SUMMARY

[0007] Disclosed is a pasta filata cheese comprising a moisture content of at least about 55% by weight, a solids-non-fat content of up to about 45% by weight, the solids-non-fat comprising at least about 70% by weight protein, the protein comprising at least about 65% by weight casein, and a mineral content comprising

a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, or a total divalent cation content of about 50 to about 150 meq divalent cations/100 g casein, and

a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, or a total monovalent cation content of about 100 to about 250 meq monovalent cations/100 g casein, and

a total cation content of about 150 to about 300 mMol total cations/100 g casein.

[0007a] In one aspect, the present disclosure refers to a pasta filata cheese comprising a moisture content of at least about 55% by weight, a solids-non-fat content of up to about 45% by weight, the solids-non-fat comprising at least about 70% by weight protein, the protein comprising at least about 65% by weight casein, and a mineral content comprising

a) a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, and

b) a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, and

c) a total cation content of about 150 to about 300 mMol total cations/100 g casein.

[0008] Disclosed is a pasta filata cheese comprising a moisture content of at least about 55% by weight, a solids-non-fat content of up to about 45% by weight, the solids-non-fat comprising at least about 70% by weight protein, the protein comprising at least about 65% by weight casein, and a mineral content comprising

less than about 2840 mg calcium/100 g casein, or less than about 70 mMol calcium/100 g casein, or less than about 140 meq calcium/100 g casein, and

less than about 145 mg magnesium/100 g casein, or less than about 6.0 mMol magnesium/100 g casein, or less than 12.0 meq magnesium/100 g casein,

less than about 16.5 µg manganese/100 g casein, less than about 0.3 µmMol manganese/100 g casein, and/or less than about 0.00006 meq manganese/100 g casein,

less than about 13 mg zinc/100 g casein, less than 0.2 µMol zinc/100 g casein, and/or less than 0.0004 meq zinc/100 g casein,

less than about 4.5 g sodium/100 g casein, less than about 195 mMol sodium/100 g casein, and/or less than about 195 meq sodium/100 g casein,

less than about 0.2 g potassium/100 g casein, less than about 5.0 mMol potassium/100 g casein, and/or less than about 5.0 meq potassium/100 g casein, and

less than about 4 g phosphate/100 g casein, or less than 795 mMol phosphate/100 g casein.

[0008a] In one aspect, the present disclosure refers to a pasta filata cheese comprising a moisture content of at least about 55% by weight, a solids-non-fat content of up to about 45% by weight, the solids-non-fat comprising at least about 70% by weight protein, the protein comprising at least about 65% by weight casein, and a mineral content comprising

a) less than about 2840 mg calcium per 100 g casein, and

b) less than about 145 mg magnesium per 100 g casein,

c) less than about 16.5 µg manganese per 100 g casein,

d) less than about 13 mg zinc per 100 g casein,

e) less than about 4.5 g sodium per 100 g casein,

f) less than about 0.2 g potassium per 100 g casein, and

g) less than about 4 g phosphate per 100 g casein.

[0009] In one example the disclosure relates to a process for making a pasta filata cheese comprising

a) providing a source of milk protein comprising

i) at least 65 to 99% by weight casein, and

ii) a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, or a total divalent cation content of about 50 to about 150 meq divalent cations/100 g casein, and
iii) a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, or a total monovalent cation content of about 100 to about 250 meq monovalent cations/100 g casein, and
iv) a total cation content of about 150 to about 300 mMol total cations/100 g casein, and
v) a pH of from about 4.9 to about 6,

b) contacting the source of milk protein with a coagulating agent at a temperature of 8 to 50 °C to produce a milk curd,
c) mixing at least one lipid ingredient and the curd to produce a mixture,
d) heating and mechanically working the mixture at a temperature from about 65 to about 90 °C to produce a heated cheese mass, and
e) processing the heated cheese mass to form a pasta filata cheese product.

