

Description

Title of the Invention

BAKERY PRODUCT AND METHOD FOR MANUFACTURING SAME

Technical Field

[0001]

The present invention relates to a bakery product that is excellent in chewy texture and also has soft texture, i.e., a bakery product that is excellent in mochi-like texture and also has soft texture, and a method for producing the same.

Background Art

[0002]

Mochi (rice cake) is typically produced from glutinous rice steamed and pounded into paste. This traditional food has been favored since olden times because of its unique texture of gumminess, stickiness, and elasticity. In recent years, an increasing number of consumers have preferred food having chewy texture (mochi-like texture) upon eating. Accordingly, the number of products having mochi-like texture is also on the increase among bakery products. Particularly, bakery products not only having mochi-like texture but further having moist texture and soft texture upon eating have been demanded in the market. Such bakery products having mochi-like texture, however, tend to exhibit weakened mochi-like texture when their moist texture or soft texture is enhanced.

[0003]

Some methods have heretofore been disclosed as methods for conferring mochi-like texture to bakery products. Two methods for conferring mochi-like texture to bakery products are known, one of which employs a particular raw material and the other of which utilizes hot water-kneaded dough. Among these methods for conferring mochi-like texture to bakery products, for example, a method for producing a bakery product that is soft, albeit with elasticity, and is excellent in mochi-like texture, comprising combining a phosphate-cross-linked waxy corn starch with a pregelatinized starch is disclosed in Patent Document 1 as the method which employs a particular raw material in order to confer mochi-like texture to bakery products. The waxy corn starch, however, has a characteristic grain-derived odor and therefore causes problems such as impairment of the original bakery flavor of the bakery product.

[0004]

Patent Document 2 discloses a method for producing a bread having mochi-like texture by use of a raw material powder consisting of 62 to 92.5 parts by mass of wheat flour, 7 to 30 parts by mass of a hydroxypropyl starch and/or an acetyl starch, and 0.5 to 8 parts by mass of a pregelatinized starch. Unfortunately, the bread tends to fail to have soft texture because of its purpose of merely conferring chewy texture thereto. Alternatively, Patent Document 3 discloses a method for producing a bread having chewy texture and moist texture using wheat flour, pregelatinized wheat flour and/or pregelatinized wheat

starch, and α -amylase. The bread is made of a wheat-derived raw material and therefore, unfortunately, has weaker mochi-like texture than that of a bread containing strong flour and an etherified starch.

[0005]

Thus, Patent Document 4 discloses a method for producing a bread enhanced in mochi-like texture, soft texture, moist texture, and melt-in-the-mouth, comprising preparing flour paste dough using waxy wheat flour or mixing waxy wheat flour and a pregelatinized starch into hot water-kneaded dough. The bread surely has well-balanced mochi-like texture and soft texture, which, however, cannot always satisfy recent consumers who prefer stronger mochi-like texture.

[0006]

On the other hand, for example, a method for producing hot water-kneaded dough for a bakery product, comprising at least mixing and kneading a dough ingredient containing at least wheat flour and an emulsion with the water temperature of an aqueous phase in the emulsion set to 80 to 100°C, the emulsion containing 3 to 90% by mass of an oil phase and 10 to 97% by mass of the aqueous phase, is disclosed in Patent Document 5 as the method for conferring mochi-like texture to bakery products using hot water-kneaded dough. Patent Document 6 discloses a bakery product produced using hot water-kneaded dough containing 0.05 to 7 parts by mass (in terms of solid content) of a milk raw material with respect to 100 parts by mass of cereal flours and/or starches, the milk raw material having a phospholipid content in a milk-derived solid

content of 0.5% by mass or more with respect to the solid content. These methods which utilize hot water-kneaded dough require using hot water of 80°C to 100°C during dough production and involve complicated steps. Also, these methods require strictly controlling the temperature of hot water. In addition, these methods tend to vary in final products and disadvantageously, cannot easily be applied to mass production.

[0007]

As described above, various methods are disclosed as the methods for conferring mochi-like texture to bakery products. Nevertheless, none of these disclosed methods can mass-produce bakery products having both mochi-like texture and soft texture. The problems associated with the production of such bakery products still remain to be solved.

[0008]

In addition to those described above, the following techniques for producing bakery products using waxy starch are disclosed: Patent Document 7 discloses a mix for bakery food containing a waxy potato starch as a main raw material powder and having a protein content of 0 to 4.0% by mass with respect to the whole mass of the mix, and bakery food having non-conventional appearance and texture obtained using the mix. Mochi-like texture is not conferred to the bakery food, though the Document states that the bakery food has clarity and softness. Alternatively, Patent Document 8 discloses a bakery food that is excellent in keeping quality and has soft texture and moist texture, the bakery food being produced using an

ingredient containing 0.2 to 10 parts by mass of a pregelatinized modified waxy potato starch with respect to 100 parts by mass of raw material cereal flour with wheat flour as a main raw material. This invention is intended to confer soft texture and moist texture to the bakery product and does not confer mochi-like texture to the bakery product.

[0009]

Patent Document 9 discloses ready-to-use refrigeratable liquid dough for preparing pancakes, waffles, brownies, muffins, or cakes, comprising a starch component and an organic acid or an organic acid mixture, wherein the dough is microbiologically stabilized by heating at a temperature of 60°C to 72°C for a time sufficient for substantially reducing bacterial counts in the dough so that the dough can be stored at a temperature of 8°C or lower for at least 3 weeks and wherein the dough has water activity A_w larger than 0.90 and viscosity of 5,000 to 60,000 cP at 4°C and 0.3 rpm and can be stored for a long period, and a baked product obtained using the dough. A feature of this invention is to use a starch with a high gelatinization temperature in order to form a gel only during cooking. The Document states that the dough can be stored for a long period. Characteristic sourness is conferred to the dough due to the organic acid or the organic acid mixture essentially contained therein and therefore, unfortunately, impairs the flavor of the bakery product.

Prior Art Documents

Patent Documents

[0010]

Patent Document 1: Japanese unexamined Patent Application
Publication No. 10-056946

Patent Document 2: Japanese unexamined Patent Application
Publication No. 10-295253

Patent Document 3: Japanese unexamined Patent Application
Publication No. 2003-199482

Patent Document 4: Japanese unexamined Patent Application
Publication No. 2010-057368

Patent Document 5: Japanese unexamined Patent Application
Publication No. 2004-000029

Patent Document 6: Japanese unexamined Patent Application
Publication No. 2009-201469

Patent Document 7: Japanese unexamined Patent Application
Publication No. 2013-179841

Patent Document 8: Japanese unexamined Patent Application
Publication No. 2007-325526

Patent Document 9: Japanese unexamined Patent Application
Publication No. 2004-512846

Summary of the Invention

Object to be Solved by the Invention

[0011]

An object of the present invention is to provide a bakery product that is excellent in mochi-like texture and also has soft texture, and a method for producing the same. Specifically, an object of the present invention is to provide a bakery product having "soft texture" and "mochi-

like texture" with "chewy texture" and "elastic texture", and a method for producing the same.

Means to Solve the Object

[0012]

To attain the object, the present inventors have conducted diligent studies on the production of a bakery product that is excellent in mochi-like texture and also has soft texture and on a starchy raw material for use in production of the bakery product, the formula thereof, etc. Consequently, the present inventors have completed the present invention by finding that a starchy raw material for bakery product production containing a particular amount of a waxy tapioca starch enables production of a bakery product that is excellent in mochi-like texture and also has soft texture.

[0013]

Specifically, according to the present invention, a bakery product that is excellent in mochi-like texture and also has soft texture is produced using a starchy raw material for use in bakery product production, wherein the starchy raw material contains 0.5 to 100 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch with respect to 100 parts by mass of the starchy raw material. The method for producing a bakery product according to the present invention can be applied to the production of various bakery products and can also be applied to the production of bakery products using refrigerated dough or frozen dough to produce a bakery

product that is excellent in mochi-like texture and also has soft texture.

[0014]

As described above, various methods which involve devised selection and formula of raw materials or devised production methods thereof have heretofore been disclosed as methods for conferring mochi-like texture to bakery products. Bakery products having mochi-like texture, however, tend to exhibit weakened mochi-like texture when their moist texture or soft texture is enhanced. Unfortunately, bakery products having both mochi-like texture and soft texture are technically difficult to mass-produce.

