

COMPOSITIONS CONTAINING BRAZZEIN

TECHNICAL FIELD

The present disclosure relates to compositions and methods, which use brazzein in
5 combination with sweetness modifiers, aroma ingredients and/or taste modifiers, in flavor
compositions and consumables, to improve the taste quality and/or the mouthfeel of sweet-tasting
substances.

BACKGROUND

10 Compounds for modifying the taste of consumable products, that is, products taken orally
either for ingestion or spitting out, such as foodstuffs, beverages, confectionery, oral care
products and the like are widely used. They do not themselves add flavor to the consumable, but
they provide desirable ancillary benefits, such as enhanced mouthfeel and/or sweetness, or
masking undesirable characteristics of other ingredients, such as the distinctive tastes and
15 textures perceived as unappealing of products containing sugar replacers.

In the case of sugar replacers, the tastes they impart can present different temporal
profiles, flavor-profiles or adaptation behaviors compared with the sugars which they replace, in
whole or in part. For example, the sweet taste of natural and synthetic high-intensity sweeteners
(HIS), is generally slower in onset and longer in duration than the sweet taste produced by sugar
20 (sweet, short-chain, soluble carbohydrates, including glucose, fructose, sucrose, maltose and
lactose) or high fructose corn syrups (HFCS) which is known as a replacement for sugar, and this
can change the taste balance of an edible composition containing them. This can create
unbalanced temporal taste profiles. In addition to the difference in temporal profile, high-
intensity sweeteners generally exhibit lower maximal response than sugar; off-tastes including
25 bitter, metallic, cooling, astringent, licorice-like taste and/or sweetness, which diminishes on
iterative tasting.

However, all high-intensity sweeteners have undesirable after-taste in the form of off-
notes, such as liquorice-like after-taste, and/or lingering sweetness. In the particular case of Reb
A, this takes the form of a combination of an undesirable lingering sweetness and a liquorice-like
30 after-taste. This after-taste detracts from the desired sugar-like sweetness, and thus effectively
masking undesirable tastes or off-tastes in edible compositions is key to consumer acceptance of
many edible compositions.

Accordingly, there remains a need to provide flavor compositions in order to improve the
taste quality and/or the mouthfeel of sweet-tasting substances.

SUMMARY

In one illustrative embodiment, a flavor composition comprises brazzein and at least one aroma ingredient selected from the group consisting of furonol, ethyl furanone, maltol, furfural, 5-methyl furfural, vanillin and combinations thereof.

In another illustrative embodiment, a flavor composition comprises brazzein, at least one aroma ingredient selected from the group consisting of furonol, ethyl furanone, maltol, furfural, 5-methyl furfural, vanillin and combinations thereof, and at least one sweetness modifier selected from the group consisting of steviol glycosides, mogrosides, dihydrochalcones and combinations thereof.

In another illustrative embodiment, a flavor composition comprises brazzein, at least one sweetness modifier selected from the group consisting of steviol glycosides, mogrosides, dihydrochalcones and combinations thereof, and at least one taste modifier selected from the group consisting of chlorogenic acids, choline chloride, N-oleoyl proline, N-oleoyl valine, N-oleoyl serine, N-oleoyl aspartic acid, N-acylated methionine sulfoxides and combinations thereof.

In yet another illustrative embodiment, a method is disclosed for imparting a more sugar-like temporal profile, flavor profile and/or taste profile to a consumable by adding the flavor compositions disclosed herein to the consumable, thereby providing a consumable having a more sugar-like temporal profile, flavor profile and/or taste profile.

In another embodiment, the more sugar-like temporal profile is a reduced sweetness linger compared to a consumable to which the flavor composition disclosed herein had not been added.

In a further embodiment, the more sugar-like flavor profile is an improved mouthfeel (for example, increased body or fullness) compared to a consumable to which the flavor composition disclosed herein had not been added.

In yet another illustrative embodiment, a consumable is provided. The consumable includes at least one sweetener and a flavor composition according to the present disclosure comprising brazzein. The at least one sweetener is present in a sweetening amount.

Certain embodiments of any aspect of the present disclosure may provide one or more of the following advantages:

- increased sweetness in a composition;
- enhanced sweetness in a composition including at least one sweetener;
- decrease in the amount of caloric sweetener required to obtain desired sweetness;

- improvement of one or more sweetness characteristics to make sweet taste more similar to sugar (sucrose);
- weakening of lingering sweetness (e.g., decreasing the length of time the sweet taste remains and/or decreasing the intensity of the sweet taste more rapidly);
- 5 - weakening of bitter taste and/or liquorice taste and/or metallic taste;
- weakening of the sensory perceptions of dryness and/or astringent mouthfeel;
- improvement in sweetness impact (e.g., increasing the maximum intensity of the sweet taste and/or decreases the length of time for the sweet taste to be detected) (e.g., decreasing the lingering sweetness).
- 10 These and other features, aspects and advantages of specific embodiments will become evident to those skilled in the art from a reading of the present disclosure.

DETAILED DESCRIPTION

The following text sets forth a broad description of numerous different embodiments of the present disclosure. The description is to be construed as exemplary only and does not describe every possible embodiment since describing every possible embodiment would be impractical, if not impossible. It will be understood that any feature, characteristic, component, composition, ingredient, product, step or methodology described herein can be deleted, combined with or substituted for, in whole or part, any other feature, characteristic, component, composition, ingredient, product, step or methodology described herein. Numerous alternative embodiments could be implemented, using either current technology or technology developed after the filing date of this patent, which would still fall within the scope of the claims. All publications and patents cited herein are incorporated herein by reference.

The present disclosure relates to the surprising finding that flavor compositions including brazzein in combination with aroma ingredients, sweetness modifiers and/or taste modifiers improve the taste quality and/or the mouthfeel of sweet-tasting substances.

Brazzein is a sweet-tasting protein extracted from the West African fruit of the climbing plant Oubli (*Pentadiplandra brazzeana Baillon*). It was first isolated by the University of Wisconsin-Madison in 1994. Brazzein is found in the extracellular region, in the pulp tissue surrounding the seeds. Like the other sweet proteins discovered in plants, it is extremely sweet compared to commonly used sweeteners (500 to 2000 times sweeter than sucrose).