[0009a] In one aspect, the present disclosure refers to a process for making a pasta filata cheese comprising

a) providing a source of milk protein comprising
i) at least 65 to 99% casein, and
ii) a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, and
iii) a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, and
iv) a total cation content of about 150 to about 300 mMol total cations/100 g casein, and
v) a pH of from about 4.9 to about 6,
b) contacting the source of milk protein with a coagulating agent at a temperature of 8–50 °C to produce a milk curd,
c) mixing at least one lipid ingredient and the curd to produce a mixture,
d) heating and mechanically working the mixture at a temperature of from about 65 to about 90 °C to produce a heated cheese mass, and
e) processing the heated cheese mass to form a pasta filata cheese product.

[0010] In a further example the disclosure relates to a process for making a pasta filata cheese comprising

a) providing a source of milk protein comprising
i) at least about 65 to 99% by weight casein, and
ii) a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, or a total divalent cation content of about 50 to about 150 meq divalent cations/100 g casein, and
iii) a pH of from about 4.9 to about 6,
b) contacting the source of milk protein with a coagulating agent at a temperature of 8 to 50 °C to produce a milk curd,
c) mixing at least one lipid ingredient and the curd to produce a mixture and adjusting the monovalent cation content to obtain
i) a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, or a total monovalent cation content of about 100 to about 250 meq monovalent cations/100 g casein, and

ii) a total cation content of about 150 to about 300 mMol total cations/100 g casein, and

d) heating and mechanically working the mixture at a temperature from about 65 to about 90 °C to produce a heated cheese mass, and

e) processing the heated cheese mass to form a pasta filata cheese product.

[0010a] In one aspect, the present disclosure refers to a process for making a pasta filata cheese comprising

a) providing a source of milk protein comprising

i) at least 65 to 99% by weight casein, and

ii) a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, and

iii) a pH of from about 4.9 to about 6,

b) contacting the source of milk protein with a coagulating agent at a temperature of 8 to 50 °C to produce a milk curd,

c) mixing at least one lipid ingredient and the curd to produce a mixture and adjusting the monovalent cation content to obtain

i) a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, and

ii) a total cation content of about 150 to about 300 mMol total cations/100 g casein, and

d) heating and mechanically working the mixture at a temperature from about 65 to about 90 °C to produce a heated cheese mass, and

e) processing the heated cheese mass to form a pasta filata cheese product.

[0011] In a further example the present disclosure relates to a process for making a pasta filata cheese comprising

a) providing a first pasta filata cheese product produced by the process comprising
   i) providing a source of milk protein comprising at least 65 to 99% by weight casein and a pH of from about 4.9 to about 6,
   ii) contacting the source of milk protein with a coagulating agent at a temperature of 8 to 50 °C to produce a milk curd,
   iii) mixing at least one lipid ingredient to the curd to produce a mixture,
   iv) heating and mechanically working the mixture at a temperature from about 65 to about 90 °C to produce a heated cheese mass, and
   v) processing the heated cheese mass to form a first pasta filata cheese product;
b) determining the monovalent and the divalent cation content of the first pasta filata cheese product,
c) preparing a second pasta filata cheese product by a process comprising
   i) providing a source of milk protein comprising at least 65 to 99% by weight casein and a pH of from about 4.9 to about 6,
   ii) contacting the source of milk protein with a coagulating agent at a temperature of 8 to 50 °C to produce a milk curd,
   iii) mixing at least one lipid ingredient to the curd to produce a mixture,
   iv) heating and mechanically working the mixture at a temperature from about 65 to about 90 °C to produce a heated cheese mass, and
   v) processing the heated cheese mass to form a first pasta filata cheese product;
d) adjusting the monovalent cation content of the curd, the mixture, the cheese mass, or a combination thereof, based on the measurement of the first pasta filata to produce a pasta filata cheese product having
   i) a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, and
   ii) a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, and
   iii) a total cation content of about 150 to about 300 mMol total cations/100 g casein.

[0012] The following examples may relate to any of the above aspects.

[0013] In one example the milk protein is pasteurised.

[0014] In one example the pasta filata cheese comprises up to about 75 mMol/100 g casein of total monovalent cations comprising about 2.5 to about 72.5 mMol sodium ions/100 g casein and about 2.5 to about 35 mMol potassium ions/100 g casein.

[0015] In one example the pasta filata cheese comprises up to about 250 mMol/100 g casein of total monovalent cations comprising about 175 to about 247.5 mMol sodium ion /100 g casein and about 2.5 to about 75 mMol potassium ion /100 g casein.