[0015]

The production of the bakery product of the present invention employs a waxy tapioca starch (β waxy tapioca starch) and/or a modified waxy tapioca starch as a starchy raw material. A pregelatinized waxy tapioca starch can be used as the modified waxy tapioca starch. Also, one or more modified waxy tapioca starches selected from a hydroxypropyl pregelatinized waxy tapioca starch, a hydroxypropylated cross-linked pregelatinized waxy tapioca starch, an acetyl pregelatinized waxy tapioca starch, and an acetylated cross-linked pregelatinized waxy tapioca starch can be used as the modified waxy tapioca starch. Alternatively, one or more modified waxy tapioca starches selected from an acetyl waxy tapioca starch, an acetylated cross-linked waxy tapioca starch, a hydroxypropyl waxy tapioca starch, and a hydroxypropylated cross-linked waxy tapioca starch of the waxy tapioca starch (β waxy tapioca

starch) can be used as the modified waxy tapioca starch for use in the production of the bakery product of the present invention.

[0016]

The starchy raw material for use in bakery product production of the present invention can be prepared as a starchy raw material mix for bakery product production containing 0.5 to 100 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch with respect to 100 parts by mass of the starchy raw material.

[0017]

The present invention encompasses a method for producing a bakery product having mochi-like texture and soft texture, comprising producing the bakery product using the starchy raw material mix for bakery product production of the present invention as a starchy raw material. The method for producing a bakery product can be used in the production of various bakery products. Examples of the bakery products can include breads, cakes, doughnuts, baked confectioneries, and non-fermented breads.

[0018]

More specifically, the present invention includes:
[1] a bakery product produced using a starchy raw material for use in bakery product production, wherein the starchy raw material contains 0.5 to 100 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch with respect to 100 parts by mass of the starchy raw material;
[2] the bakery product according to [1], wherein the modified waxy tapioca starch is a pregelatinized waxy tapioca starch;
[3] the bakery product according to [1],

wherein the modified waxy tapioca starch is one or more modified waxy tapioca starches selected from the group consisting of a hydroxypropyl pregelatinized waxy tapioca starch, a hydroxypropylated cross-linked pregelatinized waxy tapioca starch, an acetyl pregelatinized waxy tapioca starch, and an acetylated cross-linked pregelatinized waxy tapioca starch; [4] the bakery product according to [1], wherein the modified waxy tapioca starch is one or more modified waxy tapioca starches selected from the group consisting of an acetyl waxy tapioca starch, an acetylated cross-linked waxy tapioca starch, a hydroxypropyl waxy tapioca starch, and a hydroxypropylated cross-linked waxy tapioca starch; and [5] the bakery product according to any one of [1] to [4], wherein the bakery product is a bread, a cake, a doughnut, a baked confectionery, or a non-fermented bread.

[0019]

The present invention also includes: [6] a starchy raw material mix for bakery product production comprising a starchy raw material for use in bakery product production, wherein the starchy raw material contains 0.5 to 100 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch with respect to 100 parts by mass of the starchy raw material; [7] the starchy raw material mix for bakery product production according to [6], wherein the modified waxy tapioca starch contained in the starchy raw material is a modified waxy tapioca starch defined in any one of [2] to [4]; [8] a method for producing a bakery product having mochi-like texture and soft texture, comprising producing the bakery product

using a starchy raw material mix for bakery product production according to [6] or [7] as a starchy raw material; and [9] the method for producing a bakery product according to [8], wherein the bakery product is a bread, a cake, a doughnut, a baked confectionery, or a non-fermented bread.

Effect of the Invention

[0020]

The present invention provides a bakery product that is soft and is also excellent in chewy texture, i.e., a bakery product that is excellent in mochi-like texture and also has soft texture. The method for producing a bakery product according to the present invention can be used in the production of various bakery products and can be applied to the production of a wide range of bakery products to produce a bakery product that is excellent in mochi-like texture and also has soft texture. The method for producing a bakery product according to the present invention can be further applied to refrigerated dough or frozen dough and as such, can provide a high-quality bakery product excellent in distribution characteristics.

Mode for Carrying Out the Invention

[0021]

According to the present invention, a bakery product that is excellent in mochi-like texture and also has soft texture is produced using a starchy raw material for use in bakery product production, wherein the starchy raw material contains 0.5 to 100 parts by mass of a waxy

tapioca starch and/or a modified waxy tapioca starch with respect to 100 parts by mass of the starchy raw material.

[0022]

In the production of the bakery product of the present invention, the "waxy tapioca starch" used in the starchy raw material refers to a starch made of waxy tapioca as a raw material and composed almost 100% of amylopectin. A waxy tapioca starch produced by Siam Quality Starch Co., Ltd. (Thailand) using cassava roots of waxy tapioca obtained from Thai Tapioca Development Institute (Thailand) as a raw material can be used as the waxy tapioca starch.

[0023]

In the production of the bakery product of the present invention, an unmodified waxy tapioca starch (non-pregelatinized starch is referred to as a β starch relative to a pregelatinized starch) and a modified waxy tapioca starch (physically and/or chemically modified form of the starch) can be used as the waxy tapioca starch contained in the starchy raw material. A pregelatinized waxy tapioca starch can be used as the modified waxy tapioca starch. In this context, the pregelatinized starch refers to a powdery starch obtained by the heating of a starch in the presence of water using a drum dryer, an extruder, a spray dryer, or the like and the drying of the starch thus pregelatinized, followed by pulverization according to the need. The β waxy tapioca starch and the pregelatinized waxy tapioca starch can be used in the present invention.

[0024]

In the production of the bakery product of the present invention, a modified waxy tapioca starch obtained by the chemical modifying of the β waxy tapioca starch or the pregelatinized waxy tapioca starch can be used as the chemically modified waxy tapioca starch contained in the starchy raw material. This modifying of the waxy tapioca starch can be carried out by one or a combination of general starch modifying methods selected from hydroxypropylation, acetylation, cross-linking, oxidation, and acid dipping. In this context, the hydroxypropylation refers to a treatment by which a starch is reacted with propylene oxide. The acetylation refers to a treatment by which a starch is reacted with an acetic anhydride or a vinyl acetate monomer or the like. These treatments can each be carried out according to a routine method. The cross-linking refers to a treatment by which a starch is reacted by the addition of a cross-linking agent such as metaphosphate or phosphorus oxychloride, and can be carried out according to a routine method. The oxidation refers to a treatment by which sodium hypochlorite is allowed to act on a starch. The acid dipping refers to a treatment by which sulfuric acid is allowed to act on a starch. These treatments can each be carried out according to a routine method.

[0025]

In the production of the bakery product of the present invention, the β waxy tapioca starch and/or the modified waxy tapioca starch contained in the starchy raw material is contained at 0.5 parts by mass or more with respect to 100 parts by mass of the starchy raw material

and can thereby confer favorable mochi-like texture and soft texture to the bakery product. The blending ratio of the β waxy tapioca starch and/or the modified waxy tapioca starch is more preferably 10 to 85 parts by mass and can thereby achieve more favorable mochi-like texture and soft texture.

[0026]

In the production of the bakery product of the present invention, the starchy raw material may contain, for example, a raw material cereal flour other than the β waxy tapioca starch and/or the modified waxy tapioca starch. In such a case, wheat flour, a starch other than the waxy tapioca starch, and other grain powders can be contained according to the need in consideration of the type of the bakery product, etc. General wheat flour for use in bakery production can be used as the wheat flour. For example, extra strong flour, strong flour, all-purpose flour, or weak flour can be used. Typical examples thereof include: strong flour such as wheat flour produced from Canada Western Red Spring wheat; all-purpose flour such as wheat flour produced from Australian Standard White wheat; and weak flour such as wheat flour produced from Western White wheat or White Club wheat. Alternatively, wheat flour yielded in Japan (e.g., Yumekikara, Kitahonami, and Haruyo-Koi), low-amylose wheat flour, high-amylose wheat flour, waxy wheat flour, or the like may be used.

[0027]

In the production of the bakery product of the present invention, the starchy raw material may contain,

for example, the raw material cereal flour other than the β waxy tapioca starch and/or the modified waxy tapioca starch. In such a case, a starch such as corn starch, waxy corn starch, potato starch, waxy potato starch, wheat starch, waxy wheat starch, tapioca starch, sago starch, mung bean starch, pea starch, rice starch, glutinous rice starch, ocarina starch, or modified starch or pregelatinized starch thereof can be used as the cereal flour other than wheat flour in the starchy raw material. The starch may be mixed with a protein component such as glutenin, gliadin, or gluten and used as a substitute for wheat flour. In such a case of use, the content of the raw material cereal flours inclusive of the protein component such as gluten can be calculated. Also, a resistant starch (RS) provided with resistance to human digestive enzymes may be used. The resistant starch is generally classified into four types called RS1, RS2, RS3, and RS4. RS1 refers to a starch that is physically inaccessible due to the trapping of its granules in the protein matrix. RS2 refers to a starch that can resist digestion with α -amylase. RS3 refers to a starch consisting of retrograded amylose. RS4 refers to a modified starch that can resist digestion with α -amylase.

