advantageous Effects of Invention

[0007]

The noodles of the present invention are excellent in flavor and texture and have good noodle-making properties

even when the noodles have a high protein content.

The noodle production method of the present invention can produce, with good noodle-making properties, noodles which are excellent in flavor and texture even when the noodles have a high protein content.

Description of Embodiments

[0008]

<Noodles>

The noodles of the present invention are made from a raw material composition comprising wheat flour and a milk protein-containing raw material. In other words, the noodles of the present invention comprise, as raw materials, wheat flour and a milk protein-containing raw material. To put it still another way, the noodles of the present invention correspond to common noodles using wheat flour as a raw material, except that the wheat flour is partly replaced with a milk protein-containing raw material.

As used herein, "noodle-making properties" refer to production properties during the process of preparing noodles from the raw material composition. The noodle-making properties can be determined by the coming-together of dough in a process of kneading the raw material composition into the dough or in a process of rolling out the dough before cutting it into noodles, or by the shape

retention of the noodles after they are boiled.

[0009]

Examples of the wheat flour include hard wheat flour, all-purpose flour, soft wheat flour, semolina flour, and a mixture of two or more of such flours. The wheat flour may be appropriately selected depending on the type of the noodles.

[0010]

The milk protein-containing raw material comprises milk protein. At least part of the milk protein is micellar casein.

The micellar casein refers to casein having a micellar structure, in particular casein that maintains a micellar structure as observed in milk.

The micellar casein is preferably derived from milk of a mammal, more preferably from milk of cow, sheep, goat, or the like, and even more preferably from milk of cow. Micellar casein derived from cow milk is generally an assembly of α_{s1} -casein, α_{s2} -casein, β -casein, κ -casein, etc. Small micelles, called sub-micelles, aggregate to form micellar casein. Calcium phosphate is involved in the steric structure of each casein and in the binding site between casein sub-micelles. Therefore, micellar casein is characterized by a high content of calcium. Thus, the micellar casein according to the present invention may be a

micelle composed of casein and calcium phosphate. According to a document (Ito (2004), *Nyuseihin seizougaku* [Dairy Product Manufacturing Technology], Kourinsha, p. 14), 2.9 g of calcium is contained in 100 g of cow milk-derived micelles. In one aspect, the micellar casein according to the present invention contains 2.3 to 3.5 g, preferably 2.6 to 3.2 g of calcium per 100 g of the casein.

The micellar casein in the milk protein-containing raw material is preferably not denatured, i.e. has a native structure. The micellar casein may contain calcium phosphate in addition to casein. Thus, the micellar casein may be a micelle composed of casein and calcium phosphate. The native structure refers to, for example, a state in which the steric structures of casein species constituting the micellar casein are not collapsed and the micellar structure as aggregates of sub-micelles is maintained. When the micellar structure is denatured e.g. by the influence of an acid, and the native structure cannot be maintained, then the casein cannot form aggregates any more. Further, the casein cannot maintain hydrophilicity, and therefore becomes insoluble in water. In addition, such non-native casein has lost its calcium phosphate-binding ability, and therefore does not contain calcium phosphate in its molecular structure. In one aspect, the micellar casein according to the present invention can be dispersed in neutral water at a

concentration of not less than 1% by mass, and contains calcium phosphate in its molecular structure. In another aspect, in the micellar casein according to the present invention, the steric structure(s) of casein species contained and a crosslinked structure between sub-micelles have not collapsed.

It appears that the micellar casein maintains its structure even during the process of making the raw material composition into noodles. It is, therefore, conceivable that the noodles, made from the raw material composition, contain the micellar casein.

[0011]

The milk protein may be composed solely of micellar casein or may be a mixture of micellar casein and other milk protein(s), i.e. a milk protein(s) which is not micellar casein. The milk protein which is not micellar casein can be exemplified by whey protein, casein separated by acid precipitation, caseinate, etc. In the case of casein separated by acid precipitation, calcium phosphate, which is necessary for the formation of a micellar structure, has become soluble and has been lost. Thus, the casein does not have a micellar structure. The caseinate is obtained by precipitating casein with an acid, and then dissolving the precipitate in an alkali to convert the casein into a salt (e.g. sodium salt, potassium salt or calcium salt). The

caseinate does not have a micellar structure.

