

CLAIMS

1. An effervescent composition formulated for dissolving into a nutritional product suitable for administration to an individual having dysphagia, the effervescent composition comprising an acid compound, an alkaline compound, and a thickening agent.
2. The effervescent composition according to Claim 1, wherein the acid compound comprises at least one of citric acid, ascorbic acid, nicotinic acid, acetylsalicylic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, adipic acid, malic acid, anhydrides, or salts thereof.
3. The effervescent composition according to Claim 1 or 2, wherein the alkaline compound comprises at least one of potassium carbonate, sodium carbonate, sodium bicarbonate, potassium bicarbonate, sodium glycine carbonate, calcium carbonate, arginine carbonate, potassium bitartrate, or sodium tartrate.
4. The effervescent composition according to any of Claims 1 to 3 further comprising a trigeminal ingredient comprising at least one of cinnamaldehyde with zinc, cinnamaldehyde without zinc, p-anisaldehyde, cumminaldehyde, tiglic aldehyde, Sichuan pepper, capsaicin, capsiate, or isothiocyanate.
5. The effervescent composition according to any of Claims 1 to 4, wherein the thickening agent comprises at least one of xanthan gum, gum arabic, carrageenan (lambda), carrageenan (iota), carrageenan (kappa), sodium alginate, konjac, locust bean gum, carboxymethyl cellulose (CMC), chitosan, inulin, pectin (from citrus), pectin (from apple), hydroxypropyl methylcellulose (HPMC), or tara gum.
6. The effervescent composition according to any of Claims 1 to 4, wherein the thickening agent comprises at least one of a plant mucilage or a plant derived polysaccharide.
7. The effervescent composition according to Claim 6, wherein the plant mucilage or plant derived polysaccharide comprises at least one of okra gum, beta-glucan, cactus mucilage,

kiwi mucilage, psyllium mucilage, mallow mucilage, flax seed mucilage, marshmallow mucilage, ribwort mucilage, mullein mucilage, or cetraria mucilage.

8. The effervescent composition according to any of Claims 1 to 7 further comprising at least one of a protein, a fat, a fiber, a carbohydrate, a prebiotic, a probiotic, an amino acid, a fatty acid, a phytonutrient, an antioxidant, an electrolyte, or a vitamin.

9. The effervescent composition according to any of Claims 1 to 8, wherein the effervescent composition is in a powder, a tablet, a powder in soluble packaging, a brick, a liquid or gel in suitable packaging.

10. The effervescent composition according to any of Claims 1 to 9, wherein the nutritional product is in an administrable form selected from the group consisting of a pharmaceutical formulation, a nutritional formulation, a medical food, a dietary supplement, a functional food and beverage product, and a ready-to-drink (RTD) beverage.

11. The effervescent composition according to Claim 1, wherein the nutritional product is carbonated.

12. The effervescent composition according to Claim 1, wherein the nutritional product is a ready-to-drink (RTD) beverage.

13. A nutritional product made by dissolving the effervescent composition of Claim 1 in a diluent.

14. A ready-to-drink (RTD) beverage made by dissolving the effervescent composition of Claim 1 in a diluent.

15. A ready-to-drink (RTD) beverage formulated for administration to an individual having dysphagia, wherein the ready-to-drink (RTD) beverage has a relaxation time, determined

by a Capillary Breakup Extensional Rheometry (CaBER) experiment, of more than 10 ms at 20° C and/or a shear viscosity up to about 2,000 mPas measured at a shear rate of 50 s⁻¹ at 20° C.

16. The ready-to-drink (RTD) beverage according to Claim 16 comprising at least one ingredient selected from the group consisting of proteins, vitamins, and minerals, and the ready-to-drink (RTD) beverage is fat-free.

17. A method of preventing, alleviating, and/or compensating swallowing dysfunction in a patient in need thereof, the method comprising:

providing an effervescent composition comprising an acid compound, an alkaline compound, a thickening agent and optionally a trigeminal ingredient;

dissolving the effervescent composition in a liquid to provide a nutritional product; and orally administering the nutritional product to the patient.