[0028]

In the production of the bakery product of the present invention, a grain powder such as whole wheat, bran, rye, rice, corn, barley, Japanese barnyard millet, foxtail millet, millet, sprouted brown rice, black rice, red rice, soybean, adzuki bean, amaranth, or quinoa flour can be used as other grain powders contained in the

starchy raw material. The starchy raw material other than the waxy tapioca starch in the bakery product of the present invention is particularly preferably wheat flour, which can maximize the original flavor of the bakery product.

[0029]

In the production of the bakery product of the present invention, the pregelatinized waxy tapioca starch and/or the modified pregelatinized waxy tapioca starch contained in the starchy raw material is contained in the range of 0.5 parts by mass or more with respect to 100 parts by mass of the starchy raw material. The content of the pregelatinized waxy tapioca starch is particularly preferably 0.5 to 15 parts by mass, more preferably 1 to 10 parts by mass, with respect to 100 parts by mass of the starchy raw material. Use of the pregelatinized waxy tapioca starch and/or the modified pregelatinized waxy tapioca starch can confer, at a smaller content, more favorable mochi-like texture and soft texture to the bakery product, compared with use of the β waxy tapioca starch and/or the modified β waxy tapioca starch. The object of the present invention can be achieved even if the content of the pregelatinized waxy tapioca starch and/or the modified pregelatinized waxy tapioca starch exceeds the upper limit of the above range. From the viewpoint of cost, however, it is more preferred that the content should not exceed the upper limit.

[0030]

In the production of the bakery product of the present invention, the modified β waxy tapioca starch

contained in the starchy raw material is particularly preferably a hydroxypropyl waxy tapioca starch or an acetyl waxy tapioca starch and may be a hydroxypropylated cross-linked waxy tapioca starch or an acetylated cross-linked waxy tapioca starch obtained by further cross-linking treatment of the starch. The modified β waxy tapioca starch can confer favorable mochi-like texture and soft texture to the bakery product and further improves the shelf life of the bakery product.

[0031]

In the production of the bakery product of the present invention, the modified pregelatinized waxy tapioca starch contained in the starchy raw material is particularly preferably a hydroxypropyl pregelatinized waxy tapioca starch or an acetyl pregelatinized waxy tapioca starch and may be a hydroxypropylated cross-linked pregelatinized waxy tapioca starch or an acetylated cross-linked pregelatinized waxy tapioca starch obtained by further cross-linking treatment of the starch. The modified pregelatinized waxy tapioca starch can confer favorable mochi-like texture and soft texture to the bakery product and further improves the shelf life of the bakery product.

[0032]

In this context, an index called a degree of substitution (indicated by the number of moles of substituents per anhydroglucose residue in the starch) can be used as an index showing the progression of hydroxypropylation or acetylation reaction for the modified waxy tapioca starch. The degree of substitution

can be measured according to a method described in Denpun-Kanren Toushitsu Jikken Ho (Experimental Methods for Starch and Related Carbohydrates in English) (Nakamura and Kainuma ed., Gakkai Shuppan Center Co., Ltd.). The degree of substitution in the hydroxypropylation or acetylation of the waxy tapioca starch used in the present invention is not particularly limited and is preferably 0.02 to 0.18.

[0033]

Also, an index called a sedimentation volume can be used as an index showing the progression of cross-linking. The sedimentation volume can be measured according to the following method: a suspension containing 2.0 g (in terms of dry content) of a sample dispersed in 98 mL of water is heated at 90°C for 30 minutes and then cooled to 30°C. This starch solution is placed in a 100-mL graduated cylinder. The upper end of the solution is allowed to stand at 100 mL. After 24 hours, the volume (mL) of a whitish layer is measured. This measurement value is used as the sedimentation volume. The sedimentation volume of the cross-linked waxy tapioca starch used in the present invention is not particularly limited and is preferably 85 or lower.

[0034]

In the production of the bakery product of the present invention, yeast, baking powder, common salt, water, and other secondary ingredients may be added, if necessary, in addition to the starchy raw material. Bakery dough is prepared on the basis of these raw materials according to a routine method and heat-treated by baking, frying, steaming, or the like to produce the

bakery product of the present invention. At that time, the raw material cereal flours are contained at preferably 10 parts by mass to 80 parts by mass with respect to 100 parts by mass of the bakery product.

[0035]

In this context, the secondary ingredients refer to general secondary ingredients for use in bakery production or secondary ingredients for use depending on the type of a bakery, its desired quality, etc. Specific examples of the secondary ingredients can include: carbohydrates such as sugar, glucose, isomerized sugar, rare sugar, rare sugar-containing isomerized sugar (e.g., Rare Sugar Sweet, manufactured by Matsutani Chemical Industry Co., Ltd.), oligosaccharides, dextrin, and decomposition products of reduced starch; dairy products such as non-fat dry milk powder, whole milk powder, and cow's milk; fats such as shortening, margarine, butter, powdered fat, and emulsified fat; emulsifiers such as glycerin fatty acid ester, sucrose fatty acid ester, and calcium stearoyl lactate; spices such as cinnamon and basil; liquors such as brandy and rum; dry fruits such as raisin and dry cherry; nuts such as almond and peanut; enzymes such as α -amylase, β -amylase, glucosidase, protease, lipase, xylanase, hemicellulase, and glucose oxidase; flavors such as vanilla essence; artificial sweeteners such as aspartame; dietary fibers such as pectin, guar gum decomposition products, agarose, glucomannan, polydextrose, sodium alginate, cellulose, hemicellulose, lignin, chitin, chitosan, resistant dextrin, and citrus fiber; and other ingredients such as vital gluten and cocoa powder.

[0036]

In the method for producing a bakery product according to the present invention, the bakery production method itself does not differ in raw materials, production procedures, and production conditions from bakery production methods known in the art except that a starchy raw material containing the waxy tapioca starch and/or the modified waxy tapioca starch is used as the starchy raw material. The starchy raw material of the present invention containing the waxy tapioca starch and/or the modified waxy tapioca starch can be prepared as a starchy raw material mix for bakery production. Alternatively, the starchy raw material of the present invention containing the waxy tapioca starch may be combined with an enzyme, a high water-absorbent material and the like to prepare a quality improving agent in advance. This improving agent can also be added to dough for a bakery product to obtain the bakery product of the present invention. The starchy raw material containing the waxy tapioca starch and/or the modified waxy tapioca starch may be further used in a bakery production method called hot water-kneading method, which involves preliminarily kneading a portion of dough with hot water. Also, the waxy tapioca starch containing the waxy tapioca starch and/or the modified waxy tapioca starch can be applied to refrigerated dough or frozen dough, which has been utilized in recent years for the purpose of rationalizing bakery food production steps or in light of distribution.

[0037]

Examples of the bakery product to which the method for producing a bakery product according to the present invention can be applied can include: breads such as "white breads including Pullman breads and white breads with a round top, French breads including baguettes and Parisien breads, and various bread rolls including sweet buns, Danish pastries, crescent rolls, buns, bagels, naans, focaccias, English muffins, and table rolls"; doughnuts such as "yeast doughnuts and cake doughnuts"; cakes such as "steamed cakes, sponge cakes, butter cakes, pancakes, madeleines, and muffins"; non-fermented breads such as "Biscoito de polvilho and Pao de queijo"; baked confectioneries such as "pate a choux, crapes, waffles, Dorayaki (two small pancakes with bean jam in between), castella (kasutera sponge cake), Taiyaki (fish-shaped cake filled with red bean paste), Imagawa-yaki (Japanese-style pancake filled with bean jam), and cookies"; and other products such as pizza, tortilla, Chinese dumplings, and steamed breads.

[0038]

Hereinafter, the present invention will be described specifically with reference to Examples and Comparative Examples. However, the scope of the present invention is not limited by Examples below. In this context, "part" represents part by mass, and "%" represents % by mass. Starch without the term "pregelatinized" represents β starch.

Examples

[0039]

(Regarding starch used)

The waxy tapioca starch used was waxy tapioca starch from Siam Quality Starch Co., Ltd. (Thailand). Modified β waxy tapioca starch, pregelatinized waxy tapioca starch, modified pregelatinized waxy tapioca starch were prepared as shown in Reference Examples 1 to 7 using the waxy tapioca starch as a raw material.