[0012]

In the milk protein-containing raw material, at least 60% by mass of the milk protein is micellar casein. Thus, the percentage of micellar casein in the milk protein is not less than 60% by mass of the total mass of the milk protein. When at least 60% by mass of the milk protein is micellar casein, the raw material composition has good noodle-making properties even when the protein content is high. For example, when preparing dough from the raw material composition, the dough easily comes together and does not become sticky. Furthermore, the noodles are excellent in flavor and texture even when the protein content is high.

The percentage of micellar casein in the milk protein is preferably not less than 70% by mass, more preferably not less than 75% by mass, even more preferably not less than 80% by mass, still more preferably not less than 85% by mass, still more preferably not less than 88% by mass, and still more preferably not less than 90% by mass of the total mass of the milk protein. There is no particular limitation on the upper limit of the percentage of micellar casein in the milk protein. However, in view of e.g. the availability of micellar casein, the percentage of micellar casein is preferably not more than 97% by mass of the total mass of the milk protein.

The percentage, in the milk protein, of a milk protein which is not micellar casein is not more than 40% by mass, preferably not more than 30% by mass, more preferably not more than 25% by mass, even more preferably not more than 20% by mass, still more preferably not more than 15% by mass, still more preferably not more than 12% by mass, and still more preferably not more than 10% by mass of the total mass of the milk protein in the milk protein-containing raw material. The percentage, in the milk protein, of a milk protein which is not micellar casein is preferably not less than 3% by mass of the total mass of the milk protein. It is to be noted that the sum of the content of micellar casein and the content of a milk protein which is not micellar casein does not exceed 100% by mass of the total mass of the milk protein in the milk protein-containing raw material.

The percentage of micellar casein in the milk protein can be determined based on ISO 17997-1 (IDF 29-1) (Milk - Determination of casein-nitrogen content - Part 1: Indirect method (Reference method)).

[0013]

The milk protein-containing raw material may further contain a component(s) other than milk protein. The component(s) other than milk protein includes a lipid, a carbohydrate, a mineral, moisture, a peptide, an amino acid, etc.

[0014]

The milk protein content of the milk protein-containing raw material is not less than 80% by mass, preferably not less than 82% by mass, more preferably not less than 85% by mass on a solid content basis, i.e. in terms of the mass percentage of milk protein based on 100% by mass of the total solid content of the milk protein-containing raw material. The milk protein content of not less than 80% by mass is sufficiently higher than the protein content of wheat flour, and therefore can increase the protein content of noodles. It is to be noted that the protein content of wheat flour on a solid content basis (the percentage of wheat flour protein based on 100% by mass of the total solid content of the wheat flour) is generally about 5 to 15% by mass.

There is no particular limitation on the upper limit of the milk protein content of the milk protein-containing raw material. However, in view of e.g. the availability of milk protein, the milk protein content of the milk protein-containing raw material is preferably not more than 95% by mass on a solid content basis.

The percentage of "a component(s) other than milk protein and moisture" is not more than 20% by mass, preferably not more than 18% by mass, and more preferably not more than 15% by mass based on 100% by mass of the total

solid content of the milk protein-containing raw material. The percentage of "a component(s) other than milk protein and moisture" is preferably not less than 5% by mass based on 100% by mass of the total solid content of the milk protein-containing raw material. It is to be noted that the sum of the content of milk protein and the content of "a component(s) other than milk protein and moisture" does not exceed 100% by mass of the total solid content of the milk protein-containing raw material.

The percentage of moisture is, for example, 0.5 to 10% by mass, more limitedly 1 to 8% by mass, and even more limitedly 2 to 7% by mass based on 100% by mass of the total mass of the milk protein-containing raw material.

As used herein, solid content refers to a value calculated according to the following equation: Solid content (mass %) = 100 - moisture (mass %). As used herein, moisture content refers to a value measured by a normal-pressure heating/drying method.