18. The method according to Claim 17, wherein the acid compound comprises at least one of citric acid, ascorbic acid, nicotinic acid, acetylsalicylic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, adipic acid, malic acid, anhydrides, or salts thereof.

19. The method according to Claim 17, wherein the alkaline compound comprises at least one of potassium carbonate, sodium carbonate, sodium bicarbonate, potassium bicarbonate, sodium glycine carbonate, calcium carbonate, arginine carbonate, potassium bitartrate, or sodium tartrate.

20. The method according to Claim 17, wherein the trigeminal ingredient comprises at least one of cinnamaldehyde with zinc, cinnamaldehyde without zinc, p-anisaldehyde, cuminaldehyde, tiglic aldehyde, Sichuan pepper, capsaicin, capsiate, or isothiocyanate.

21. The method according to Claim 17, wherein the thickening agent comprises at least one of xanthan gum, gum arabic, carrageenan (lambda), carrageenan (iota), carrageenan (kappa), sodium alginate, konjac, locust bean gum, carboxymethyl cellulose (CMC), chitosan, inulin, pectin (from citrus), pectin (from apple), hydroxypropyl methylcellulose (HPMC), or tara gum.

22. The method according to Claim 17, wherein the thickening agent is present in an amount that provides to the nutritional product, a relaxation time, determined by a Capillary Breakup Extensional Rheometry (CaBER) experiment, of more than 10 ms at 20° C and/or a shear viscosity up to about 2,000 mPas measured at a shear rate of 50 s⁻¹ at 20° C.

23. The method according to Claim 17, wherein the nutritional product further comprises at least one of a protein, a fat, a fiber, a carbohydrate, a prebiotic, a probiotic, an amino acid, a fatty acid, a phytonutrient, an antioxidant, an electrolyte, or a vitamin.

24. The method according to Claim 17 further comprising:
identifying a level of severity of the swallowing disorder in the patient; and
selecting, based on the level of severity of the swallowing disorder in the patient, an amount of the effervescent composition for dissolving in the liquid, wherein the amount of the effervescent tablet is selected from a plurality of predetermined amounts that each corresponds to a different level of swallowing disorder severity.

25. The method according to Claim 24, wherein the amount of the effervescent composition is an effective amount for administration of the nutritional product to the patient to achieve at least one of (i) supplemental nutrition, (ii) hydration or (iii) replacement of one or more full meals.

26. The method according to Claim 17, wherein an amount of the effervescent composition provides, after dissolving in the liquid, an appropriate number, density, and/or size of CO₂ bubbles that in turn, when in contact with salivary carbonic anhydrase, yields a concentration of carbonic acid effective to provide a trigeminal stimulation, which in turn improves swallowing safety.

27. A method of promoting swallowing safety and/or efficiency in a patient in need thereof, the method comprising:

providing an effervescent composition comprising an acid compound, an alkaline compound, a thickening agent and optionally a trigeminal ingredient;

dissolving the effervescent composition in a liquid to provide a nutritional product; and orally administering the nutritional product to the patient.

28. The method according to Claim 27, wherein the acid compound comprises at least one of citric acid, ascorbic acid, nicotinic acid, acetylsalicylic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, adipic acid, malic acid, anhydrides, or salts thereof.

29. The method according to Claim 27, wherein the alkaline compound comprises at least one of potassium carbonate, sodium carbonate, sodium bicarbonate, potassium bicarbonate, sodium glycine carbonate, calcium carbonate, arginine carbonate, potassium bitartrate, or sodium tartrate.

30. The method according to Claim 27, wherein the trigeminal ingredient comprises at least one of cinnamaldehyde with zinc, cinnamaldehyde without zinc, p-anisaldehyde, cuminaldehyde, tiglic aldehyde, Sichuan pepper, capsaicin, capsiate, or isothiocyanate.

31. The method according to Claim 27, wherein the thickening agent comprises at least one of xanthan gum, gum arabic, carrageenan (lambda), carrageenan (iota), carrageenan (kappa), sodium alginate, konjac, locust bean gum, carboxymethyl cellulose (CMC), chitosan, inulin, pectin (from citrus), pectin (from apple), hydroxypropyl methylcellulose (HPMC), or tara gum.