[0040]

[Reference Example 1]

20 parts of sodium sulfate were dissolved in 130 parts of water. 100 parts of waxy tapioca starch were dispersed in this solution to prepare slurry. 1000 ppm of sodium trimetaphosphate was added to the slurry under alkaline conditions of pH = 11 to 12 and reacted therewith at 40°C for 20 hours to perform the cross-linking treatment of the waxy tapioca starch. The slurry thus reacted was neutralized with sulfuric acid, then washed with water, dehydrated, and dried to obtain phosphate-cross-linked waxy tapioca starch (sample No. 1). The starch had a sedimentation volume of 4.5.

[0041]

[Reference Example 2]

100 parts of waxy tapioca starch were dispersed in 130 parts of water to prepare slurry. A 3% aqueous caustic soda solution was added to the slurry with stirring. While the pH was kept at 8.0 to 8.5, 4.5% vinyl acetate was added to the mixture and reacted therewith at 25°C for 20 minutes to perform the acetylation treatment of the waxy tapioca starch. The slurry thus reacted was neutralized with sulfuric acid, then washed with water,

dehydrated, and dried to obtain acetyl waxy tapioca starch (sample No. 2). The starch had a degree of substitution of 0.054.

[0042]

[Reference Example 3]

100 parts of waxy tapioca starch were dispersed in 130 parts of water to prepare slurry. 6.0% propylene oxide was added to the slurry under alkaline conditions of pH = 11 to 12 and reacted therewith at 40°C for 20 hours to perform the hydroxypropylation treatment of the waxy tapioca starch. The slurry thus reacted was neutralized with sulfuric acid, then washed with water, dehydrated, and dried to obtain hydroxypropyl waxy tapioca starch (sample No. 3). The starch had a degree of substitution of 0.097.

[0043]

[Reference Example 4]

100 parts of waxy tapioca starch were dispersed in 130 parts of water to prepare slurry. 6.0% propylene oxide was added to the slurry under alkaline conditions of pH = 11 to 12 and reacted therewith at 40°C for 20 hours. Subsequently, 1000 ppm of sodium trimetaphosphate was added to the mixture and reacted therewith. The reaction mixture was neutralized with sulfuric acid, then washed with water, dehydrated, and dried to obtain hydroxypropylated phosphate-cross-linked waxy tapioca starch (sample No. 4). The starch had a degree of substitution of 0.095 and a sedimentation volume of 4.9.

[0044]

[Reference Example 5]

100 parts of waxy tapioca starch were dispersed in 120 parts of water to prepare slurry. The slurry was dried with a drum dryer to pregelatinize the starch, which was then pulverized to obtain pregelatinized waxy tapioca starch (sample No. 5).

[0045]

[Reference Example 6]

100 parts of the hydroxypropylated phosphate-cross-linked waxy tapioca starch of sample No. 4 were added to 120 parts of water to prepare slurry. The slurry was dried with a drum dryer to pregelatinize the starch, which was then pulverized to obtain hydroxypropylated cross-linked pregelatinized waxy tapioca starch (sample No. 6).

[0046]

[Reference Example 7]

100 parts of the hydroxypropyl waxy tapioca starch of sample No. 3 were added to 120 parts of water to prepare slurry. The slurry was dried with a drum dryer to pregelatinize the starch, which was then pulverized to obtain hydroxypropyl pregelatinized waxy tapioca starch (sample No. 7).

[0047]

(Method for evaluating bakery product)

Each bakery product was prepared according to a routine method. The bakery product was evaluated for its softness (soft texture) and elasticity (mochi-like texture) upon eating. For use in the evaluation, the prepared bakery product was naturally cooled at room temperature. The bakery product thus allowed to return to room temperature was put in a vinyl bag, which was then

hermetically sealed and kept at 20°C for 24 hours to prepare a sample for evaluation. The sample was evaluated for the soft texture and mochi-like texture of the bakery product by ten well-trained panelists on a scale of on which 5 is perfection for each item as shown in Table 1. Scores for the soft texture and mochi-like texture of a reference sample were each set to 3. Averages of the scores given by these ten panelists were determined and used as the scores for the soft texture and mochi-like texture of each sample.

[0048]

Comprehensive evaluation was conducted as follows:

Poor: The scores of soft texture and mochi-like texture were both lower than 3.7.

Fair: Only either of the scores of soft texture and mochi-like texture was 3.7 or higher.

Good: The scores of soft texture and mochi-like texture were both 3.7 or higher and the total score of them was lower than 8.4.

Excellent: The scores of soft texture and mochi-like texture were both 3.7 or higher and the total score of them was 8.4 or higher.

[0049]

[Table 1]

	Score	Evaluation criteria
Softness (soft texture)	5	Very soft.
	4	Soft.
	3	Slightly soft. Hardly dry and mealy. (Reference sample)
	2	Slightly less soft. Slightly dry or mealy.
	1	Not soft. Dry and mealy.
Elasticity (mochi-like texture)	5	Very elastic.
	4	Elastic.
	3	Slightly elastic. Hardly fragile or texture substantially without a lack of body. (Reference sample)
	2	Slightly less elastic. Slightly fragile or texture with a slight lack of body.
	1	Less elastic. Fragile or texture with a lack of body and a lack of firmness.

[0050]

<Test 1>

[0051]

(White bread test 1)

Each white bread with a round top was produced according to the blending ratios shown in Table 2 by the sponge method using wheat flour partially replaced with waxy tapioca starch, tapioca starch, waxy corn starch, waxy potato starch, or potato starch.

[0052]

[Table 2]

	Ingredient	Comparative Example 1	Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4	Comparative Example 5
Sponge	Strong flour	70	70	70	70	70	70
	Yeast food	0.12	0.12	0.12	0.12	0.12	0.12
	Baker's yeast	2	2	2	2	2	2
	Water	42	42	42	42	42	42
Dough mixing	Strong flour	30	15	15	15	15	15
	Waxy tapioca starch	-	15	-	-	-	-
	Tapioca starch	-	-	15	-	-	-
	Waxy corn starch	-	-	-	15	-	-
	Waxy potato starch	-	-	-	-	15	-
	Potato starch	-	-	-	-	-	15
	Caster sugar	6	6	6	6	6	6
	Common salt	2	2	2	2	2	2
	Non-fat dry milk powder	2	2	2	2	2	2
	Water	24	24	24	24	24	24
	Shortening	5	5	5	5	5	5

[0053]

(Results of white bread test 1)

As shown in Table 3, the white bread produced using the waxy tapioca starch had sufficient mochi-like texture and soft texture, compared with the white breads produced using other starches. Thus, the white bread of interest was obtained.

[0054]

[Table 3]

Item	Comparative Example 1	Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4	Comparative Example 5
Type of starch	-	Waxy tapioca	Tapioca	Waxy corn	Waxy potato	Potato
Softness	3.0	4.5	3.5	4.4	3.3	2.5
Elasticity	3.0	4.3	3.3	1.8	2.8	2.1
Total score	6.0	8.8	6.8	6.2	6.1	4.6
Comprehensive evaluation	Poor	Excellent	Poor	Fair	Poor	Poor

[0055]

<Test 2>

[0056]

(White bread test 2)

Each white bread with a round top was produced by the sponge method using varying contents of waxy tapioca starch as shown in Table 4.

[0057]

[Table 4]

	Ingredient	Comparative Example 6	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8
Sponge	Strong flour	70	70	70	70	70	50	15	5
	Waxy tapioca starch	0	0	0	0	0	20	55	65
	Yeast food	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
	Baker's yeast	2	2	2	2	2	2	2	2
	Water	42	42	42	42	42	42	42	42
Dough mixing	Strong flour	29.7	29.5	27	20	0	0	0	0
	Waxy tapioca starch	0.3	0.5	3	10	30	30	30	30
	Wheat gluten	-	-	-	-	-	6	10	10
	Caster sugar	6	6	6	6	6	6	6	6
	Common salt	2	2	2	2	2	2	2	2
	Non-fat dry milk powder	2	2	2	2	2	2	2	2
	Water	24	24	24	24	24	24	24	24
	Shortening	5	5	5	5	5	5	5	5

[0058]

(Results of white bread test 2)

As shown in Table 5, the white bread containing 0.5 parts by mass or more of the waxy tapioca starch with respect to 100 parts by mass of the starchy raw material exhibited favorable soft texture and mochi-like texture.

