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(54) Title: TEA-BASED PRODUCT

(57) Abstract: Disclosed is a tea-based product having a mass of less than 600 g and comprising: black tea solids in an amount of at least 1% by dry weight of the product; exogenous protein; and greater than 70 mg caffeine. The product can be used to reduce tension and/or increase relaxation of an individual consuming the product.



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Description**TEA-BASED PRODUCT****TECHNICAL FIELD OF THE INVENTION**

[0001] The present invention relates to tea-based products containing high levels of caffeine. More particularly the present invention relates to black tea-based products containing proteins, such as milk tea beverages, having high levels of caffeine and the use of such products to decrease tension and/or promote relaxation.

BACKGROUND TO THE INVENTION

[0002] Mental well-being and “mood foods” are an area of increasing importance for modern consumers. However, there are few products on the market that have been demonstrated to improve the mood of a consumer simply through consumption of the food.

[0003] Caffeine is a stimulant, and especially shows stimulant effects in people with habitually low caffeine intake such as Chinese consumers. In addition caffeine can bring unwanted bitterness to foods and beverages formulated therewith.

[0004] Thus there is a need for food products which bring the positive mood effects of high levels of caffeine but without unwanted stimulant effects such as increasing tension.

[0005] Apart from water, tea is consumed in greater volumes than any other beverage. In Europe, the USA and the Indian subcontinent most of that tea is so-called “black tea” which is obtained from the leaves of the plant *Camellia sinensis* by a process (termed “fermentation”) that allow polyphenols in the leaf to be oxidised by enzymes within the leaf (such as polyphenol oxidase) to produce the coloured polymeric materials that are responsible for the characteristic colour of black teas and of the infusions made from them.

[0006] Black tea is also becoming popular in many other parts of the world, including those parts of the world where tea has been traditionally consumed in unfermented form (i.e., “green tea”). Often black tea is consumed with milk which gives it an improved flavour. Indeed many consumers consider milked tea beverages as indulgent or luxurious drinks.

[0007] US 4,946,701 (Procter & Gamble) discloses a beverage containing a flavourant and green tea solids. When caffeine is present, this beverage is said to retain the alertness benefit of caffeine along with the relaxing effects attributed to the green tea solids. In contrast, US 4,946,701 teaches that black tea (as opposed to green tea) is considered to be a stimulating beverage due to its higher levels of caffeine in relation to the unpolymerized flavanols.

[0008] We have now found that protein-containing black tea products, such as milk tea beverages, actually decrease tension and/or promote relaxation when formulated to deliver high levels of caffeine. Furthermore including protein, fat and/or sweeteners in the product can allow the use of high levels of caffeine without bringing excessive bitterness.

DEFINITIONS

Tea

[0009] "Tea" for the purposes of the present invention means material from *Camellia sinensis* var. *sinensis* and/or *Camellia sinensis* var. *assamica*.

"Tea-based" refers to a composition and/or product comprising at least 1% tea solids by dry weight.

Beverage

[0010] As used herein the term "beverage" refers to a substantially aqueous drinkable composition suitable for human consumption.

Exogenous Protein

[0011] "Exogenous protein" for the purposes of the present invention means protein that is not derived from tea.

Sugars

[0012] As used herein the term "sugars" refers to monosaccharides, disaccharides, oligosaccharides or mixtures thereof.

Miscellaneous

[0013] Except in the examples, or where otherwise explicitly indicated, all numbers in this description indicating amounts of material or conditions of reaction, physical properties of materials and/or use may optionally be understood as modified by the word "about".

[0014] All amounts are by dry weight of the final product, unless otherwise

specified.

- [0015] It should be noted that in specifying any range of concentration or amount, any particular upper concentration can be associated with any particular lower concentration or amount.
- [0016] For the avoidance of doubt, the word “comprising” is intended to mean “including” but not necessarily “consisting of” or “composed of”. In other words, the listed steps or options need not be exhaustive.
- [0017] The disclosure of the invention as found herein is to be considered to cover all embodiments as found in the claims as being multiply dependent upon each other irrespective of the fact that claims may be found without multiple dependency or redundancy.