32. The method according to Claim 27, wherein the nutritional product further comprises at least one of a protein, a fat, a fiber, a carbohydrate, a prebiotic, a probiotic, an amino acid, a fatty acid, a phytonutrient, an antioxidant, an electrolyte, or a vitamin.

33. The method according to Claim 27, wherein the thickening agent is present in an amount that provides to the nutritional product a relaxation time, determined by a Capillary Breakup Extensional Rheometry (CaBER) experiment, of more than 10 ms at 20° C and/or a shear viscosity up to about 2,000 mPas measured at a shear rate of 50 s⁻¹ at 20° C.

34. A method of mitigating a risk of aspiration during swallowing of a nutritional product in a patient in need thereof, the method comprising:

providing an effervescent composition comprising an acid compound, an alkaline compound, a thickening agent and optionally a trigeminal ingredient;
dissolving the effervescent composition in a liquid to provide a nutritional product; and
orally administering the nutritional product to the patient.

35. The method according to Claim 34, wherein the acid compound comprises at least one of citric acid, ascorbic acid, nicotinic acid, acetylsalicylic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, adipic acid, malic acid, anhydrides, or salts thereof.

36. The method according to Claim 34, wherein the alkaline compound comprises at least one of potassium carbonate, sodium carbonate, sodium bicarbonate, potassium bicarbonate, sodium glycine carbonate, calcium carbonate, arginine carbonate, potassium bitartrate, or sodium tartrate.

37. The method according to Claim 34, wherein the trigeminal ingredient comprises at least one of cinnamaldehyde with zinc, cinnamaldehyde without zinc, p-anisaldehyde, cuminaldehyde, tiglic aldehyde, Sichuan pepper, capsaicin, capsiate, or isothiocyanate.

38. The method according to Claim 34, wherein the thickening agent comprises at least one of xanthan gum, gum arabic, carrageenan (lambda), carrageenan (iota), carrageenan (kappa), sodium alginate, konjac, locust bean gum, carboxymethyl cellulose (CMC), chitosan, inulin, pectin (from citrus), pectin (from apple), hydroxypropyl methylcellulose (HPMC), or tara gum.

39. The method according to Claim 34, wherein the nutritional product comprises at least one of a protein, a fat, a fiber, a carbohydrate, a prebiotic, a probiotic, an amino acid, a fatty acid, a phytonutrient, an antioxidant, an electrolyte, or a vitamin.

40. The method according to Claim 34, wherein the thickening agent is present in an amount that provides to the nutritional product a relaxation time, determined by a Capillary

Breakup Extensional Rheometry (CaBER) experiment, of more than 10 ms at 20° C and a shear viscosity up to about 2,000 mPas measured at a shear rate of 50 s⁻¹ at 20° C.

41. A method of making a nutritional product, the method comprising:
providing an effervescent composition comprising an acid compound, an alkaline compound, a thickening agent and optionally a trigeminal ingredient;
dissolving the effervescent composition in a liquid to provide the nutritional product, wherein the thickening agent provides to the nutritional product a relaxation time, determined by a Capillary Breakup Extensional Rheometry (CaBER) experiment, of more than 10 ms at 20° C and/or a shear viscosity up to about 2,000 mPas measured at a shear rate of 50 s⁻¹ at 20° C, and the nutritional product is suitable for administration to an individual having dysphagia.

42. The method according to Claim 41, wherein the acid compound comprises at least one of citric acid, ascorbic acid, nicotinic acid, acetylsalicylic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, adipic acid, malic acid, anhydrides, or salts thereof.

43. The method according to Claim 41, wherein the alkaline compound comprises at least one of potassium carbonate, sodium carbonate, sodium bicarbonate, potassium bicarbonate, sodium glycine carbonate, calcium carbonate, arginine carbonate, potassium bitartrate, or sodium tartrate.

44. The method according to Claim 41, wherein the trigeminal ingredient comprises at least one of cinnamaldehyde with or without zinc, p-anisaldehyde, cuminaldehyde, tiglic aldehyde, Sichuan pepper, capsaicin, capsiate, or isothiocyanate.