The aroma ingredients may comprise one or more of a wide variety of compounds. According to certain illustrative embodiments, the aroma ingredients are selected from the group consisting of furonol, ethyl furanone, maltol, furfural, 5-methyl furfural, vanillin and combinations thereof. The term “aroma ingredient”, as used herein, refers to a compound that is understood by a person skilled in the art to which the present disclosure relates, as allowing to influence or modify in a positive way or in a way that is pleasant to perception and taste of the composition, and not simply as a compound that tastes.

According to certain illustrative embodiments, a flavor composition may comprise brazzein in combination with at least one aroma ingredient.

According to certain embodiments, the amount of brazzein present in the flavor composition may be in a concentration of from about 100 ppm to about 50,000 ppm, in another embodiment from 100 ppm to about 40,000 ppm, such as, for example, from about 100 ppm to about 30,000 ppm, from about 100 ppm to about 25,000 ppm, from about 100 ppm to about 20,000 ppm, from about 100 ppm to about 15,000 ppm, from about 100 ppm to about 10,000 ppm and from about 100 ppm to about 5,000 ppm.

According to certain embodiments, the amount of aroma ingredients present in the flavor composition may be in a concentration of from about 10 ppm to about 20,000 ppm, in another embodiment from 100 ppm to about 10,000 ppm, and in another embodiment from about 500 ppm to about 5,000 ppm.

The sweetness modifiers may comprise one or more of a wide variety of compounds. According to certain illustrative embodiments, the sweetness modifiers are selected from the group consisting of steviol glycosides, mogrosides, dihydrochalcones and combinations thereof. The term “sweetness modifier”, as used herein, refers to a compound that modifies, enhances, amplifies or potentiates the perception of sweetness of a consumable when the compound is present in the consumable in a concentration at or below the compound’s sweetness recognition threshold, i.e., a concentration at which the compound does not contribute any noticeable sweet taste in the absence of additional sweetener(s).

According to certain embodiments, the amount of sweetness modifiers present in the flavor composition may be in a concentration of from about 1,000 ppm to about 200,000 ppm, in another embodiment from 2,000 ppm to about 100,000 ppm, and in another embodiment from about 5,000 ppm to about 50,000 ppm.

The term “sweetness recognition threshold concentration,” as used herein, is the lowest known concentration of a compound that is perceivable by the human sense of taste as sweet. In one embodiment, the sweetness modifier is a steviol glycoside(s). Examples of steviol

glycosides include, for example, stevioside (CAS: 57817-89-7), rebaudioside A (CAS: 58543-16-1), rebaudioside B (CAS: 58543-17-2), rebaudioside C (CAS: 63550-99-2), rebaudioside D (CAS: 63279-13-0), rebaudioside E (CAS: 63279-14-1), rebaudioside F (CAS: 438045-89-7), rebaudioside G (CAS: 127345-21-5), rebaudioside H, rebaudioside I (CAS: 1220616-34-1),
 5 rebaudioside J, rebaudioside K, rebaudioside L, rebaudioside M (CAS: 1220616-44-3), rebaudioside N (CAS: 1220616-46-5), rebaudioside O (CAS: 1220616-48-7), dulcoside A (CAS: 64432-06-0), dulcoside B (CAS: 63550-99-2), rubusoside (CAS: 64849-39-4) and Naringin Dihydrochalcone (CAS: 18916-17-1).

In another embodiment, the steviol glycoside may be a glucosylated steviol glycoside.
 10 The glucosylated steviol glycoside included in the composition may be selected from any one or more steviol glycosides capable of having one or more glucose units added to the molecule by a glucosylation reaction. By way of example, but not in limitation, the glucosylated steviol glycoside included in the sweetness modifying composition may be selected from glucosylated stevioside, glucosylated rebaudioside A, glucosylated rebaudioside B, glucosylated rebaudioside
 15 C, glucosylated rebaudioside D, glucosylated rebaudioside E, glucosylated rebaudioside F, glucosylated rebaudioside G, glucosylated rebaudioside H, glucosylated rebaudioside I, glucosylated rebaudioside J, glucosylated rebaudioside K, glucosylated rebaudioside L, glucosylated rebaudioside M, glucosylated rebaudioside N, glucosylated rebaudioside O, glucosylated dulcoside A, glucosylated dulcoside B, glucosylated rubusoside, any other
 20 glucosylated steviol glycosides derived from an extract of *Stevia rebaudiana*, and mixtures thereof.

The glucosylated steviol glycosides may have different degrees of glucosylation. The glucosylated steviol glycoside of the composition may therefore comprise a blend of the same type of glucosylated steviol glycoside and having different or varying degrees of glucosylation.
 25 The glucosylated steviol glycoside of the composition may also comprise a blend of one or more different types of glucosylated steviol glycoside having the same degree of glucosylation. The glucosylated steviol glycoside of the composition may further comprise a blend of one or more of different types of glucosylated steviol glycoside with each type having different or varying degrees of glucosylation.

30 The glucosylated steviol glycosides may comprise a blend of at least one glucosylated steviol glycoside and at least one residual steviol glycoside. A residual steviol glycoside refers to an unreacted steviol glycoside that has not been glucosylated. The residual steviol glycoside may include residual stevioside, residual rebaudioside A, residual rebaudioside B, residual rebaudioside C, residual rebaudioside D, residual rebaudioside E, residual rebaudioside F,

residual rebaudioside G, residual rebaudioside H, residual rebaudioside I, residual rebaudioside J, residual rebaudioside K, residual rebaudioside L, residual rebaudioside M, residual rebaudioside N, residual rebaudioside O, residual dulcoside A, residual dulcoside B, residual rubusoside, any other residual steviol glycosides derived from an extract of *Stevia rebaudiana*, and mixtures thereof. The blend of the at least one glucosylated steviol glycoside and the at least one residual steviol glycoside may comprise about 1 percent and 15 percent of the at least one residual steviol glycoside. According to certain embodiments, the blend of the at least one glucosylated steviol glycoside and the at least one residual steviol glycoside may comprise between about 1 percent and 10 percent, or about 1 percent to about 8 percent, or about 1 percent to about 6 percent, or about 1 percent to about 4 percent, or about 1 percent to about 2 percent, of the at least one residual steviol glycoside.