[0059]

[Table 5]

Item	Comparative Example 6	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8
Ratio of waxy tapioca starch	0.3	0.5	3	10	30	50	85	95
Softness	3.5	3.9	4.1	4.2	4.5	4.6	4.6	4.5
Elasticity	3.7	3.9	4.2	4.2	4.5	4.4	4.1	3.7
Total score	7.2	7.8	8.3	8.4	9.0	9.0	8.7	8.2
Comprehensive evaluation	Fair	Good	Good	Excellent	Excellent	Excellent	Excellent	Good

[0060]

<Test 3>

[0061]

(White bread test 3)

Each white bread with a round top was produced by the sponge method using modified β waxy tapioca starch (sample Nos. 1 to 4) as shown in Table 6. In this context, sample No. 1 is cross-linked waxy tapioca starch; sample No. 2 is acetyl waxy tapioca starch; sample No. 3 is hydroxypropyl waxy tapioca starch; sample No. 4 is hydroxypropylated cross-linked waxy tapioca starch; and sample No. 5 is pregelatinized waxy tapioca starch.

[0062]

[Table 6]

	Ingredient	Example 9	Example 10	Example 11	Example 12	Example 13	Example 14
Sponge	Strong flour	70	70	70	70	70	70
	Yeast food	0.12	0.12	0.12	0.12	0.12	0.12
	Baker's yeast	2	2	2	2	2	2
	Water	42	42	42	42	42	42
Dough mixing	Strong flour	22	22	27	22	15	27.5
	Sample No.1	8	-	-	-	-	-
	Sample No.2	-	8	-	-	-	-
	Sample No.3	-	-	3	-	15	2
	Sample No.4	-	-	-	8	-	-
	Sample No.5	-	-	-	-	-	0.5
	Caster sugar	6	6	6	6	6	6
	Common salt	2	2	2	2	2	2
	Non-fat dry milk powder	2	2	2	2	2	2
	Water	24	24	24	24	24	24.5
	Shortening	5	5	5	5	5	5

[0063]

(Results of white bread test 3)

As shown in Table 7, use of the waxy tapioca starch treated by acetylation, hydroxypropylation, or hydroxypropylation and cross-linking as modified β waxy tapioca starch produced particularly favorable results about both soft texture and mochi-like texture. Also, use of the modified β waxy tapioca starch and the pregelatinized waxy tapioca starch in combination resulted in favorable soft texture and mochi-like texture.

[0064]

[Table 7]

Item	Example 9	Example 10	Example 11	Example 12	Example 13	Example 14
Type of modifying of waxy tapioca	Cross-linked	Acetylated	Hydroxypropylated	Hydroxypropylated Cross-linked	Hydroxypropylated	Hydroxypropylated + pregelatinized
Softness	4.0	4.5	4.5	4.7	4.8	4.5
Elasticity	4.0	4.6	4.3	4.5	4.3	4.3
Total score	8.0	9.1	8.8	9.2	9.1	8.8
Comprehensive evaluation	Good	Excellent	Excellent	Excellent	Excellent	Excellent

[0065]

<Test 4>

[0066]

(White bread test 4)

Each white bread with a round top was produced according to the formula shown in Table 8 by the sponge method using wheat flour partially replaced with pregelatinized waxy tapioca starch (sample No. 5), modified pregelatinized waxy tapioca starch (sample No. 6 or 7), or pregelatinized tapioca starch (Matsunorin M-22, manufactured by Matsutani Chemical Industry Co., Ltd.).

[0067]

[Table 8]

	Ingredient	Comparative Example 7	Comparative Example 8	Example 15	Example 16	Example 17	Example 18	Example 19	Example 20	Example 21
Sponge	Strong flour	70	70	70	70	70	70	70	70	70
	Yeast food	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
	Baker's yeast	2	2	2	2	2	2	2	2	2
	Water	42	42	42	42	42	42	42	42	42
Dough mixing	Strong flour	27	29.8	29.5	29.0	27.0	20	15	27	27
	Pregelatinized tapioca starch	3	-	-	-	-	-	-	-	-
	Sample No.5	-	0.2	0.5	1	3	10	15	-	-
	Sample No.6	-	-	-	-	-	-	-	3	-
	Sample No.7	-	-	-	-	-	-	-	-	3
	Caster sugar	6	6	6	6	6	6	6	6	6
	Common salt	2	2	2	2	2	2	2	2	2
	Non-fat dry milk powder	2	2	2	2	2	2	2	2	2
	Water	27	24.2	24.5	24.5	27	34	39	27	27
	Shortening	5	5	5	5	5	5	5	5	5

[0068]

(Results of white bread test 4)

As shown in Table 9, the white bread containing 0.5 parts by mass or more of the pregelatinized waxy tapioca starch with respect to 100 parts by mass of the starchy raw material exhibited favorable soft texture and mochi-like texture. Also, the white bread produced using the pregelatinized waxy tapioca starch treated by hydroxypropylation or hydroxypropylation followed by cross-linking exhibited favorable soft texture and mochi-like texture.

[0069]

[Table 9]

Item	Comparative Example 7	Comparative Example 8	Example 15	Example 16	Example 17	Example 18	Example 19	Example 20	Example 21
Type of starch	Pregelatinized tapioca	Pregelatinized waxy tapioca						Hydroxypropylated cross-linked pregelatinized waxy tapioca	Hydroxypropyl pregelatinized waxy tapioca
Content	3	0.2	0.5	1	3	10	15	3	3
Softness	4.1	3.5	3.9	4.2	4.3	4.8	4.8	4.5	4.9
Elasticity	2.2	3.8	4.0	4.2	4.3	4.2	3.4	4.5	3.9
Total score	6.3	7.3	7.9	8.4	8.6	9.0	8.2	9.0	8.8
Comprehensive evaluation	Fair	Fair	Good	Excellent	Excellent	Excellent	Good	Excellent	Excellent

[0070]

<Test 5>

[0071]

(White bread test 5)

Each white bread with a round top was produced by the sponge method using wheat flour made in Japan and modified β waxy tapioca starch (sample Nos. 1 to 4) as shown in Table 10. In this context, sample No. 1 is cross-linked waxy tapioca starch; sample No. 2 is acetyl waxy tapioca starch; sample No. 3 is hydroxypropyl waxy tapioca starch; and sample No. 4 is hydroxypropylated cross-linked waxy tapioca starch.

[0072]

[Table 10]

	Ingredient	Comparative Example 9	Example 22	Example 23	Example 24	Example 25
Sponge	Extra strong flour made in Japan	42	42	42	42	42
	All-purpose flour made in Japan	28	28	28	28	28
	Yeast food	0.12	0.12	0.12	0.12	0.12
	Baker's yeast	2	2	2	2	2
	Water	42	42	42	42	42
Dough mixing	Extra strong flour ^{*1}	18	15	15	15	27
	All-purpose flour ^{*2}	12	-	-	-	-
	Sample No.1	-	15	-	-	-
	Sample No.2	-	-	15	-	-
	Sample No.3	-	-	-	15	-
	Sample No.4	-	-	-	-	15
	Caster sugar	6	6	6	6	6
	Common salt	2	2	2	2	2
	Non-fat dry milk powder	2	2	2	2	2
	Water	24	24	24	24	24
	Shortening	5	5	5	5	5

*1: Yumechikara (wheat flour made in Hokkaido, Japan)

*2: Kitahonami (wheat flour made in Hokkaido, Japan)

[0073]

(Results of white bread test 5)

As shown in Table 11, even use of wheat flour made in Japan was able to confer favorable soft texture and

mochi-like texture to the white bread by the partial replacement of the wheat flour with waxy tapioca starch.

[0074]

[Table 11]

Item	Comparative Example 9	Example 22	Example 23	Example 24	Example 25
Type of modification	-	Cross-linked	Acetylated	hydroxypropylated	hydroxypropylated cross-linked
Softness	3.0	4.5	4.9	4.7	4.5
Elasticity	3.0	4.6	4.3	4.5	4.3
Total score	6.0	9.1	9.2	9.2	8.8
Comprehensive evaluation	Poor	Excellent	Excellent	Excellent	Excellent

[0075]

<Test 6 (white bread test 6)>

Each quality improving agent was prepared according to the formula shown in Table 12 using tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3), Herbacel AQ Plus as a highly water-absorbent material, and the like. Each white bread was produced according to the formula shown in Table 13 by a routine method using the quality improving agent.

[0076]

[Table 12]

Ingredient	Improving agent 1	Improving agent 2	Improving agent 3
Tapioca starch	50	-	-
Waxy tapioca starch	-	50	-
Sample No.3	-	-	50
Vital gluten ^{*3}	40	40	40
Citrus fiber ^{*4}	10	10	10

*3: PineGlu M (Matsutani Chemical Industry Co., Ltd.)

*4: Herbacel AQ Plus (DSP Gokyo Food & Chemical Co., Ltd.)