45. The method according to Claim 41, wherein the thickening agent comprises at least one of xanthan gum, gum arabic, carrageenan (lambda), carrageenan (iota), carrageenan (kappa), sodium alginate, konjac, locust bean gum, carboxymethyl cellulose (CMC), chitosan, inulin, pectin (from citrus), pectin (from apple), hydroxypropyl methylcellulose (HPMC), or tara gum.

46. The method according to Claim 41, wherein the nutritional product comprises at least one of a protein, a fat, a fiber, a carbohydrate, a prebiotic, a probiotic, an amino acid, a fatty acid, a phytonutrient, an antioxidant, an electrolyte, or a vitamin.

47. Use of an effervescent composition and a liquid in preparation of an orally administrable nutritional product, the liquid is suitable for consumption by an individual without dysphagia, the orally administrable nutritional product is suitable for administration to an individual having dysphagia, the effervescent composition comprising an acid compound, an alkaline compound, a thickening agent and optionally a trigeminal ingredient.

48. The use according to Claim 47, wherein the acid compound comprises at least one of citric acid, ascorbic acid, nicotinic acid, acetylsalicylic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, adipic acid, malic acid, anhydrides, or salts thereof.

49. The use according to Claim 41, wherein the alkaline compound comprises at least one of potassium carbonate, sodium carbonate, sodium bicarbonate, potassium bicarbonate, sodium glycine carbonate, calcium carbonate, arginine carbonate, potassium bitartrate, or sodium tartrate.

50. The use according to Claim 47, wherein the trigeminal ingredient comprises at least one of cinnamaldehyde with or without zinc, p-anisaldehyde, cuminaldehyde, tiglic aldehyde, Sichuan pepper, capsaicin, capsiate, or isothiocyanate.

51. The use according to Claim 47, wherein the thickening agent comprises at least one of xanthan gum, gum arabic, carrageenan (lambda), carrageenan (iota), carrageenan (kappa), sodium alginate, konjac, locust bean gum, carboxymethyl cellulose (CMC), chitosan, inulin, pectin (from citrus), pectin (from apple), hydroxypropyl methylcellulose (HPMC), or tara gum.

52. The use according to Claim 47, wherein the nutritional product comprises at least one of a protein, a fat, a fiber, a carbohydrate, a prebiotic, a probiotic, an amino acid, a fatty acid, a phytonutrient, an antioxidant, an electrolyte, or a vitamin.

53. A system for production of a homogenous single phase beverage for administration to an individual having dysphagia, the system comprising:

a container containing an effervescent composition formulated for dilution into the homogenous single phase beverage, the effervescent composition comprising an acid compound, an alkaline compound, a thickening agent and optionally a trigeminal ingredient; and

a metering device connected to the container and configured to dispense a predetermined amount of the effervescent composition.

54. The system according to Claim 53, wherein the acid compound comprises at least one of citric acid, ascorbic acid, nicotinic acid, acetylsalicylic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, adipic acid, malic acid, anhydrides, or salts thereof.

55. The system according to Claim 53, wherein the alkaline compound comprises at least one of potassium carbonate, sodium carbonate, sodium bicarbonate, potassium bicarbonate, sodium glycine carbonate, calcium carbonate, arginine carbonate, potassium bitartrate, or sodium tartrate.

56. The system according to Claim 53, wherein the trigeminal ingredient comprises at least one of cinnamaldehyde with or without zinc, p-anisaldehyde, cuminaldehyde, tiglic aldehyde, Sichuan pepper, capsaicin, capsiate, or isothiocyanate.

57. The system according to Claim 53, wherein the thickening agent comprises at least one of xanthan gum, gum arabic, carrageenan (lambda), carrageenan (iota), carrageenan (kappa), sodium alginate, konjac, locust bean gum, carboxymethyl cellulose (CMC), chitosan, inulin, pectin (from citrus), pectin (from apple), hydroxypropyl methylcellulose (HPMC), or tara gum.