The content of milk protein can be measured by a combustion method, in particular a combustion method (improved Dumas method) for the measurement of protein, described in "Standard Tables of Food Composition in Japan, 2015 edition (seventh revised edition), Analytical Manual".

[0015]

The milk protein-containing raw material at least

partly comprises micellar casein. The milk protein-containing raw material comprising micellar casein may solely comprise micellar casein as the milk protein, or may also comprise a milk protein which is not micellar casein.

The milk protein-containing raw material comprising micellar casein can be exemplified by a concentrate obtained through membrane separation from a micellar casein-containing dairy product such as milk or skim milk. A liquid concentrate, obtained by membrane separation, is generally dried, for example by spray drying, into a powdery concentrate.

A dairy product, such as milk or skim milk, contains micellar casein and whey protein as milk proteins, and also contains other components such as fat, lactose and minerals. By subjecting such a dairy product to membrane separation, the content of milk protein can be increased while maintaining the micellar structure of micellar casein.

The micellar casein in the concentrate is not subjected to a chemical treatment (e.g. an acid precipitation treatment or an alkali dissolution treatment) as performed in a process for producing a caseinate such as sodium caseinate. Therefore, the casein maintains a "micellar structure" which the casein has in unprocessed milk.

As long as the micellar structure is maintained, a dairy product containing micellar casein may be subjected to

an acid addition treatment or an alkali addition treatment. In terms of flavor, the concentrate is preferably not subjected to an acid addition treatment or an alkali addition treatment.

[0016]

Skim milk is preferred as a dairy product to be subjected to membrane separation from the viewpoint of obtaining a concentrate having a higher content of milk protein. Examples of usable skim milks include, but are not limited to, skim milk obtained by defatting raw milk, concentrated skim milk obtained by concentrating the skim milk, a solution of dried skim milk, and demineralized skim milk.

[0017]

A microfiltration membrane (MF) or an ultrafiltration membrane (UF) can be used in the membrane separation.

In the case of using a microfiltration membrane in the membrane separation, micellar casein generally does not permeate the membrane, whereas whey protein and other smaller-sized components (lactose, mineral, moisture, etc.) permeate the membrane. Therefore, by subjecting skim milk, for example, to membrane separation using a microfiltration membrane, a condensed fraction having an increased content of milk protein and an increased percentage of micellar casein in the milk protein can be obtained. Micellar casein

generally has a size of 20 to 600 nm, and an average size of about 200 nm (0.2 μm). On the other hand, whey protein and other components (lactose, mineral, moisture, etc.) have a size of not more than a few nm. The size difference can be utilized to increase the percentage of micellar casein in the milk protein. The pore size of the microfiltration membrane is, for example, 0.01 μm to 1 μm , particularly 0.02 μm to 0.6 μm , more particularly 0.05 μm to 0.2 μm , and even more particularly 0.1 μm to 0.2 μm .

[0018]

In a dairy product (such as milk or skim milk) before membrane separation, the mass ratio between micellar casein and whey protein is generally about 8:2 (the percentage of micellar casein in milk protein is about 80% by mass). By subjecting such a dairy product to membrane separation using a microfiltration membrane, micellar casein is concentrated, whereby the percentage of micellar casein in milk protein becomes higher than 80% by mass. For example, a concentrate can be obtained which has a mass ratio between micellar casein and whey protein of about 9:1 (the percentage of micellar casein in milk protein is about 90% by mass).

A concentrate, in which the percentage of micellar casein in milk protein is about 90% by mass (e.g. 85 to 95% by mass) is commonly called a micellar casein concentrate (MCC). The milk protein content of an MCC on a solid content

basis is generally about 80% by mass (e.g. 70 to 88% by mass).