[0016] In one example the pasta filata cheese is shredded and applied to a food product. Preferably the food product is a pizza.

[0017] In one example, upon use on or in a food product, the cooked pasta filata cheese exhibits the characteristics of:

i) a blister percentage of less than 35%,
ii) a maximum blister size score of less than 20 mm,
iii) a pizza blister Hunter L scale colour value of less than 50,
iv) a melt value of less than 6 on the (FRDC) modified Schreiber melt test,
v) a free oil content of less than 20% cheese mass,
vi) a stretch of less than 50 cm, and
vii) any combination of two or more of (i) to (vi) above.

[0018] In one example the source of milk protein is selected from whole fat milk, whole milk retentate/concentrate, semi skimmed milk, skimmed milk, skimmed retentate/concentrate, butter milk, butter milk retentate/concentrate and whey protein retentate/concentrate; or

one or more powders, such as whole milk powder, skimmed milk powder, milk protein concentrate powder, milk protein isolate powder, whey protein concentrate powder, whey protein isolate powder and buttermilk powder or other powders made from milk, reconstituted or dry, singularly or in combination.

[0019] In one example the mineral content of the milk protein is altered by filtration, acid addition, and/or mineral sequestration or a combination thereof.

[0020] In one example the monovalent content is adjusted through the addition of NaCl or KCl. Preferably NaCl is used.

[0021] In some examples the monovalent content is adjusted in the curd, the mixture, the cheese mass or a mixture thereof.

[0022] In one example the mixture is adjusted to a sodium content of 100, 120, 140, 160, 180, 200, 220, 240 or 250 mMol Na/100 g Casein, and useful ranges may be selected between any of these values.

[0023] In one example the adjustment of the cation content is an iterative process.

[0024] In one example the filtration comprises subjecting the source of milk protein to at least one filtration step to produce a protein retentate.

[0025] In one example the filtration comprises contacting the milk protein with a cation ion exchange resin, the counter ions in the resin comprising sodium, potassium or sodium and potassium, to replace at least about 15 to about 30% of the divalent cations in the retentate with sodium, potassium or sodium and potassium.

[0026] In one example the cation resin is a sodium-cation resin.

[0027] In one example the retentate undergoes further mineral adjustment by mixing the mineral adjusted retentate with a further source of milk protein and/or retentate to produce a mixed retentate with a standardised mineral content.

[0028] In those examples in which the mineral content of the milk protein is altered by filtration, the retentate is subjected to filtration comprising ultrafiltration or microfiltration or both, using a diafiltration medium consisting of water supplemented with added potassium and/or sodium ions to produce a retentate with additional mineral adjustment. Preferably the diafiltration medium contains specified amounts of dissolved potassium ions.

[0029] In one example the milk protein is acidified through the addition of a food grade acid.

[0030] In one example the milk protein is subjected to fermenting acidification through the addition of lactic acid starter bacteria.

[0031] In one example the milk curd is particularised. Preferably by grinding.

[0032] In one example the mixture includes the addition of whey protein gel particles.

[0033] In one example the whey protein gel particles are prepared from a whey protein solution.

[0034] In some examples the lipid-whey mixture is an emulsion.

[0035] In some examples the lipid-whey mixture is mixed with a high speed mixer.

[0036] In some examples the lipid-whey mixture is homogenised at relatively low pressure, being up to 100, 120, 140, 160, 180 or 200 bar, and useful ranges may be selected between any of these values.

[0037] In one example the temperature during mixing of the whey protein solution with the mixture is maintained at about 50 °C.

[0038] In some examples the lipid source is a milk lipid. Preferably the milk lipid is selected from cream, high fat cream, or anhydrous milk fat.

[0039] In some examples the emulsion is prepared in absence of added emulsifier.

[0040] In some examples other milk product are added, such as GRAS ingredients.

[0041] In some examples the lipid combined with the whey protein solution accounts for at least 70, 75, 80, 85, 90, 95 or 100% of the total fat in the final cheese product, and useful ranges may be selected between any of these values.

[0042] In some examples the mixture of whey and lipid is heated to at least 65, 70, 75, 80 or 85 °C, for at least about 10, 15, 20, 25, 30, 35 or 40 seconds, and useful ranges may be selected between any of these values.