[0077]

[Table 13]

	Ingredient	Comparative Example 10	Example 26	Example 27
Sponge	Strong flour	70	70	70
	Yeast food	0.12	0.12	0.12
	Baker's yeast	2	2	2
	Water	42	42	42
Dough mixing	Strong flour	25	25	25
	Improving agent 1	5	-	-
	Improving agent 2	-	5	-
	Improving agent 3	-	-	5
	Caster sugar	6	6	6
	Common salt	2	2	2
	Non-fat dry milk powder	2	2	2
	Water	26	26	26
	Shortening	5	5	5

[0078]

(Results of white bread test 6)

As shown in Table 14, the white bread obtained using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch in the quality improving agent also exhibited favorable soft texture and mochi-like texture.

[0079]

[Table 14]

Item	Comparative Example 10	Example 26	Example 27
Type of starch	Tapioca	Waxy tapioca	Hydroxypropyl waxy tapioca
Softness	3.8	4.3	4.5
Elasticity	3.1	4.2	4.5
Total score	6.9	8.5	9.0
Comprehensive evaluation	Fair	Excellent	Excellent

[0080]

<Test 7>

[0081]

(Table roll test)

Each table roll was produced according to the formula shown in Table 15 by the sponge method using wheat flour partially replaced with waxy tapioca starch, tapioca

starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0082]

[Table 15]

	Ingredient	Comparative Example 11	Comparative Example 12	Example 28	Example 29	Example 30
Sponge	Strong flour	70	70	70	70	70
	Yeast food	0.12	0.12	0.12	0.12	0.12
	Caster sugar	3	3	3	3	3
	Whole egg	10	10	10	10	10
	Baker's yeast	2.5	2.5	2.5	2.5	2.5
	Water	32	32	32	32	32
Dough mixing	Strong flour	30	15	15	15	15
	Tapioca starch	-	15	-	-	7.5
	Waxy tapioca starch	-	-	15	-	7.5
	Sample No.3	-	-	-	15	-
	Caster sugar	11	11	11	11	11
	Common salt	1.6	1.6	1.6	1.6	1.6
	Non-fat dry milk powder	3	3	3	3	3
	Water	22	22	22	22	22
	Margarine	10	10	10	10	10

[0083]

(Results of table roll test)

As shown in Table 16, use of the waxy tapioca starch or the hydroxypropyl waxy tapioca starch was able to produce a table roll having favorable soft texture and mochi-like texture.

[0084]

[Table 16]

Item	Comparative Example 11	Comparative Example 12	Example 28	Example 29	Example 30
Type of starch	Wheat flour alone	Tapioca	Waxy tapioca	Hydroxypropyl waxy tapioca	Waxy tapioca + tapioca
Softness	3.0	3.7	4.4	4.8	4.1
Elasticity	3.0	3.3	4.5	4.6	3.8
Total score	6.0	7.0	8.9	9.4	7.9
Comprehensive evaluation	Poor	Fair	Excellent	Excellent	Good

[0085]

<Test 8 (sweet bun test)>

Each sweet bun (Anpan (Japanese sweet red bean bun)) was produced according to the formula shown in Table 17 by the sponge method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3). The Japanese sweet red bean used was Japanese sweet red bean from Matoba-Seianjo Co., Ltd.

[0086]

[Table 17]

	Ingredient	Comparative Example 13	Comparative Example 14	Example 31	Example 32
Sponge	Strong flour	70	70	70	70
	Yeast food	0.1	0.1	0.1	0.1
	Caster sugar	3	3	3	3
	Whole egg	10	10	10	10
	Baker's yeast	4	4	4	4
	Water	31	31	31	31
Dough mixing	Strong flour	30	15	15	15
	Tapioca starch	-	15	-	-
	Waxy tapioca starch	-	-	15	-
	Sample No.3	-	-	-	15
	Caster sugar	22	22	22	22
	Common salt	1	1	1	1
	Non-fat dry milk powder	3	3	3	3
	Water	20	20	20	20
	Shortening	8	8	8	8

[0087]

(Results of sweet bun (Anpan (Japanese sweet red bean bun)) test)

As shown in Table 18, the sweet bun produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch exhibited favorable soft texture and mochi-like texture.

[0088]

[Table 18]

Item	Comparative Example 13	Comparative Example 14	Example 31	Example 32
Type of starch	Wheat flour alone	Tapioca	Waxy tapioca	Hydroxypropyl waxy tapioca
Softness	3.0	3.0	4.2	4.7
Elasticity	3.0	3.7	4.2	4.5
Total score	6.0	6.7	8.4	9.2
Comprehensive evaluation	Poor	Fair	Excellent	Excellent

[0089]

<Test 9 (Danish pastry test)>

Each Danish pastry was produced according to the formula shown in Table 19 by a routine method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0090]

[Table 19]

Ingredient	Comparative Example 15	Comparative Example 16	Example 33	Example 34
Strong flour	80	65	65	65
Weak flour	20	-	-	-
Tapioca starch	-	35	-	-
Waxy tapioca starch	-	-	35	-
Sample No.3	-	-	-	35
Baker's yeast	4	4	4	4
Yeast food	0.12	0.12	0.12	0.1
Caster sugar	18	18	18	18
Common salt	1.4	1.4	1.4	1.4
Non-fat dry milk powder	4	4	4	4
Shortening	10	10	10	10
Whole egg	10	10	10	10
Water	46	46	46	46
Roll-in fat	40	40	40	40

[0091]

(Results of Danish pastry test)

As shown in Table 20, the Danish pastry produced using the waxy tapioca starch or the hydroxypropyl waxy

tapioca starch exhibited favorable soft texture and mochi-like texture.

[0092]

[Table 20]

Item	Comparative Example 15	Comparative Example 16	Example 33	Example 34
Type of starch	Wheat flour alone	Tapioca	Waxy tapioca	Hydroxypropyl waxy tapioca
Softness	3.0	3.8	4.3	4.5
Elasticity	3.0	3.1	4.2	4.5
Total score	6.0	6.9	8.5	9.0
Comprehensive evaluation	Poor	Fair	Excellent	Excellent

[0093]

<Test 10 (Danish pastry test 2)>

Each flour paste rolled-dough was prepared according to the formula shown in Table 21 by a routine method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3). The dough was baked to produce each Danish pastry.

[0094]

[Table 21]

Ingredient	Comparative Example 17	Comparative Example 18	Example 35	Example 36
Powder for exclusive use in French bread	100	60	60	60
Tapioca starch	-	40	-	-
Waxy tapioca starch	-	-	40	-
Sample No.3	-	-	-	40
Baker's yeast	4	4	4	4
Yeast food	0.12	0.12	0.12	0.12
Caster sugar	16	16	16	16
Common salt	1.8	1.8	1.8	1.8
Non-fat dry milk powder	6	6	6	6
Margarine	10	10	10	10
Whole egg	10	10	10	10
Water	45	45	45	45
Flour paste*5	vs. dough 30	vs. dough 30	vs. dough 30	vs. dough 30

*5: Roll-in Sheet Milk (Oriental Yeast Co., Ltd.)

[0095]

(Results of Danish pastry test 2)

As shown in Table 22, the Danish pastry produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch exhibited favorable soft texture and mochi-like texture.

[0096]

[Table 22]

Item	Comparative Example 17	Comparative Example 18	Example 35	Example 36
Type of starch	Wheat flour alone	Tapioca	Waxy tapioca	Hydroxypropyl waxy tapioca
Softness	3.0	3.8	4.3	4.5
Elasticity	3.0	3.1	4.2	4.5
Total score	6.0	6.9	8.5	9.0
Comprehensive evaluation	Poor	Fair	Excellent	Excellent

[0097]

<Test 11 (English muffin test)>

Each English muffin was produced according to the formula shown in Table 23 by the straight method using wheat flour partially replaced with tapioca starch, waxy

tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0098]

[Table 23]

Ingredient	Comparative Example 19	Comparative Example 20	Example 37	Example 38
Strong flour	100	80	80	80
Tapioca starch	-	20	-	-
Waxy tapioca starch	-	-	20	-
Sample No.3	-	-	-	20
Baker's yeast	4	4	4	4
Yeast food	0.1	0.1	0.1	0.1
Caster sugar	2	2	2	2
Common salt	1.5	1.5	1.5	1.5
Baking powder	0.5	0.5	0.5	0.5
Shortening	1	1	1	1
Vinegar	0.3	0.3	0.3	0.3
Water	84	84	84	84

[0099]

(Results of English muffin test)

As shown in Table 24, the English muffin produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch exhibited favorable soft texture and mochi-like texture.