A concentrate, in which the percentage of micellar casein in milk protein is about 90% by mass (e.g. 85 to 95% by mass) and the content of milk protein on a solid content basis is further increased to about 90% by mass (e.g. more than 88% by mass and not more than 95% by mass), is a kind of MCC, but is commonly called micellar casein isolate (MCI).
[0019]

In the case of using an ultrafiltration membrane in the membrane separation, micellar casein and whey protein generally do not permeate the membrane, whereas other smaller-sized components (lactose, mineral, moisture, etc.) permeate the membrane, whereby the content of milk protein can be increased. The pore size of the ultrafiltration membrane is generally not more than 100 nm, particularly 1 to 100 nm, more particularly 1 to 10 nm.
[0020]

In a concentrate obtained by membrane separation using an ultrafiltration membrane, the mass ratio between micellar casein and whey protein is generally about 8:2 (the percentage of micellar casein in milk protein is about 80% by mass) which is the same as that in the dairy product before membrane separation.

A concentrate, in which the percentage of micellar

casein in milk protein is about 80% by mass (e.g. 70 to 85% by mass, or not less than 70% by mass and less than 85% by mass) and the content of milk protein on a solid content basis is about 80% by mass (e.g. 70 to 88% by mass), is commonly called milk protein concentrate (MPC), and sometimes called total milk protein (TMP).

A concentrate, in which the percentage of micellar casein in milk protein is about 80% by mass (e.g. 70 to 85% by mass, or not less than 70% by mass and less than 85% by mass) and the content of milk protein on a solid content basis is about 90% by mass (e.g. more than 88% by mass and not more than 95% by mass), is commonly called milk protein isolate (MPI).

[0021]

From the viewpoint of the content of micellar casein, the milk protein-containing raw material is preferably at least one member selected from the group consisting of MPC, MPI, MCC and MCI and, from the viewpoint of a low content of whey protein and good flavor, is more preferably at least one member selected from the group consisting of MCC and MCI.

As described above, in MPC, the percentage of micellar casein in milk protein is, for example, not less than 70% by mass and less than 85% by mass, and the content of milk protein on a solid content basis is, for example, 70 to 88% by mass. In MPI, the percentage of micellar casein in milk

protein is, for example, not less than 70% by mass and less than 85% by mass, and the content of milk protein on a solid content basis is, for example, more than 88% by mass and not more than 95% by mass. In MCC, the percentage of micellar casein in milk protein is, for example, 85 to 95% by mass, and the content of milk protein on a solid content basis is, for example, 70 to 88% by mass. In MCI, the percentage of micellar casein in milk protein is, for example, 85 to 95% by mass, and the content of milk protein on a solid content basis is, for example, more than 88% by mass and not more than 95% by mass. "The percentage of micellar casein in milk protein" refers to the percentage of micellar casein based on 100% by mass of the total mass of milk protein. "The content of milk protein on a solid content basis" refers to the percentage of milk protein based on 100% by mass of the total solid content of the milk protein-containing raw material (MPC, MPI, MCC, MCI, or the like).

The milk protein-containing raw material may comprise at least one member, selected from the group consisting of MPC, MPI, MCC and MCI, and other milk protein-containing raw material(s). The other milk protein-containing raw material(s) is, for example, a whey protein concentrate (WPC). The WPC can be obtained, for example, by subjecting whey to membrane separation using an ultrafiltration membrane.

[0022]

The milk protein-containing raw material may be either a product which is produced by a known method as described above, or a commercial product. For example, MCC and MCI are available from Leprino Foods Company.

[0023]

In the raw material composition, the percentage of the milk protein-containing raw material is preferably 2 to 65% by mass, more preferably 2 to 30% by mass, even more preferably 5 to 25% by mass, and especially preferably 5 to 20% by mass based on 100% by mass of the total amount of wheat flour and the milk protein-containing raw material. The effect of increasing the protein content of noodles can be easily achieved when the percentage of the milk protein-containing raw material is not less than 2% by mass. The flavor and texture of noodles, and the noodle-making properties are superior when the percentage of the milk protein-containing raw material is not more than the above upper limit.

The percentage of the total amount of wheat flour and the milk protein-containing raw material is, for example, 25 to 90% by mass, more limitedly 30 to 88% by mass, even more limitedly 50 to 85% by mass of the total mass of the raw material composition.

[0024]

The raw material composition generally contains added

moisture.

The percentage of added moisture is, for example, 10 to 75% by mass of the total mass of the raw material composition.