SUMMARY OF THE INVENTION

- [0018] In a first aspect the present invention provides a tea-based product having a mass of less than 600 g and comprising: black tea solids in an amount of at least 1% by dry weight of the product; and exogenous protein; and wherein the total amount of caffeine in the product is greater than 70 mg.
- [0019] In another aspect the present invention provides the use of the product of the first aspect for reducing tension and/or increasing relaxation in an individual.
- [0020] In a further aspect of the invention there is provided a method of reducing tension and/or increasing relaxation in an individual, comprising administering the product of the first aspect to the individual.

DETAILED DESCRIPTION

Tea Solids

- [0021] The product of the present invention is tea-based and comprises at least 1% by dry weight black tea solids. Preferably the product comprises the black tea solids in an amount of at least 4%, more preferably at least 7%, and most preferably at least 9% by dry weight of the product. Owing to the presence of exogenous protein and optional ingredients, such as sugars, the product preferably comprises less than 50% black tea solids by dry weight of the product, more preferably less than 30% and most preferably less than 20%.
- [0022] Although the product may comprise unfermented tea solids (i.e. green tea

solids) in addition to the black tea solids it is preferable that the majority of tea solids are black tea solids as black tea is the type of tea which tastes the best when combined with exogenous protein, such as milk protein. More preferably at least 75% by weight of the tea solids present in the product are black tea solids, most preferably from 80 to 100% of the tea solids are black tea solids.

Protein

[0023] The product of the present invention comprises exogenous protein. The preferred exogenous proteins are milk proteins such as whey proteins and/or caseins. Thus the exogenous protein preferably comprises milk protein. More preferably at least 50% by weight of the protein is milk protein, most preferably from 75 to 100% by weight of the exogenous protein. Suitable sources of milk protein include, for example, whole milk powder, skimmed milk powder, whey protein concentrate, whey protein isolate, caseinate powder, non-dairy creamer powders, and mixtures thereof.

[0024] Non-dairy proteins may also be used as an alternative or in addition to milk proteins. For example, the exogenous protein may comprise soy protein.

[0025] The amount of exogenous protein is preferably at least 0.5% by dry weight of the product, more preferably at least 1%, more preferably still at least 2% and most preferably at least 3%. However, to retain at least some of the desirable taste of the tea solids, it is preferred that the exogenous protein is present in the product in an amount of less than 50% by dry weight, more preferably less than 30%, more preferably still less than 20% and most preferably less than 10%.

Caffeine

[0026] The product of the present invention comprises greater than 70 mg of caffeine. Despite delivering such a high level of caffeine, the product of the present invention is found to reduce tension and/or increase relaxation in an individual consuming it. Such effects may even be observed if the amount of caffeine in the product is at least 75 mg, more preferably at least 80 mg, and most preferably at least 90 mg. Too high a level of caffeine is preferably avoided to reduce unwanted bitterness. Thus it is

preferred that the product comprises the caffeine in an amount of less than 500 mg, more preferably less than 300 mg and most preferably less than 200 mg.

[0027] The caffeine is conveniently delivered as part of the black tea solids. Thus it is preferred that at least part of the caffeine is provided by the tea solids, more preferably at least 50% by weight of the caffeine is provided by the black tea solids, more preferably still at least 75% and most preferably from 90 to 100%. Delivery of caffeine as part of the tea solids may also help in ameliorating the tension-increasing effects of caffeine as, unlike other beverage materials such as coffee or cocoa, tea solids contain compounds such as theanine and GABA which are also capable of positively affecting the mental state of a consumer. Thus it is preferred that the tea-based product is substantially free from coffee and cocoa solids. In particular it is preferred that the product of the present invention comprises less than 5% by dry weight of coffee and cocoa solids, more preferably the total amount of coffee and cocoa solids is less than 2% by dry weight, more preferably still less than 1%, and most preferably less than 0.5% by dry weight of the product.