58. The system according to Claim 53, wherein the nutritional product comprises at least one of a protein, a fat, a fiber, a carbohydrate, a prebiotic, a probiotic, an amino acid, a fatty acid, a phytonutrient, an antioxidant, an electrolyte, or a vitamin.

59. The system according to Claim 53 further comprising a nozzle configured to dispense the homogenous single phase beverage.

60. A method of mitigating a risk of aspiration during swallowing of a nutritional product in a patient in need thereof, the method comprising: orally administering to the patient a ready-to-drink (RTD) beverage formulated having a relaxation time, determined by a Capillary Breakup Extensional Rheometry (CaBER) experiment, of more than 10 ms at 20° C and/or a shear viscosity up to about 2,000 mPas measured at a shear rate of 50 s⁻¹ at 20° C.

61. A method of promoting swallowing safety and/or efficiency in a patient in need thereof, the method comprising orally administering to the patient a ready-to-drink (RTD) beverage formulated having a relaxation time, determined by a Capillary Breakup Extensional Rheometry (CaBER) experiment, of more than 10 ms at 20° C and/or a shear viscosity up to about 2,000 mPas measured at a shear rate of 50 s⁻¹ at 20° C.

62. A method of preventing, alleviating, and/or compensating swallowing dysfunction in a patient in need thereof, the method comprising orally administering to the patient a ready-to-drink (RTD) beverage formulated having a relaxation time, determined by a Capillary Breakup Extensional Rheometry (CaBER) experiment, of more than 10 ms at 20° C and/or a shear viscosity up to about 2,000 mPas measured at a shear rate of 50 s⁻¹ at 20° C.

63. An easy and/or fast dissolving thickener composition formulated for dissolving into a nutritional product suitable for administration to an individual having dysphagia, the easy and/or fast dissolving thickener composition comprising an acid compound, an alkaline compound, a thickening agent, and optionally a trigeminal ingredient.

64. An easy and/or fast dissolving thickener composition formulated to use an effervescent action to dissolve in a liquid into a nutritional product with little or no subsequent stirring, wherein the nutritional product has a relaxation time, determined by a Capillary Breakup

Extensional Rheometry (CaBER) experiment, of more than 10 ms at 20° C and/or a shear viscosity up to about 2,000 mPas measured at a shear rate of 50 s⁻¹ at 20° C.

65. The easy and/or fast dissolving thickener composition according to Claim 63 or 64, wherein the easy and/or fast dissolving thickener composition is formulated to release CO₂ over a sustained period of time.

66. The easy and/or fast dissolving thickener composition according to Claim 63 or 64, wherein the acid compound comprises at least one of citric acid, ascorbic acid, nicotinic acid, acetylsalicylic acid, succinic acid, adipic acid, tartaric acid, fumaric acid, adipic acid, malic acid, anhydrides, or salts thereof.

67. The easy and/or fast dissolving thickener composition according to Claim 63 or 64, wherein the alkaline compound comprises at least one of potassium carbonate, sodium carbonate, sodium bicarbonate, potassium bicarbonate, sodium glycine carbonate, calcium carbonate, arginine carbonate, potassium bitartrate, or sodium tartrate.

68. The easy and/or fast dissolving thickener composition according to Claim 63 or 64, wherein the trigeminal ingredient comprises at least one of cinnamaldehyde with or without zinc, p-anisaldehyde, cuminaldehyde, tiglic aldehyde, Sichuan pepper, capsaicin, capsiate, or isothiocyanate.

69. The easy and/or fast dissolving thickener composition according to Claim 63 or 64, wherein the thickening agent comprises at least one of xanthan gum, gum arabic, carrageenan (lambda), carrageenan (iota), carrageenan (kappa), sodium alginate, konjac, locust bean gum, carboxymethyl cellulose (CMC), chitosan, inulin, pectin (from citrus), pectin (from apple), hydroxypropyl methylcellulose (HPMC), or tara gum.

70. The easy and/or fast dissolving thickener composition according to Claim 63 or 64, wherein the nutritional product comprises at least one of a protein, a fat, a fiber, a carbohydrate, a

prebiotic, a probiotic, an amino acid, a fatty acid, a phytonutrient, an antioxidant, an electrolyte, or a vitamin.