[0043] In some examples the heated emulsion of whey protein and lipid is cooled to a low temperature (e.g. 4 °C) appropriate for storage, and can be used at a later date.

[0044] In alternate examples the heated emulsion is added directly, while it is hot, as an ingredient, to the mixture of ingredients for making mozzarella or pasta filata cheese.

[0045] In one example the heated cheese mass is stretched in a mozzarella or pasta filata kneader/stretcher device.

[0046] In one example the heated cheese mass is placed onto a casting device, which cools the cheese to form a continuous sheet or ribbon.

[0047] In one example the cast cheese is shredded to produce individual shredded cheese particles.

[0048] In one example an anticaking agent is added to the shredded cheese particles.

[0049] In one example the shredded cheese particles are immediately frozen as Individually Quick Frozen (IQF) shredded particles.

[0050] In one example the molten cheese mass is placed into a low temperature extruder to extrude and cut the cheese mass as shreds immediately into a freezer.

[0051] In one example the pasta filata cheese limits moisture release (syneresis) and loss during baking.

[0052] In one example the pasta filata cheese, when present as a frozen IQF shred, can be immediately placed upon a pizza without thawing and the pizza baked and the cheese will produce all the desired functional effects.

[0053] The term "comprising" as used in this specification and claims means "consisting at least in part of". When interpreting statements in this specification and claims which include the term "comprising", other features besides the features prefaced by this term in each statement can also be present. Related terms such as "comprise" and "comprised" are to be interpreted in similar manner.

[0054] As used herein the term "and/or" means "and" or "or", or both.

[0055] It is intended that reference to a range of numbers disclosed herein (for example, 1 to 10) also incorporates reference to all rational numbers within that range (for example, 1, 1.1, 2, 3, 3.9, 4, 5, 6, 6.5, 7, 8, 9 and 10) and also any range of rational numbers within that range (for example, 2 to 8, 1.5 to 5.5 and 3.1 to 4.7) and, therefore, all sub-ranges of all ranges expressly disclosed herein are hereby expressly disclosed. These are only examples of what is specifically intended and all possible combinations of numerical values between the lowest value and the highest value enumerated are to be considered to be expressly stated in this application in a similar manner.

[0056] To those skilled in the art to which the disclosure relates, many changes in construction and differing examples and applications of the disclosure will suggest themselves without departing from the scope of the disclosure as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any sense limiting.

WE CLAIM

1. A pasta filata cheese comprising a moisture content of at least about 55% by weight, a solids-non-fat content of up to about 45% by weight, the solids-non-fat comprising at least about 70% by weight protein, the protein comprising at least about 65% by weight casein, and a mineral content comprising

a) a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, and

b) a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, and

c) a total cation content of about 150 to about 300 mMol total cations/100 g casein.

2. A pasta filata cheese comprising a moisture content of at least about 55% by weight, a solids-non-fat content of up to about 45% by weight, the solids-non-fat comprising at least about 70% by weight protein, the protein comprising at least about 65% by weight casein, and a mineral content comprising

a) less than about 2840 mg calcium per 100 g casein, and

b) less than about 145 mg magnesium per 100 g casein,

c) less than about 16.5 µg manganese per 100 g casein,

d) less than about 13 mg zinc per 100 g casein,

e) less than about 4.5 g sodium per 100 g casein,

f) less than about 0.2 g potassium per 100 g casein, and

g) less than about 4 g phosphate per 100 g casein.

3. A pasta filata cheese of claim 2 comprising up to about 75 mMol of total monovalent cations/100 g casein, the total monovalent cations comprising about 2.5 to about 72.5 mMol sodium ions/100 g casein and about 2.5 to about 35 mMol potassium ions/100 g casein.

4. A pasta filata cheese of claim 3 comprising up to about 250 mMol of total monovalent cations/100 g casein, the total monovalent cations comprising about 175 to about 247.5 mMol sodium ion /100 g casein and about 2.5 to about 75 mMol potassium ion /100 g casein.