[0025]

The raw material composition may optionally contain an additional material(s) other than wheat flour, the milk protein-containing raw material and moisture as long as the effect of the present invention is not impaired.

Any material that is known as a material for noodles can be used as the additional material. Examples of the additional material include salt, buckwheat flour, rice flour, edible fat and oil, egg (whole egg, yolk or egg white), brine water, seasonings, etc.

The percentage of the additional material(s) is, for example, 1 to 15% by mass based on 100% by mass of the total amount of wheat flour and the milk protein-containing raw material.

In one aspect of the present invention, the percentage of wheat flour is 25 to 80% by mass, the percentage of the milk protein-containing raw material is 10 to 50% by mass, the percentage of salt is 0.4 to 1.0% by mass, and the percentage of moisture is 10 to 70% by mass of the total mass of the raw material composition. It is to be noted that the sum of the percentage of wheat flour, the percentage

of the milk protein-containing raw material, the percentage of salt and the percentage of moisture does not exceed 100% by mass of the total mass of the raw material composition. The milk protein-containing raw material preferably comprises at least one member selected from the group consisting of MPC, MPI, MCC and MCI, and may also contain other milk protein-containing raw material(s) (e.g. WPC).

[0026]

The noodles of the present invention comprise at least wheat protein and milk protein as a protein component. The noodles of the present invention may also comprise, as a protein component, a protein(s) other than wheat protein and milk protein. The percentage of the total mass of wheat protein and milk protein is preferably not less than 60% by mass, more preferably not less than 80% by mass, and especially preferably 100% by mass of the total mass of protein.

The protein content of the noodles of the present invention is preferably 10 to 60% by mass, more preferably 10 to 50% by mass, and even more preferably 14 to 37% by mass on a solid content basis. The noodles are useful as a high-protein food product when the protein content is not less than 10% by mass. The flavor and texture of the noodles, and the noodle-making properties are superior when the protein content is not more than 60% by mass. The protein

content refers to the proportion of protein to the total solid content of the noodles.

[0027]

The noodles of the present invention may be dried noodles, raw noodles, frozen noodles, etc.

Specific examples of the noodles include pasta, Chinese noodles, udon, somen, hiyamugi, and buckwheat noodles. The pasta may include flat pasta such as fettuccine, cylindrical pasta such as spaghetti, and hollow cylindrical pasta such as macaroni.

[0028]

<Noodle Production Method>

The noodles of the present invention can be produced by subjecting the above-described raw material composition to a noodle-making process.

The noodle-making process can be performed by a known method which is suitable for the type of noodles to be produced.

An exemplary noodle-making method comprises mixing the components (wheat flour, the milk protein-containing raw material, water, and an optional other material(s)) of the raw material composition to prepare dough, shaping the dough into the intended noodles, and drying the resulting noodles as necessary.

The components of the raw material composition may be

mixed simultaneously. Alternatively, a method may be used which comprises first mixing powdery materials, adding kneading water to the resulting mixture, and further mixing the mixture. The kneading water may be water, or a solution of some material(s) (e.g. salt) in water.

The shaping of the dough can be performed by a known method which is suitable for the type of noodles to be produced. In the case of flat noodles, for example, the dough can be shaped by a method comprising rolling the dough into a sheet-like shape, and cutting it into noodles with a desired width (e.g. 1.0 to 30 mm).

The drying of the shaped dough can be performed by a known drying method. The drying temperature may be set appropriately depending on the drying method used. For example, the drying temperature may be set to 30 to 150°C in the case of hot-air drying. The moisture percentage of the noodles after drying (dried noodles) is, for example, 5 to 20% by mass of the total mass of the noodles.

[0029]

As described hereinabove, the noodles of the present invention use the raw material composition comprising wheat flour and the milk protein-containing raw material, wherein the milk protein content of the milk protein-containing raw material is not less than 80% by mass on a solid content basis, and wherein at least 60% by mass of the milk protein

is micellar casein. Therefore, compared to common noodles (corresponding to the above-described raw material composition in which the milk protein-containing raw material is entirely replaced with wheat flour), the noodles of the present invention have a higher protein content. Further, compared to the case of using another protein-containing raw material (soy protein, pea protein, etc.) instead of the milk protein-containing raw material, the noodles of the present invention are superior in flavor and texture, and have better noodle-making properties.