Fat

[0028] The product of the present invention may optionally comprise fat, which may help in masking bitterness caused by high caffeine levels. For example, the product may comprise at least 0.1% fat by dry weight of the product, more preferably at least 1%, more preferably still at least 2% and most preferably at least 5%. Preferably, however, the amount of fat is not too high otherwise the product may become too high in calories and/or the desired taste of tea may be masked. Thus it is preferred that the amount of fat is less than 30% by dry weight of the product, more preferably less than 20% by dry weight of the product and most preferably less than 15% by dry weight of the product.

[0029] Conveniently the fat may be milk fat, especially where the exogenous protein comprises milk protein, as then the fat and protein may be added as part of a single composition. For example, the product may comprise milk powder and at least part of the fat and at least part of the protein may

be derived from the milk powder.

[0030] Non-dairy creamers may provide at least part of the exogenous protein in the product of the present invention and typically although such non-dairy creamers comprise milk proteins, any fat used therein is non-dairy fat such as vegetable fat. Thus in one embodiment the fat comprises vegetable fat.

[0031] It is most preferred that at least part of the fat is present in the product as emulsified particles. By "emulsified particles" is meant that the fat is dispersed or dispersible in water to form an emulsion of the particles in the water. Conveniently, at least part of the exogenous protein will coat the emulsified fat particles in order to allow dispersion of the fat particles in water, i.e. at least part of the exogenous protein will be present in the product as an emulsifier for the fat particles.

Sugars

[0032] The product of the present invention may optionally comprise sugars, which may help in masking bitterness caused by high caffeine levels. For example, the product may comprise one or more sugars in an amount of at least 20% by dry weight of the product, more preferably at least 30%, more preferably still at least 40% and most preferably at least 50%. Preferably, however, the amount of sugar is not too high otherwise the product may become too high in calories and/or the desired taste of tea may be masked. Thus it is preferred that the amount of sugar is less than 90% by dry weight of the product, more preferably less than 85% by dry weight of the product and most preferably less than 80% by dry weight of the product.

[0033] Many milk powders and non-dairy creamers contain sugars. For example milk contains lactose. Thus in one embodiment the one or more sugars in the product comprise lactose. Alternatively the product may be suitable for consumers who are lactose intolerant. Thus in another embodiment the product is substantially free from lactose. In particular the product may comprise less than 10% lactose by dry weight, more preferably less than 5% and most preferably from 0.0001% to 1%.

Form of the Product

[0034] The product of the present invention is suitable for human consumption or

at least adapted for preparation of a product suitable for direct human consumption. Preferably the product is a beverage or precursor thereof.

[0035] In a particularly preferred embodiment, the product of the present invention is a dry beverage precursor, most preferably a powdered beverage precursor which can be reconstituted with water to give a milked tea beverage. By "dry beverage precursor" is meant that the beverage precursor has a moisture content of less than 30% by weight, preferably from 0.1 to 10%.

[0036] The mass of the product is such that it may be consumed in a single serving. Thus the mass is less than 600 g. Where the product is a beverage, the mass is typically less than 550 g, more preferably from 100 to 400 g. Where the product is a beverage precursor, the mass is typically less than 100 g, more preferably less than 50 g and most preferably from 2 to 20 g.

Use of the Product

[0037] The product of the present invention may be used for reducing tension and/or increasing relaxation in an individual. This use may also be said to be a method of reducing tension and/or increasing relaxation in an individual, comprising administering the product to the individual. Preferably the product is administered orally. Additionally or alternatively the product is administered in 1 or 2 servings per day, preferably in a single serving.

[0038] The present invention also provides use of the product of the invention in the manufacture of a medicament for reducing tension and/or increasing relaxation in an individual.

EXAMPLE

[0039] The present invention will be further described with reference to the following example.

Method

[0040] A study was conducted employing a placebo controlled, double blind, randomised, parallel design. It consisted of a 2 week intervention period. Volunteers consumed a milk tea variant containing: caffeine (~100 mg per serve), gamma-aminobutyric acid (GABA) (~200 mg per serve), or placebo

(low caffeine milk tea) and completed a daily diary.

[0041] There were 546 participants recruited from the Shanghai area of China and with the following profile:

- 271 males, 275 females;
- 20-35 years old;
- 305 single, 241 married;
- Not regular milk tea consumers, although they like it;
- Above average income and education;
- In good health.