5. A pasta filata cheese of claim 4, wherein upon use on a food product, the cooked pasta filata cheese exhibits the characteristics of:

i) a blister percentage of less than 35%,

ii) a maximum blister size score of less than 20 mm,

iii) a pizza blister Hunter L scale colour value of less than 50,

iv) a melt value of equal to or less than 6 on the modified Schreiber melt test,

v) a free oil content of less than 20% cheese mass,

vi) a stretch of less than 50 cm, or

vii) any combination of two or more of (i) to (vi) above.

6. A process for making a pasta filata cheese comprising

a) providing a source of milk protein comprising

i) at least 65 to 99% casein, and

ii) a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, and

iii) a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, and

iv) a total cation content of about 150 to about 300 mMol total cations/100 g casein, and

v) a pH of from about 4.9 to about 6,

b) contacting the source of milk protein with a coagulating agent at a temperature of 8–50 °C to produce a milk curd,

c) mixing at least one lipid ingredient and the curd to produce a mixture,

d) heating and mechanically working the mixture at a temperature of from about 65 to about 90 °C to produce a heated cheese mass, and

e) processing the heated cheese mass to form a pasta filata cheese product.

7. A process for making a pasta filata cheese comprising

a) providing a source of milk protein comprising

i) at least 65 to 99% by weight casein, and

ii) a total divalent cation content of about 25 to about 75 mMol of divalent cations/100 g casein, and

iii) a pH of from about 4.9 to about 6,

b) contacting the source of milk protein with a coagulating agent at a temperature of 8 to 50 °C to produce a milk curd,

c) mixing at least one lipid ingredient and the curd to produce a mixture and adjusting the monovalent cation content to obtain

i) a total monovalent cation content of about 100 to about 250 mMol monovalent cations/100 g casein, and

ii) a total cation content of about 150 to about 300 mMol total cations/100 g casein, and

d) heating and mechanically working the mixture at a temperature from about 65 to about 90 °C to produce a heated cheese mass, and

e) processing the heated cheese mass to form a pasta filata cheese product.

8. A process of claim 6 wherein the source of milk protein is selected from whole milk, skim milk, milk protein concentrate, milk protein isolate, whey protein concentrate, whey protein isolate or any combination of any two or more thereof.

9. A process of claim 6 wherein the mineral content of the source of milk protein is adjusted by filtration, acid addition, or sequestration or a combination thereof.

10. A process of claim 9 wherein the filtration comprises subjecting the source of milk protein to at least one filtration step to produce a protein retentate.

11. A process of claim 10 comprising contacting the retentate with a cation ion exchange resin, the counter ions in the resin comprising sodium, potassium or sodium and potassium, to replace at least about 15 to about 30% of the divalent cations in the retentate with sodium, potassium or sodium and potassium.

12. A process of claim 11 wherein the retentate is mixed with a further source of milk protein.

13. A process of claim 10 wherein the retentate is subjected to filtration comprising ultrafiltration or microfiltration or both, using a diafiltration medium consisting of water supplemented with added potassium and/or sodium ions to produce a mineral adjusted retentate.

14. A process of claim 6 wherein the monovalent cations are adjusted in the curd, the mixture, the cheese mass, or a combination thereof.

15. A process of claim 14 wherein the monovalent cations are adjusted through removal or one or more monovalent cations or the addition of one or more monovalent cations.

16. A process of claim 15 wherein the monovalent cations are adjusted through the addition of NaCl or KCl.

17. A process of claim 6 wherein the sodium content in the curd, the mixture, or the curd and the mixture is adjusted to about 100 to about 250 mMol Na/100 g Casein.

18. A process of claim 6 wherein the milk protein is acidified through the addition of a food grade acid.

19. A process of claim 6 wherein the milk protein is subjected to fermenting acidification through the addition of lactic acid starter bacteria.

20. A process of claim 6 wherein the milk curd is ground.

21. A process of claim 6 wherein the heated cheese mass is stretched in a mozzarella or pasta filata kneader/stretcher device.

22. A process of claim 6 wherein the heated cheese mass is shaped and cooled.

23. A process of claim 6 wherein the heated cheese mass is placed onto a casting device, which cools the cheese to form a continuous sheet or ribbon.

24. A process of claim 23 wherein the cast cheese is shredded to produce individual shredded cheese particles.

25. A process of claim 6 wherein the heated cheese mass is placed into a low temperature extruder to extrude and cut the cheese mass to form shreds and the shreds are immediately placed into a freezer.