The glucosylated steviol glycosides may be prepared by preparing a reaction mixture of one or more steviol glycosides, a source of glucose units to be added to the steviol glycoside molecules, an enzyme to catalyze the glucosylation reaction, and a suitable solvent. According to certain embodiments, the glucosylated steviol glycosides are prepared by preparing a reaction mixture of one or more steviol glycosides, a starch as the source of glucose units to be added to the steviol glycoside molecules, CGTase (cyclodextrin glucano-transferase) to catalyze the glucosylation reaction, and water as the solvent. The glucosylation reaction is carried out on the reaction mixture, and the resulting product is purified and dried. By way of example, the glucosylated steviol glycosides may be prepared in accordance with the disclosure of JP2001-120218 A, which is incorporated by reference. The alpha-glycosyl steviol glycosides (alpha-GS) are prepared by the alpha-addition of glucose by means of cyclodextrin glucosyl-transferase to a stevia extract that contains at least 1.5 times as much RebA as stevioside.

In another embodiment, the sweetness modifier may be one or more mogroside(s). Mogrosides are a group of triterpene glycosides and may be obtained from the fruit Luo Han Guo (*Siraitia grosvenorii*), also known as arhat fruit or longevity fruit or swingle fruit. Mogrosides make up approximately 1% of the flesh of the fresh fruit. Through extraction, an extract in the form of a powder containing up to 80% mogrosides can be obtained. Examples of mogrosides include, for example, grosvenorine II, grosvenorine I, 11-O-mogroside II (I), 11-O-mogroside II (II), 11-O-mogroside II (III), mogroside II (I), mogroside II (II), mogroside II (III), 11-dehydroxy-mogroside III, 11-O-mogroside III, mogroside III (I), mogroside III (II), mogroside IIIe, mogroside IIIx, mogroside IV (I) (siamenoside), mogroside IV (II), mogroside IV (III), mogroside IV (IV), deoxymogroside V (I), deoxymogroside V (II), 11-O-mogroside V (I), mogroside V isomer, mogroside V, iso-mogroside V, 7-O-mogroside V, 11-O-mogroside VI,

mogroside VI (I), mogroside VI (II), mogroside VI (III) (neomogroside) and mogroside VI (IV). The mogroside(s) may, for example, be obtained or obtainable from Luo Han Guo extracts.

In another embodiment, the sweetness modifier may be one or more dihydrochalcones. Examples of dihydrochalcones include, for example, trilobatin (1-[4-(beta-D-glucopyranosyloxy)-2,6-dihydroxyphenyl]-3-(4-hydroxyphenyl)-1-propanone is also known as
5 p-Phlorizin, Phloretin 4'-glucoside, Phloretine-4'-glucoside, Prunin dihydrochalcone, or p-Phloridzin); HDG or hesperitin dihydrochalcone (4''-beta-D-glucoside is also known as 1-[4-(-D-glucopyranosyloxy)-2,6-dihydroxyphenyl]-3-(3-hydroxy-4-methoxyphenyl)-1-propanone);
naringin dihydrochalcone (NarDHC, is also known as 1-[4-[[2-O-(6-Deoxy-alpha-L-
10 mannopyranosyl)-beta-D-glucopyranosyl]oxy]-2,6-dihydroxyphenyl]-3-(4-hydroxyphenyl)-1-propanone); and neohesperidin dihydrochalcone (NHDC, E959).

Trilobatin is a natural dihydrochalcone type sweetener that occurs in the Chinese sweet tea plant *Lithocarpus polystachyus*, the leaves of which have been consumed as sweet tea in the south of China for centuries. HDG is present in peels/fruit of *Citrus sinensis* L. (Rutaceae),
15 commonly known as sweet orange and *C. reticulata*, commonly known as tangerine or mandarin. The synthesis of HDG may be performed by reduction of hesperidin in dilute alkali which yields hesperidin dihydrochalcone, followed by partial hydrolysis, either by acid or by a dissolved or immobilized enzyme, to form HDG, for example as described in US 3,429,873.

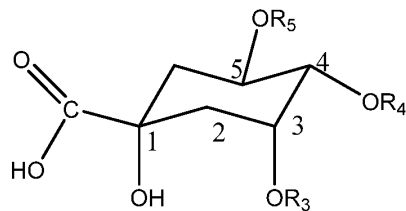
According to certain illustrative embodiments, a flavor composition may comprise
20 brazzein in combination with at least one aroma ingredient and at least one sweetness modifier.

The taste modifiers may comprise one or more of a wide variety of compounds. According to certain illustrative embodiments, the at least one taste modifier may be selected from the group consisting of chlorogenic acids, choline chloride, N-oleoyl proline, N-oleoyl valine, N-oleoyl serine, N-oleoyl aspartic acid, N-acylated methionine sulfoxides and
25 combinations thereof. For the purposes of this specification, the term "taste modifier" refers to one or more components that improves the sweet taste profile of a reduced sugar sweetened composition or sweetened consumable to which it is added.

According to certain embodiments, the amount of certain taste modifiers selected from chlorogenic acid or choline chloride and combinations thereof present in the flavor composition
30 may be in a concentration of from about 500 ppm to about 100,000 ppm, in another embodiment from 1,000 ppm to about 50,000 ppm, and in another embodiment from about 5,000 ppm to about 30,000 ppm. According to other embodiments, the amount of certain taste modifiers selected from N-oleoyl proline, N-oleoyl valine, N-oleoyl serine, N-oleoyl aspartic acid, N-acylated methionine sulfoxides and combinations thereof present in the flavor composition may

be in a concentration of from about 0.1 ppm to about 1,000 ppm, in another embodiment from 0.5 ppm to about 500 ppm, and in another embodiment from about 1 ppm to about 100 ppm.