The raw material composition according to the present invention is thus useful for making noodles.

Examples

[0030]

The following examples illustrate the present invention in greater detail and are not intended to limit the scope of the invention. In the examples, percentages are by mass unless otherwise indicated.

[0031]

<Test Example 1>

This test was conducted to examine the influence of the type of a protein-containing raw material, which replaces part of wheat flour, and the rate of the replacement on the flavor and texture of noodles and on the noodle-making properties.

[0032]

(1) Production of Noodles

The materials shown in Tables 1 to 3, excepting water, were mixed. Water was gradually mixed into the resulting mixture to prepare dough. The resulting dough was formed into a sheet having a thickness of 7 mm. The resulting sheet-like dough was layered and formed again into a sheet having a thickness of 8 mm. The resulting sheet-like dough was rolled with a rolling mill into a sheet having a final thickness of 1.4 mm. The dough sheet was cut into noodles with a width of 5 mm. Thereafter, the noodles were dried in a circulation dryer at 40°C for one hour, and then dried in a proofer at 50°C and 70% RH for 20 hours to obtain flat dried noodles.

[0033]

In Tables 1 to 3, "wheat flour replacement rate (%)" indicates the percentage of a protein-containing raw material based on 100% of the total amount of wheat flour and the protein-containing raw material. "TS" indicates solid content. In Table 3, "micellar casein percentage (%)" indicates the proportion of micellar casein to the total mass of milk protein.

The "protein content" was measured by a combustion method.

The "carbohydrate content" was measured by a

subtraction method. In particular, the carbohydrate content was determined by subtracting the total amount of four components, fat, protein, ash and moisture, from the total amount of all the components (calculation formula: $100\% - (\text{total amount of the four components, fat, protein, ash and moisture})$). The content of fat was measured by the Rose-Gottlieb method. The content of ash was measured by a direct ashing method.

[0034]

The following are the particulars of the protein-containing materials used in the examples.

MCC: micellar casein concentrate, manufactured by Milei GmbH, powdery, the content of protein 80% on a solid content basis, the percentage of micellar casein in milk protein 90%

TMP: milk protein concentrate (MPC), manufactured by Milei GmbH, powdery, the content of protein 80% on a solid content basis, the percentage of micellar casein in milk protein 80%

WPC: whey protein concentrate, manufactured by Milei GmbH, powdery, the content of protein 80% on a solid content basis, the milk protein composed entirely of whey protein and containing no micellar casein

Soy protein-containing raw material: Fujipro manufactured by Fuji Oil Co., Ltd., powdery

Pea protein-containing raw material; Empro E86
manufactured by Emsland, powdery
[0035]

(2) Evaluation of Noodle-Making Properties

The noodle-making properties (coming-together of dough, etc.) upon the production of the noodles of Examples 1 to 5 and Comparative Examples 2 to 4 were evaluated by the following criteria. The results are shown in Tables 1 to 3 below.

Good: as good as in Comparative Example 1 (wheat flour replacement rate 0%)

Allowable: some roughening of the dough structure, but no problem for noodles

No good: failure in making noodles e.g. due to poor coming-together of dough or breaking of dough during its rolling

[0036]

(3) Evaluation of Flavor and Texture

The noodles of Examples 1 to 5 and Comparative Examples 2 to 4 were cooked by boiling. The boiling time of the respective noodles was appropriately adjusted within the range of 7 to 9 minutes so that the hardness of boiled noodles becomes equal among all the noodles. The cooked noodles were taste tested, and the flavor and texture were evaluated by the following criteria. The results are shown in Tables 1 to 3 below.