[0100]

[Table 24]

Item	Comparative Example 19	Comparative Example 20	Example 37	Example 38
Type of starch	Wheat flour alone	Tapioca	Waxy tapioca	Hydroxypropyl waxy tapioca
Softness	3.0	3.8	4.3	4.5
Elasticity	3.0	3.1	4.3	4.4
Total score	6.0	6.9	8.6	8.9
Comprehensive evaluation	Poor	Fair	Excellent	Excellent

[0101]

<Test 12 (bagel test)>

Each bagel was produced according to the formula shown in Table 25 by the straight method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0102]

[Table 25]

Ingredient	Comparative Example 21	Comparative Example 22	Example 39	Example 40
Powder for exclusive use in French bread	100	90	90	90
Tapioca starch	-	10	-	-
Waxy tapioca starch	-	-	10	-
Sample No.3	-	-	-	10
Baker's yeast	2	2	2	2
Yeast food	0.12	0.12	0.12	0.12
Caster sugar	3	3	3	3
Common salt	1.6	1.6	1.6	1.6
Malt powder	0.6	0.6	0.6	0.6
Shortening	2	2	2	2
Water	61	61	61	61

[0103]

(Results of bagel test)

As shown in Table 26, the bagel produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch exhibited favorable soft texture and mochi-like texture.

[0104]

[Table 26]

Item	Comparative Example 21	Comparative Example 22	Example 39	Example 40
Type of starch	Wheat flour alone	Tapioca	Waxy tapioca	Hydroxypropyl waxy tapioca
Softness	3.0	3.7	4.3	4.5
Elasticity	3.0	3.1	4.2	4.5
Total score	6.0	6.8	8.5	9.0
Comprehensive evaluation	Poor	Fair	Excellent	Excellent

[0105]

<Test 13 (focaccia test)>

Each focaccia was produced according to the formula shown in Table 27 by the straight method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0106]

[Table 27]

Ingredient	Comparative Example 23	Comparative Example 24	Example 41	Example 42
Strong flour	80	80	80	80
Weak flour	20	-	-	-
Tapioca starch	-	20	-	-
Waxy tapioca starch	-	-	20	-
Sample No.3	-	-	-	20
Baker's yeast	2	2	2	2
Yeast food	0.15	0.15	0.15	0.15
Caster sugar	2	2	2	2
Common salt	1.6	1.6	1.6	1.6
Shortening	3	3	3	3
Olive oil	2	2	2	2
Water	65	65	65	65

[0107]

(Results of focaccia test)

As shown in Table 28, the focaccia produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch exhibited favorable soft texture and mochi-like texture.

[0108]

[Table 28]

Item	Comparative Example 23	Comparative Example 24	Example 41	Example 42
Type of starch	Wheat flour alone	Tapioca	Waxy tapioca	Hydroxypropyl waxy tapioca
Softness	3.0	3.8	4.2	4.7
Elasticity	3.0	3.2	4.2	4.5
Total score	6.0	7.0	8.4	9.2
Comprehensive evaluation	Poor	Fair	Excellent	Excellent

[0109]

<Test 14 (cake doughnut test)>

Each cake doughnut was produced according to the formula shown in Table 29 by a routine method using tapioca starch, waxy tapioca starch, or hydroxypropylated cross-linked waxy tapioca starch (sample No. 4).

[0110]

[Table 29]

Ingredient	Comparative Example 25	Example 43	Example 44	Example 45
Tapioca starch	70	-	-	-
Waxy tapioca starch	-	30	70	-
Sample No.4	-	-	-	70
Pregelatinized starch*6	10	10	10	10
Strong flour	20	60	20	20
Caster sugar	8	8	8	8
Common salt	1.5	1.5	1.5	1.5
Baking powder	2	2	2	2
Water	70	70	70	70
Whole egg	15	15	15	15
Casein Na	1	1	1	1

*6: Eliane VC120 (Matsutani Chemical Industry Co., Ltd.)

[0111]

(Results of cake doughnut test)

As shown in Table 30, the cake doughnut containing 30 or 70 parts by mass of the waxy tapioca starch with respect to 100 parts by mass of the starchy raw material exhibited favorable soft texture and mochi-like texture.

[0112]

[Table 30]

Item	Comparative Example 25	Example 43	Example 44	Example 45
Type of starch	Tapioca	Waxy tapioca		Hydroxypropylated cross-linked waxy tapioca
Content of the starch	70	30	70	70
Softness	2.5	4.1	4.3	4.7
Elasticity	1.5	4.3	4.6	4.6
Total score	4.0	8.4	8.9	9.3
Comprehensive evaluation	Fair	Excellent	Excellent	Excellent

[0113]

<Test 15 (steamed cake test)>

Each steamed cake was produced according to the formula shown in Table 31 by a routine method using weak flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0114]

[Table 31]

Ingredient	Comparative Example 26	Comparative Example 27	Example 46	Example 47
Weak flour	100	70	70	70
Tapioca starch	-	30	-	-
Waxy tapioca starch	-	-	30	-
Sample No.3	-	-	-	30
Caster sugar	120	120	120	120
Whole egg	60	60	60	60
Egg white	60	60	60	60
Cow's milk	40	40	40	40
Emulsified fat	10	10	10	10
Baking powder	4	4	4	4
Common salt	0.3	0.3	0.3	0.3
Liquid fat	10	10	10	10

[0115]

(Results of steamed cake test)

As shown in Table 32, the steamed cake produced using the waxy tapioca starch or the hydroxypropyl waxy

tapioca starch exhibited favorable soft texture and mochi-like texture.

[0116]

[Table 32]

Item	Comparative Example 26	Comparative Example 27	Example 46	Example 47
Type of starch	Wheat flour alone	Tapioca	Waxy tapioca	Hydroxypropyl waxy tapioca
Softness	3.0	3.6	4.6	4.8
Elasticity	3.0	3.3	4.5	4.0
Total score	6.0	6.9	9.1	8.8
Comprehensive evaluation	Poor	Poor	Excellent	Excellent

[0117]

<Test 16 (pancake test)>

Each pancake was produced according to the formula shown in Table 33 by a routine method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0118]

[Table 33]

Ingredient	Comparative Example 28	Comparative Example 29	Example 48	Example 49
Weak flour	100	85	85	85
Tapioca starch	-	15	-	-
Waxy tapioca starch	-	-	15	-
Sample No.3	-	-	-	15
Caster sugar	35	35	35	35
Whole egg	40	40	40	40
Baking powder	5	5	5	5
Cow's milk	47	47	47	47
Liquid fat	8	8	8	8
Water	22	22	22	22

[0119]

(Results of pancake test)

The pancake produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch was confirmed to have favorable soft texture and mochi-like texture.

[0120]

<Test 17 (sponge cake test)>

Each sponge cake was produced according to the formula shown in Table 34 by the all-in mix method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0121]

[Table 34]

Ingredient	Comparative Example 30	Example 50	Example 51
Weak flour	90	90	90
Tapioca starch	10	-	-
Waxy tapioca starch	-	10	-
Sample No.3	-	-	10
Caster sugar	120	120	120
Whole egg	140	140	140
Emulsified fat	15	15	15
Water	18	18	18

[0122]

(Results of sponge cake test)

The sponge cake produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch was confirmed to have favorable soft texture and mochi-like texture.

[0123]

<Test 18 (madeleine test)>

Each madeleine was produced according to the formula shown in Table 35 by a routine method using wheat flour partially replaced with tapioca starch, waxy tapioca

starch, hydroxypropyl waxy tapioca starch (sample No. 3), pregelatinized waxy tapioca starch (sample No. 5), or hydroxypropyl pregelatinized waxy tapioca starch (sample No. 6).

[0124]

[Table 35]

Ingredient	Comparative Example 31	Comparative Example 32	Example 52	Example 53	Example 54	Example 55
Weak flour	100	75	75	75	95	95
Tapioca starch	-	25	-	-	-	-
Waxy tapioca starch	-	-	25	-	-	-
Sample No.3	-	-	-	25	-	-
Sample No.5	-	-	-	-	5	-
Sample No.6	-	-	-	-	-	5
Caster sugar	85	85	85	85	85	85
Whole egg	105	105	105	105	105	105
Honey	6	6	6	6	6	6
Lemon juice	6	6	6	6	6	6
Vanilla oil	0.3	0.3	0.3	0.3	0.3	0.3
Baking powder	2	2	2	2	2	2
Melted margarine	100	100	100	100	100	100

[0125]

(Results of madeleine test)

The madeleine produced using the waxy tapioca starch, the hydroxypropyl waxy tapioca starch, or the pregelatinized form thereof was confirmed to have favorable soft texture and mochi-like texture.