According to other illustrative embodiments, the taste modifier of the composition comprises one or more of a chlorogenic acid. The term chlorogenic acid refers to quinic acid
5 conjugates comprising one or more compounds of a family of esters that form between cis and trans cinnamic acids (for example, caffeic acid, ferulic acid, p-coumaric acid, sinapic acid) and quinic acid. The quinic acid conjugates are represented by the following formula:



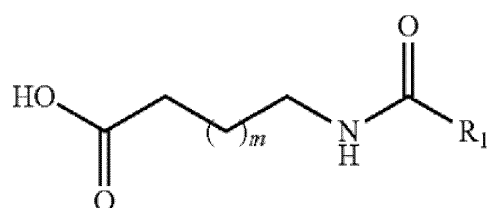
wherein certain illustrative quinic acid conjugates are defined by the R group substitutions shown
10 in the following table:

Identity of R3	Identity of R4	Identity of R5
caffeic acid	H	H
H	caffeic acid	H
H	H	caffeic acid
ferulic acid	H	H
H	ferulic acid	H
H	H	ferulic acid
p-coumaric acid	H	H
H	p-coumaric acid	H
H	H	p-coumaric acid
caffeic acid	caffeic acid	H
caffeic acid	H	caffeic acid
H	caffeic acid	caffeic acid
caffeic acid	ferulic acid	H
ferulic acid	caffeic acid	H
caffeic acid	H	ferulic acid
ferulic acid	H	caffeic acid
H	caffeic acid	ferulic acid
H	ferulic acid	caffeic acid

The use of chlorogenic acids as a taste modifier is more fully described in WO2002/100192 A1, which is fully incorporated herein by reference.

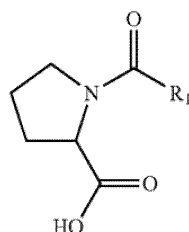
According to other illustrative embodiments, the taste modifier of the composition may comprise choline chloride as described in WO2011/073187 A1, which is incorporated by reference.

- According to other illustrative embodiments, the taste modifier of the composition comprises one or more carboxylic acid-amino acid conjugates of the following formula and derivatives thereof:



- wherein R₁ is an alkyl residue having from 6 to 30 carbon atoms, or an alkene residue containing from 9 to 25 carbon atoms with 1 to 6 double bonds together, R₁ with the carbonyl group to which it is attached is a residue of a carboxylic acid, m is 0 or 1. The edible derivatives may comprise an edible salt, including those typically used in the food and beverage industry, including, without limitation, chlorides, sulphates, phosphates, gluconates, sodium salts, citrates, carbonates, acetates and lactates. These carboxylic acid-amino acid conjugates are more fully described in WO2013/148991 A1, which is incorporated herein by reference. Examples of carboxylic acid-amino acid conjugates may include C18:2-Beta Ala and C18:2-gaba.

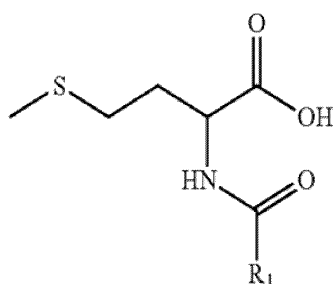
- According to other illustrative embodiments, the taste modifier of the composition comprises one or more carboxylic acid-amino acid conjugates of the following formula and derivatives thereof:



wherein R₁ is an alkyl residue having from 6 to 30 carbon atoms, or an alkene residue containing from 9 to 25 carbon atoms with 1 to 6 double bonds together, R¹ with the carbonyl group to

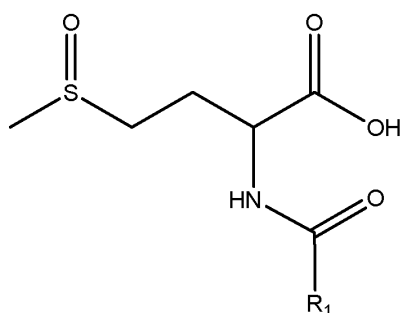
which it is attached is a residue of a carboxylic acid, m is 0 or 1. The edible derivatives may comprise an edible salt, including those typically used in the food and beverage industry, including, without limitation, chlorides, sulphates, phosphates, gluconates, sodium salts, citrates, carbonates, acetates and lactates. These carboxylic acid-amino acid conjugates are more fully
 5 described in WO2013/149022 A1, which is incorporated herein by reference. Examples of carboxylic acid-amino acid conjugates may include N-geranoyl-Pro, N-palmiteneoyl-Pro, N-stearoyl-Pro, N-oleoyl-Pro, N-linoleoyl-Pro, and N-linolenoyl-Pro.

According to other illustrative embodiments, the taste modifier of the composition comprises one or more carboxylic acid-amino acid conjugates of the following formula and
 10 derivatives thereof:



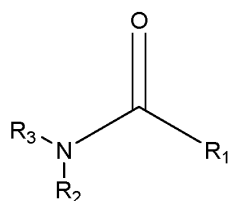
wherein R₁ is an alkyl residue having from 6 to 30 carbon atoms, or an alkene residue containing from 9 to 25 carbon atoms with 1 to 6 double bonds together, R¹ with the carbonyl group to
 15 which it is attached is a residue of a carboxylic acid, m is 0 or 1. The edible derivatives may comprise an edible salt, including those typically used in the food and beverage industry, including, without limitation, chlorides, sulphates, phosphates, gluconates, sodium salts, citrates, carbonates, acetates and lactates. These carboxylic acid-amino acid conjugates are more fully described in WO2013/149019 A1, which is incorporated herein by reference. Examples of
 20 carboxylic acid-amino acid conjugates may include N-geranoyl-Met, N-palmiteneoyl-Met, N-stearoyl-Met, N-oleoyl-Met, N-linoleoyl-Met, and N-linolenoyl-Met.