[0037]

[Criteria for Evaluation of Flavor]

A: not floury, favorable

B: somewhat floury

C: considerably floury, plus protein odor

[0038]

[Criteria for Evaluation of Texture]

A: smooth

B: somewhat rough texture

C: considerably rough texture

[0039]

[Table 1]

		Comp. Ex. 1	Ex. 1	Ex. 2
Raw material composition	Durum wheat (g)	2000	1700	1400
	MCC (g)	0	300	600
	Salt (g)	15	15	15
	Water (g)	640	720	820
Wheat flour replacement rate (%)		0	15	30
Calory	kcal/100g	272	269	264
Protein content	g/100kcal	3.37	6.04	8.62
	g/100gTS	14.1	25.3	36.2
Carbohydrate content	g/100g	53.8	45.1 (16% off)	36.8 (32% off)
Evaluation	Noodle-making properties	—	good	good
	Flavor	—	A	A
	Texture	—	A	A

[0040]

[Table 2]

		Ex. 3	Comp. Ex. 2	Comp. Ex. 3	Comp. Ex. 4
Raw material composition	Durum wheat (g)	1400	1400	1400	1400
	TMP (g)	600	0	0	0
	WPC (g)	0	600	0	0
	Soy protein-containing raw material (g)	0	0	600	0
	Pea protein-containing raw material (g)	0	0	0	600
	Salt (g)	20	20	20	20
	Water (g)	365	410	880	880
Wheat flour replacement rate (%)		30	30	30	30
Protein content	g/100gTS	36.1	36.1	39.7	37.0
Evaluation	Noodle-making properties	good	no good	no good	allowable
	Flavor	B	B	B	C
	Texture	B	C	C	C

[0041]

[Table 3]

		Ex. 4	Ex. 5
Raw material composition	Durum wheat (g)	824	604
	MCC (g)	512	690
	WPC (g)	170	250
	Salt (g)	16	16
	Water (g)	478	460
Wheat flour replacement rate (%)		45	60
Micellar casein percentage (%)		68%	66%
Calory	kcal/100g	242	252
Protein content	g/100kcal	10.7	14.1
	g/100gTS	38	50
Carbohydrate content	g/100g	32	24
Evaluation	Noodle-making properties	good	allowable
	Flavor	B	B
	Texture	B	B

[0042]

Compared to the noodles of Comparative Example 1, the noodles of Examples 1 to 5 had a higher protein content and a lower carbohydrate content. Further, the noodles of Examples 1 to 5 were excellent in flavor and texture, and had good noodle-making properties. While the flavor and the texture of the noodles of Example 5 were both rated "B", they were slightly poorer than those of the noodles of Example 4.

The noodles of Comparative Examples 2 to 4, which each used one of the comparative protein-containing raw materials, were inferior in the noodle-making properties and in flavor and texture.

CLAIMS

[Claim 1]

Noodles made from a raw material composition comprising wheat flour and a milk protein-containing raw material,

wherein a milk protein content of the milk protein-containing raw material is not less than 80% by mass on a solid content basis, and

wherein at least 60% by mass of the milk protein is micellar casein.

[Claim 2]

The noodles according to claim 1, wherein a percentage of the milk protein-containing raw material is 2 to 65% by mass based on 100% by mass of a total amount of the wheat flour and the milk protein-containing raw material.

[Claim 3]

The noodles according to claim 1 or 2, wherein a protein content of the noodles is 10 to 60% by mass on a solid content basis.

[Claim 4]

The noodles according to any one of claims 1 to 3, wherein the milk protein-containing raw material comprises at least one member selected from a group consisting of a milk protein concentrate, a milk protein isolate, a micellar

casein concentrate, and a micellar casein isolate.

[Claim 5]

A method for producing noodles, comprising subjecting a raw material composition, comprising wheat flour and a milk protein-containing raw material, to a noodle-making process,

wherein a milk protein content of the milk protein-containing raw material is not less than 80% by mass on a solid content basis, and

wherein at least 60% by mass of the milk protein is micellar casein.

[Claim 6]

The method for producing noodles according to claim 5, wherein a percentage of the milk protein-containing raw material is 2 to 65% by mass based on 100% by mass of a total amount of the wheat flour and the milk protein-containing raw material.

[Claim 7]

The method for producing noodles according to claim 5 or 6, wherein the milk protein-containing raw material comprises at least one member selected from a group consisting of a milk protein concentrate, a milk protein isolate, a micellar casein concentrate, and a micellar casein isolate.