[0126]

<Test 19 (castella (kasutera sponge cake) test)>

Each castella (kasutera sponge cake) was produced according to the formula shown in Table 36 by a routine method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0127]

[Table 36]

Ingredient	Comparative Example 33	Comparative Example 34	Example 56	Example 57
Weak flour	100	80	80	80
Tapioca starch	-	20	-	-
Waxy tapioca starch	-	-	20	-
Sample No.3	-	-	-	20
Caster sugar	222	222	222	222
Whole egg	222	222	222	222
Honey	22	22	22	22
Water	22	22	22	22

[0128]

(Results of castella (kasutera sponge cake) test)

The castella (kasutera sponge cake) produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch was confirmed to have favorable soft texture and mochi-like texture.

[0129]

<Test 20 (soft cookie test)>

Each soft cookie was produced according to the formula shown in Table 37 using wheat flour partially replaced with pregelatinized tapioca starch, pregelatinized waxy tapioca starch (sample No. 5), or hydroxypropylated cross-linked pregelatinized waxy tapioca starch (sample No. 6).

[0130]

[Table 37]

Ingredient	Comparative Example 35	Example 58	Example 59
Weak flour	93	93	93
Pregelatinized tapioca starch	7	-	-
Sample No.5	-	7	-
Sample No.6	-	-	7
Granulated sugar	30	30	30
Dextrin	30	30	30
Whole egg	20	20	20
Water	6	6	6
Cow's milk	7	7	7
Ammonium carbonate	0.2	0.2	0.2
Baking soda	0.2	0.2	0.2
Common salt	0.2	0.2	0.2
Margarine	25	25	25

[0131]

(Results of soft cookie test)

The soft cookie produced using the pregelatinized waxy tapioca starch was softer than the tapioca starch-containing cookie generally known to be soft and also had elastic texture. Also, the soft cookie produced using the hydroxypropylated cross-linked pregelatinized waxy tapioca starch was confirmed to be softer and more elastic than the cookie produced using the pregelatinized waxy tapioca starch and to be less changed over time.

[0132]

<Test 21 (Biscoito de polvilho test)>

Each Biscoito de polvilho was produced according to the formula shown in Table 38 by a routine method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0133]

[Table 38]

Ingredient	Comparative Example 36	Example 60	Example 61
Powder for French bread	15	15	15
Tapioca starch	85	-	-
Waxy tapioca starch	-	85	-
Sample No.3	-	-	85
Non-fat dry milk powder	3	3	3
Whole egg	10	10	10
Common salt	1.3	1.3	1.3
Shortening	25	25	25
Salad oil	5	5	5
Water	58	58	58
Soy sauce	3	3	3
Sesame	10	10	10

[0134]

(Results of Biscoito de polvilho test)

The Biscoito de polvilho produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch was confirmed to have favorable soft texture and mochi-like texture.

[0135]

<Test 22 (Pao de queijo test)>

Each Pao de queijo was produced according to the formula shown in Table 39 by a routine method using tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0136]

[Table 39]

Ingredient	Comparative Example 37	Example 62	Example 63
Tapioca starch	100	-	-
Waxy tapioca starch	-	100	-
Sample No.3	-	-	100
Parmesan cheese	40	40	40
Whole egg	70	70	70
Common salt	1.5	1.5	1.5
Water	40	40	40
Liquid fat	5	5	5

[0137]

(Results of Pao de queijo test)

The Pao de queijo produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch as 100% of the starchy raw material was confirmed to have favorable soft texture and mochi-like texture.

[0138]

<Test 23 (Chinese dumpling test)>

Each Chinese dumpling was produced according to the formula shown in Table 40 by a routine method using wheat flour partially replaced with tapioca starch, waxy tapioca starch, or hydroxypropyl waxy tapioca starch (sample No. 3).

[0139]

[Table 40]

Ingredient	Comparative Example 38	Comparative Example 39	Example 64	Example 65
Weak flour	100	80	80	80
Tapioca starch	-	20	-	-
Waxy tapioca starch	-	-	20	-
Sample No.3	-	-	-	20
Caster sugar	10	10	10	10
Common salt	0.5	0.5	0.5	0.5
Dry yeast	1.5	1.5	1.5	1.5
Water	42	42	42	42
Lard	10	10	10	10

[0140]

(Results of Chinese dumpling test)

The Chinese dumpling produced using the waxy tapioca starch or the hydroxypropyl waxy tapioca starch was confirmed to have favorable soft texture and mochi-like texture.

[0141]

<Reference test 1 (creep meter test)>

Each white bread with a round top was produced according to the same blending ratios as in Table 2 by the sponge method using wheat flour partially replaced with waxy tapioca starch, tapioca starch, waxy corn starch, or waxy potato starch. The central portion of the prepared bread was cut into 40 mm square and 20 mm thick. The resistive force of each sample was measured when the bread was compressed using a creep meter (RHEONER II CREEP METER RE-2-33005B, manufactured by Yamaden Co., Ltd.). After the first compression, the compression was relieved, followed by the second compression. The maximum load necessary for the first compression was used as a guideline for soft texture. The maximum load for the second compression was defined as a gumminess load. The value of gumminess load / (first maximum load) was used as a guideline for mochi-like texture.

[0142]

Creep meter measurement conditions:

Plunger: L50 + No. 2

Compression rate: 5 mm/sec.

[0143]

(Results of creep meter test)

The measurement results are shown in Table 41. The bread prepared using the waxy tapioca starch required an evidently small maximum load for compression and had an evidently large value of gumminess load / (first maximum load), compared with the breads prepared using other starches. The bread containing the waxy tapioca starch was thus shown to be soft and also have mochi-like texture.

[0144]

[Table 41]

Same as formula of Table 2	Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Type of starch	Waxy tapioca	Tapioca	Waxy corn	Waxy potato
Maximum load	3.10N	4.48N	5.22N	4.88N
Gumminess load	2.85N	3.60N	4.09N	3.79N
Gumminess load / (first maximum load)	0.92	0.80	0.78	0.78

Industrial Applicability

[0145]

The present invention provides a bakery product that is soft and is also excellent in chewy texture, i.e., a bakery product that is excellent in mochi-like texture and also has soft texture. The method for producing a bakery product according to the present invention can be used in the production of various bakery products and can be applied to the production of a wide range of bakery products to produce a bakery product that is excellent in mochi-like texture and also has soft texture. The method for producing a bakery product according to the present invention can be further applied to refrigerated dough or frozen dough and as such, can provide a high-quality bakery product excellent in distribution characteristics.

CLAIMS

1. A bakery product produced using a starchy raw material for use in bakery product production, wherein the starchy raw material contains 0.5 to 100 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch with respect to 100 parts by mass of the starchy raw material.
2. The bakery product according to claim 1, wherein the modified waxy tapioca starch is a pregelatinized waxy tapioca starch.
3. The bakery product according to claim 1, wherein the modified waxy tapioca starch is one or more modified waxy tapioca starches selected from the group consisting of a hydroxypropyl pregelatinized waxy tapioca starch, a hydroxypropylated cross-linked pregelatinized waxy tapioca starch, an acetyl pregelatinized waxy tapioca starch, and an acetylated cross-linked pregelatinized waxy tapioca starch.
4. The bakery product according to claim 1, wherein the modified waxy tapioca starch is one or more modified waxy tapioca starches selected from the group consisting of an acetyl waxy tapioca starch, an acetylated cross-linked waxy tapioca starch, a hydroxypropyl waxy tapioca starch, and a hydroxypropylated cross-linked waxy tapioca starch.

5. The bakery product according to any one of claims 1 to 4, wherein the bakery product is a bread, a cake, a doughnut, a baked confectionery, or a non-fermented bread.

6. A starchy raw material mix for bakery product production comprising a starchy raw material for use in bakery product production, wherein the starchy raw material contains 0.5 to 100 parts by mass of a waxy tapioca starch and/or a modified waxy tapioca starch with respect to 100 parts by mass of the starchy raw material.

7. The starchy raw material mix for bakery product production according to claim 6, wherein the modified waxy tapioca starch contained in the starchy raw material is a modified waxy tapioca starch defined in any one of claims 2 to 4.

8. A method for producing a bakery product having mochi-like texture and soft texture, comprising producing the bakery product using a starchy raw material mix for bakery product production according to claim 6 or 7 as a starchy raw material.

9. The method for producing a bakery product according to claim 8, wherein the bakery product is a bread, a cake, a doughnut, a baked confectionery, or a non-fermented bread.