According to other illustrative embodiments, the taste modifier of the composition comprises one or more carboxylic acid-amino acid conjugates of the following formula and
 25 derivatives thereof:



wherein R_1 is an alkyl residue containing 2 to 18 carbon atoms, or an alkene residue containing from 9 to 25 carbon atoms with 1 to 6 double bonds, R_1 together with the carbonyl group to which it is attached is a residue of a carboxylic acid. These carboxylic acid-amino acid conjugates are more fully described in US10,385,015, which is incorporated herein by reference. Examples of carboxylic acid-amino acid conjugates may include sulfoxide compounds selected from the group consisting of (2S)-2-acetamido-4-(methylsulfinyl)butanoic acid; (2S)-2-hexanamido-4-(methylsulfinyl)butanoic acid; (2S)-2-decanamido-4-(methylsulfinyl)butanoic acid; (2S)-2-((Z)-dodec-5-enamido)-4-(methylsulfinyl)butanoic acid; (2S)-2-dodecanamido-4-(methylsulfinyl)butanoic acid; (2S)-4-(methylsulfinyl)-2-tetradecanamidobutanoic acid; (2S)-4-(methylsulfinyl)-2-pentadecanamidobutanoic acid; (2S)-4-(methylsulfinyl)-2-palmitamidobutanoic acid; (2S)-2-heptadecanamido-4-(methylsulfinyl)butanoic acid; (2S)-4-(methylsulfinyl)-2-((9Z,12Z)-octadeca-9,12-dienamido)butanoic acid; (2S)-4-(methylsulfinyl)-2-oleamidobutanoic acid; and (2S)-4-(methylsulfinyl)-2-stearamidobutanoic acid.

The present invention provides in one of its aspects the use of a compound according to the formula or edible salts thereof,



wherein R_1 is an alkyl residue containing 6 to 20 carbon atoms, or an alkene residue containing from 9 to 25 carbon atoms with 1 to 6 double bonds, R_1 together with the carbonyl group to which it is attached is a residue of a carboxylic acid, and NR_2R_3 , in which R_3 is H or together with R_2 and the N-atom to which they are attached, a 5-membered ring, is a residue of an amino acid, in particular a proteinogenic amino acid, ornithine, gamma-aminobutyric acid or beta

alanine, or a 1-amino cycloalkyl carboxylic acid. These carboxylic acid-amino acid conjugates are more fully described in WO2013/148965, which is incorporated herein by reference.

Edible salts include those typically employed in the food and beverage industry and include chlorides, sulphates, phosphates, gluconates, sodium, citrates, carbonates, acetates and
5 lactates. The proteinogenic amino acids are alanine (Ala), cysteine (Cys), aspartic acid (Asp), phenylalanine (Phe), glutamic acid (Glu), histidine (His), isoleucine (Ile), lysine (Lys), leucine (Leu), methionine (Met), asparagines (Asn), glutamine (Gln), arginine (Arg), serine (Ser), threonine (Thr), valine (Val), tryptophan (Trp), tyrosine (Tyr), proline (Pro) or glycine (Gly). Examples of carboxylic acid-amino acid conjugates may include N-oleoyl valine, N-oleoyl
10 serine, N-oleoyl aspartic acid.

According to certain illustrative embodiments, a flavor composition may comprise brazzein in combination with at least one sweetness modifier and at least one taste modifier.

The flavor composition described herein may modify and/or modulate the taste of at least one sweetener. The at least one sweetener can be any known sweetener, for example, a natural
15 sweetener, a natural high potency sweetener or a synthetic sweetener.

The at least one sweetener is present in a sweetening amount. "Sweetening amount", as used herein, refers to the amount of compound required to provide detectable sweetness when present in a consumable, e.g., a beverage.

As used herein, the phrase "natural high potency sweetener" refers to any sweetener
20 found naturally in nature and characteristically has a sweetness potency greater than sucrose, fructose, or glucose, yet has less calories. The natural high potency sweetener can be provided as a pure compound or, alternatively, as part of an extract. As used herein, the phrase "synthetic sweetener" refers to any composition which is not found naturally in nature and characteristically has a sweetness potency greater than sucrose, fructose, or glucose, yet has less calories.

In other embodiments, the at least one sweetener is a carbohydrate sweetener. Suitable
25 carbohydrate sweeteners are selected from, but not limited to, the group consisting of sucrose, glyceraldehyde, dihydroxyacetone, erythrose, threose, erythrulose, arabinose, lyxose, ribose, xylose, ribulose, xylulose, allose, altrose, galactose, glucose, gulose, idose, mannose, talose, fructose, psicose, sorbose, tagatose, mannoheptulose, sedoheptulose, octulose, fucose, rhamnose,
30 turanose, cellobiose, sialose and combinations thereof. In other embodiments, the at least one sweetener does not comprise a carbohydrate sweetener.

In another embodiment, the additional sweetener is a rare sugar selected from sorbose, lyxose, ribulose, xylose, xylulose, D-allose, L-ribose, D-tagatose, L-glucose, L-fucose, L-arabinose, turanose and combinations thereof. Other sweeteners include Siamenoside I, monatin

and its salts (monatin SS, RR, RS, SR), curculin, glycyrrhizic acid and its salts, thaumatin, monellin, mabinlin, tamarin, hemandulcin, phyllodulcin, glycyphyllin, trilobatin, baiyunoside, osladin, polypodoside A, pterocaryoside A, pterocaryoside B, mukurozioside, phlomisioside I, periandrin I, abrusoside A, steviolbioside and cyclocarioside I, sugar alcohols such as erythritol, 5 sucralose, potassium acesulfame, acesulfame acid and salts thereof, aspartame, alitame, saccharin and salts thereof, hesperidin dihydrochalcone glucoside, neohesperidin dihydrochalcone, cyclamate, cyclamic acid and salts thereof, neotame, advantame, glucosylated steviol glycosides (GSGs) and combinations thereof.

In one embodiment, the sweetener is a caloric sweetener or mixture of caloric sweeteners.

10 In another embodiment, the caloric sweetener is selected from sucrose, fructose, glucose, high fructose corn/starch syrup, a beet sugar, a cane sugar and combinations thereof.

In other embodiments, the sweetener comprises at least one steviol glycoside or mogroside, wherein the at least one steviol glycoside or mogroside is present in a sweetening amount.

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Products

According to the present disclosure, brazzein may be added to a sweetened consumable (i.e., a consumable having at least one sweetener therein), or may be provided as part of a flavor composition for consumables.

20 In one embodiment, brazzein is present in the flavor composition in an amount such that, when the flavor composition is added to a sweetened consumable, the sucrose equivalence of the consumable is increased compared to the consumable in the absence of brazzein.

When added to a consumable, brazzein is included in an amount effective to modify the sweetness or mouthfeel of a sweetener without exhibiting any off-taste. According to certain 25 embodiments, the amount of brazzein present in the consumable may be in a concentration of from about 0.1 ppm to about 50 ppm, in another embodiment from 0.1 ppm to about 40 ppm, such as, for example, from about 0.1 ppm to about 30 ppm, from about 0.1 ppm to about 25 ppm, from about 0.1 ppm to about 20 ppm, from about 0.1 ppm to about 15 ppm, from about 0.1 ppm to about 10 ppm and from about 0.1 ppm to about 5 ppm.

30 In another embodiment, flavor compositions may include brazzein in combination with aroma ingredients, sweetness modifiers and/or taste modifiers to improve the taste quality and/or the mouthfeel of sweet-tasting substances. According to certain embodiments, the amount of aroma ingredients present in the consumable may be in a concentration of from about 0.01 ppm to about 20 ppm, in another embodiment from 0.1 ppm to about 10 ppm, and in another

embodiment from about 0.5 ppm to about 5 ppm. According to certain embodiments, the amount of sweetness modifiers present in the consumable may be in a concentration of from about 1 ppm to about 200 ppm, in another embodiment from 2 ppm to about 100 ppm, and in another embodiment from about 5 ppm to about 50 ppm. According to certain embodiments, the amount of certain taste modifiers selected from chlorogenic acid or choline chloride and combinations thereof present in the consumable may be in a concentration of from about 0.5 ppm to about 100 ppm, in another embodiment from 1 ppm to about 50 ppm, and in another embodiment from about 5 ppm to about 30 ppm. According to other embodiments, the amount of certain taste modifiers selected from N-oleoyl proline, N-oleoyl valine, N-oleoyl serine, N-oleoyl aspartic acid, N-acylated methionine sulfoxides and combinations thereof present in the consumable may be in a concentration of from about 0.0001 ppm to about 1 ppm, in another embodiment from 0.0005 ppm to about 0.5 ppm, and in another embodiment from about 0.001 ppm to about 0.1 ppm.

In one embodiment, the at least one sweetener described herein is present in the consumable in a concentration from about 50 ppm to about 600 ppm, such as, for example, about 50 ppm to about 500 ppm, from about 50 ppm to about 400 ppm, from about 50 ppm to about 300 ppm, from about 50 ppm to about 200 ppm, from about 50 ppm to about 100 ppm, about 100 ppm to about 600 ppm, about 100 ppm to about 500 ppm, about 100 ppm to about 400 ppm, about 100 ppm to about 300 ppm, about 100 ppm to about 200 ppm, about 200 ppm to about 600 ppm, about 200 ppm to about 500 ppm, about 200 ppm to about 400 ppm, about 200 ppm to about 300 ppm, about 300 ppm to about 600 ppm, about 300 ppm to about 500 ppm, about 300 ppm to about 400 ppm, about 400 ppm to about 600 ppm, about 400 ppm to about 500 ppm and about 500 ppm to about 600 ppm. In another embodiment, for full and reduced sugar applications, the at least one sweetener may be present in the consumable in a concentration up to 1,000 ppm.

When expressed as “ppm”, the concentration is parts per million by weight based on the total weight of the consumable. It should be understood that when a range of values is described in the present disclosure, it is intended that any and every value within the range, including the end points, is to be considered as having been disclosed. It is to be understood that the inventors appreciate and understand that any and all values within the range are to be considered to have been specified, and that the inventors have possession of the entire range and all the values within the range.

Flavor compositions may also contain one or more food grade excipient(s). Suitable excipients for flavor compositions are well known in the art and include, for example, without

limitation, solvents (including water, alcohol, ethanol, oils, fats, vegetable oil, and miglyol), binders, diluents, disintegrating agents, lubricants, flavoring agents, colouring agents, preservatives, antioxidants, emulsifiers, stabilisers, flavor-enhancers, sweetening agents, anti-caking agents, and the like. Examples of such carriers or diluents for flavors may be found e.g. in

5 "Perfume and Flavour Materials of Natural Origin", S. Arctander, Ed., Elizabeth, N.J., 1960; in "Perfume and Flavor Chemicals", S. Arctander, Ed., Vol. I & II, Allured Publishing Corporation, Carol Stream, USA, 1994; in "Flavourings", E. Ziegler and H. Ziegler (ed.), Wiley-VCH Weinheim, 1998, and "CTFA Cosmetic Ingredient Handbook", J.M. Nikitakis (ed.), 1st ed., The Cosmetic, Toiletry and Fragrance Association, Inc., Washington, 1988.

10 The flavor composition may have any suitable form, for example liquid or solid, wet or dried, or in encapsulated form bound to or coated onto carriers/particles or as a powder.

In the present disclosure, the term "about" used in connection with a value is inclusive of the stated value and has the meaning dictated by the context. For example, it includes at least the degree of error associated with the measurement of the particular value. One of ordinary skill in

15 the art would understand the term "about" is used herein to mean that an amount of "about" of a recited value produces the desired degree of effectiveness in the compositions and/or methods of the present disclosure. One of ordinary skill in the art would further understand that the metes and bounds of "about" with respect to the value of a percentage, amount or quantity of any component in an embodiment can be determined by varying the value, determining the

20 effectiveness of the compositions or methods for each value, and determining the range of values that produce compositions or methods with the desired degree of effectiveness in accordance with the present disclosure.

The consumable may include a base. As used herein, the term "base" refers to all the ingredients necessary for the consumable, apart from the flavor composition. These will

25 naturally vary in both nature and proportion, depending on the nature and use of the consumable or additive, but they are all well known to the art and may be used in art-recognized proportions. The formulation of such a base for every conceivable purpose is therefore within the ordinary skill of the art. For example, the base for a beverage according to the present disclosure may include 5% sucrose and 0.05% citric acid in water.

30 Without limitation, and only by way of illustration, suitable bases may include, anti-caking agents, anti-foaming agents, anti-oxidants, binders, colourants, diluents, disintegrants, emulsifiers, encapsulating agents or formulations, enzymes, fats, flavor-enhancers, flavoring agents, gums, polysaccharides, preservatives, proteins, solubilisers, solvents, stabilisers, sugar-derivatives, surfactants, sweetening agents, vitamins, waxes, and the like. Solvents which may

be used are known to those skilled in the art and include e.g., water, ethanol, ethylene glycol, propylene glycol, glycerine and triacetin. Encapsulants and gums include maltodextrin, gum arabic, alginates, gelatine, modified starch, other polysaccharides, and proteins.

5 Examples of excipients, carriers, diluents or solvents for flavor compounds may be found e.g. in “Perfume and Flavour Materials of Natural Origin”, S. Arctander, Ed., Elizabeth, N.J., 1960; in “Perfume and Flavour Chemicals”, S. Arctander, Ed., Vol. I & II, Allured Publishing Corporation, Carol Stream, USA, 1994; in “Flavourings”, E. Ziegler and H. Ziegler (ed.), Wiley-VCH Weinheim, 1998, and “CTFA Cosmetic Ingredient Handbook”, J. M. Nikitakis (ed.), 1st ed., The Cosmetic, Toiletry and Fragrance Association, Inc., Washington, 1988.

10 Non-limiting examples of suitable flavor-providing ingredients include natural flavors, artificial flavors, spices, seasonings, and the like. These include synthetic flavor oils and flavoring aromatics and/or oils, oleoresins, essences, and distillates, and combinations thereof.

Ancillary ingredients may be present to provide other benefits such as enhanced stability, ease of incorporation into a consumable or additive and enhanced nutritional value. Non-limiting
15 typical examples of such ancillary ingredients include stabilizers, emulsifiers, preservatives, gums, starches, dextrans, vitamins and minerals, functional ingredients, salts, antioxidants, and polyunsaturated fatty acids. Particular examples are emulsifiers and carriers, useful in spray drying processes. Non-limiting examples of these are modified starches, such as CAPSUL™, and maltodextrin.

20 The additive may be a single ingredient or a blend of ingredients, or it may be encapsulated in any suitable encapsulant. The additive may be prepared by any suitable method, such as spray drying, extrusion and fluidized bed drying.

According to the present disclosure, the term “consumable” refers to products for consumption by a subject, typically via the oral cavity (although consumption may occur via
25 non-oral means such as inhalation), for at least one of the purposes of enjoyment, nourishment, or health and wellness benefits. Consumables may be present in any form including, but not limited to, liquids, solids, semi-solids, tablets, capsules, lozenges, strips, powders, gels, gums, pastes, slurries, solutions, suspensions, syrups, aerosols and sprays. The term also refers to, for example, dietary and nutritional, and health and wellness supplements. Consumables include
30 compositions that are placed within the oral cavity for a period of time before being discarded but not swallowed. It may be placed in the mouth before being consumed, or it may be held in the mouth for a period of time before being discarded.

Broadly, consumables include, but are not limited to, comestibles of all kinds, confectionery products, baked products, sweet products, savoury products, fermented products, dairy products, non-dairy products, beverages, nutraceuticals and pharmaceuticals.

Non-limiting examples of consumables include: wet/liquid soups regardless of
5 concentration or container, including frozen soups. For the purpose of this definition soup(s) means a food prepared from meat, poultry, fish, vegetables, grains, fruit and other ingredients, cooked in a liquid which may include visible pieces of some or all of these ingredients. It may be clear (as a broth) or thick (as a chowder), smooth, pureed or chunky, ready-to-serve, semi-condensed or condensed and may be served hot or cold, as a first course or as the main course of
10 a meal or as a between meal snack (sipped like a beverage), soup may be used as an ingredient for preparing other meal components and may range from broths (consomme) to sauces (cream or cheese-based soups); dehydrated and culinary foods, including cooking aid products such as: powders, granules, pastes, concentrated liquid products, including concentrated bouillon, bouillon and bouillon like products in pressed cubes, tablets or powder or granulated form, which
15 are sold separately as a finished product or as an ingredient within a product, sauces and recipe mixes (regardless of technology); meal solutions products such as: dehydrated and freeze dried soups, including dehydrated soup mixes, dehydrated instant soups, dehydrated ready-to-cook soups, dehydrated or ambient preparations of ready-made dishes, meals and single serve entrees including pasta, potato and rice dishes; meal embellishment products such as: condiments,
20 marinades, salad dressings, salad toppings, dips, breading, batter mixes, shelf stable spreads, barbecue sauces, liquid recipe mixes, concentrates, sauces or sauce mixes, including recipe mixes for salad, sold as a finished product or as an ingredient within a product, whether dehydrated, liquid or frozen; beverages, including beverage mixes and concentrates, including but not limited to, alcoholic and non-alcoholic ready to drink and dry powdered beverages, carbonated and non-carbonated beverages, e.g., sodas, fruit or vegetable juices, alcoholic and non-alcoholic
25 beverages, teas such as green tea and black tea, wine such as red wine; confectionery products, e.g., cakes, cookies, pies, candies, chewing gums, gelatins, ice creams, sorbets, puddings, jams, jellies, salad dressings, and other condiments, cereal, and other breakfast foods, canned fruits and fruit sauces and the like.

30 Methods of enhancing the sweetness of a consumable and/or modulating one or more taste attributes of the sweetener to make the consumable taste more like a sucrose-sweetened consumable are provided.

The disclosure is further described with reference to the following non-limiting examples.

EXAMPLES

The following examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations of the invention are possible without departing from the spirit and scope of the present disclosure.

5 While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

10 **Example 1**

A Base (5% sucrose and 0.05% citric acid in water) for use in beverages was prepared. Different combinations of the Base with brazzein, aroma ingredients, sweetness modifiers and/or taste modifiers were prepared in accordance with Tables 1 and 2 below and were evaluated by
 15 experienced flavorists for sweetness characteristics and sensory perceptions of mouthfeel.

Table 1

	Ingredients	(ppm)
1	Brazzein	10
A	Reb A ¹	30
B	Reb A + Stevioside ¹	20
C	Glucosylated Steviol Glycoside ¹	60
D	Mogroside V ¹	20
E	Siamenoside I ¹	10
F	HDG ¹	10
a	Furonol ²	1
b	Ethyl furanone ²	1
c	Maltol ²	1
d	Furfural ²	1
e	5-methyl furfural ²	1
f	Vanillin ²	1
g	Chlorogenic acid ³ based masker	20
h	Choline chloride ³ based masker	20
i	N-oleoyl-Proline ³	0.01

¹Sweetness Modifiers

²Aroma Ingredients

³Taste Modifiers

Table 2

Combination Set A	Combination Set B	Combination Set C
Base	Base	Base
1	1	1+A
a	A	1+C
b	B	1+E
c	C	1+F
d	D	A+g
e	E	A+h
f	F	A+i
1+a	1+A	C+g
1+b	1+B	C+h
1+c	1+C	C+i
1+d	1+D	E+g
1+e	1+E	E+h
1+f	1+F	E+i
A+a	A+a	F+g
A+b	B+a	F+h
A+c	C+a	F+i
A+d	D+a	1+A+g
A+e	E+a	1+A+h
A+f	F+a	1+A+i
A	a	1+C+g
1+A	1+a	1+C+h
1+A+a	1+A+a	1+C+i
1+A+b	1+B+a	1+E+g
1+A+c	1+C+a	1+E+h
1+A+d	1+D+a	1+E+i
1+A+e	1+E+a	1+F+g
1+A+f	1+F+a	1+F+h
		1+F+i

The compositions of Sets A, B and C were taste tested by experienced flavorists and the combinations were compared to the Base. The combination of brazzein with aroma ingredient(s) were found to have a more sugar-like mouthfeel. The combination of brazzein with aroma
5 ingredient(s) and sweetness modifier(s) were found to have a more sugar-like mouthfeel and more upfront sweetness. The combination of brazzein with sweetness modifier(s) and taste modifier(s) were found to have a more sugar-like mouthfeel and less lingering sweetness.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such
10 dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm”.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and
15 modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

What is claimed is:

1. A flavor composition comprising:
 - a. brazzein;
 - 5 b. at least one aroma ingredient selected from the group consisting of furonol, ethyl furanone, maltol, furfural, 5-methyl furfural, vanillin and combinations thereof; and
 - c. at least one sweetness modifier selected from the group consisting of steviol glycosides, mogrosides, dihydrochalcones and combinations thereof.
- 10 2. The flavor composition of claim 1, wherein the steviol glycosides are selected from the group consisting of rebaudioside M, rebaudioside D, rebaudioside A, rebaudioside N, rebaudioside O, rebaudioside E, steviolmonoside, steviolbioside, rubusoside, dulcoside B, dulcoside A, rebaudioside B, rebaudioside G, stevioside, rebaudioside C, rebaudioside F,

15 rebaudioside I, rebaudioside H, rebaudioside L, rebaudioside K, rebaudioside J, rebaudioside M2, rebaudioside D2, rebaudioside S, rebaudioside T, rebaudioside U, rebaudioside V, rebaudioside W, rebaudioside Z1, rebaudioside Z2, rebaudioside IX, enzymatically glucosylated steviol glycosides and combinations thereof.
- 20 3. The flavor composition of claim 1, wherein the mogrosides are selected from the group consisting of grosmogroside I, mogroside IA, mogroside IE, 1 l-oxomogroside IA, mogroside II, mogroside II A, mogroside II B, mogroside II E, 7-oxomogroside II E, mogroside III, Mogroside Hie, 1 l-oxomogroside HIE, 11- deoxymogroside III, mogroside IV, Mogroside IVA 1 l-oxomogroside IV, 1 l-oxomogroside IV A, mogroside

25 V, isomogroside V, 1 l-deoxymogroside V, 7-oxomogroside V, 11- oxomogroside V, isomogroside V, mogroside VI, mogrol, 1 l-oxomogrol, siamenoside I, and combinations thereof.
4. A consumable, including the flavor composition of claim 1.
- 30 5. A flavor composition comprising:
 - a. brazzein;
 - b. at least one sweetness modifier selected from the group consisting of steviol glycosides, mogrosides, dihydrochalcones and combinations thereof; and

- c. at least one taste modifier selected from the group consisting of chlorogenic acids, choline chloride, N-oleoyl proline, N-oleoyl valine, N-oleoyl serine, N-oleoyl aspartic acid, N-acylated methionine sulfoxides and combinations thereof.

5 6. A consumable, including the flavor composition of claim 5.

7. A consumable comprising:

- a. at least one sweetener; and
- b. a flavor composition including brazzein; at least one aroma ingredient selected
10 from the group consisting of furonol, ethyl furanone, maltol, furfural, 5-methyl
 furfural, vanillin and combinations thereof; and at least one sweetness modifier
 selected from the group consisting of steviol glycosides, mogrosides,
 dihydrochalcones and combinations thereof;
 wherein the at least one sweetener is present in a sweetening amount.

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8. The consumable of claim 7, wherein the at least one sweetener is selected from the group
consisting of sucrose, fructose, glucose, xylose, arabinose, rhamnose, tagatose, allulose,
trehalose, isomaltulose, steviol glycosides, mogrosides, stevia, trilobatin, rubusoside,
aspartame, advantame, agave syrup, acesulfame potassium (AceK), high fructose corn
20 syrup, neotame, saccharin, sucralose, high fructose corn syrup, starch syrup, Luo Han
 Guo extract, neohesperidin dihydrochalcone, naringin dihydrochalcone, HDG, sugar
 alcohols cellobiose, psicose, cyclamate, tamatin, molasses, rice syrup and combinations
 thereof.

25 9. The consumable of claim 7, wherein the at least one aroma ingredient is present in a
 concentration of from 0.01 ppm to 20 ppm.

10. The consumable of claim 7, wherein the consumable is a beverage.

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