[0042] Each participant consumed one milk-tea variant for the full 2 weeks, with one serving of the milk tea beverage per day being consumed within 1 hour after lunch. Participants were instructed to avoid consuming other caffeine-containing foods within 1 hour of consuming a milk tea beverage. Half of the participants consuming each variant were given information that the drink would have positive effects on their mood whilst the other half were given no indication as to what they may expect from the drink.

[0043] The daily diary included questions wherein the participant was asked to indicate how they felt approximately 40-60 min after drinking the milk tea. One such question required each participant to indicate an integer ranging from -3 to +3 on a scale wherein a score of -3 was associated with “relaxed”, 0 was “neutral” and +3 was associated with “tense”. Since some of the respondents chose the same answers every single day, significant effects were seen only when baseline was taken into account in the analysis of the data. The baseline was the diary scores recorded at the beginning of the study before the participants began regularly consuming the milk tea.

Formulations

[0044] Each beverage was prepared by dissolving a single serving of milk tea powder in a cup of freshly boiled water (~100-200 ml water) directly before consumption.

[0045] The formulations of the powders used for each variant were as shown in Table 1.

[0046]

Table 1

Ingredient	Variant					
	GABA		High-Caffeine		Low-Caffeine (Placebo)	
	Mass per serve (g)	% w/w	Mass per serve (g)	% w/w	Mass per serve (g)	% w/w
Sucrose	8.89	55.6	8.50	53.2	8.84	58.9
Non-Dairy Creamer	2.20	13.8	2.21	13.8	2.21	14.7
Whole Milk Powder	2.42	15.1	2.44	15.3	2.44	16.3
Sodium Caseinate	0.27	1.7	0.27	1.7	0.27	1.8
Black Tea Powder	0.94 ²	5.9 ²	2.16 ³	13.5 ³	0.90 ⁴	6.0 ⁴
GABA Powder ¹	0.94	5.9	--	--	--	--
Sodium Carboxymethyl Cellulose	0.13	0.8	0.13	0.8	0.14	0.9
Tri-calcium Phosphate	0.04	0.3	0.04	0.3	0.05	0.3
Flavour	0.15	0.9	0.23	1.4	0.15	1.0
Total	16.0	100	16.0	100	15.0	100
Caffeine content per serve (mg)	46		110		23	

1. Supplied by PharmaFoods International (Japan) – GABA content of 22.3% by weight.

2. Blend of commercially available black tea powders with total caffeine content of 4.9% by weight of the tea powder.

3. Blend of commercially available black tea powders with total caffeine content of 5.1% by

weight of the tea powder.
4. Blend of commercially available black tea powders with total caffeine content of 2.5% by weight of the tea powder.

[0047] Each variant was formulated to have approximately 7% protein, 70% sugars and 9% fat by weight of the powder.

Results

[0048] The results of the study are presented in table 2. The “Tension” variable represents the change in the diary score relative to baseline wherein a positive value indicates an increase in tension/decrease in relaxation and a negative score indicates less tension / more relaxation. The mean values at the end of the 2-week intervention period for all participants are shown along with the associated standard error.

[0049]

Table 2

Variant	Mood Communication	Tension*
GABA	None	+0.050±0.033
	Positive	-0.342±0.037
High Caffeine	None	-0.223±0.041
	Positive	-0.203±0.037
Low Caffeine (Placebo)	None	-0.069±0.042
	Positive	-0.126±0.036
* Change relative to baseline.		

[0050] These results demonstrate that although the GABA variant with positive mood communication gave the largest decrease in tension, only the high caffeine variant gave a significant decrease in tension regardless of communication.

Claims

1. A tea-based product having a mass of less than 600 g and comprising: black tea solids in an amount of at least 1% by dry weight of the product; and exogenous protein; and wherein the product comprises caffeine in a total amount of greater than 70 mg.
2. The product as claimed in claim 1 wherein the protein comprises milk protein.
3. The product as claimed in claim 1 or claim 2 wherein at least 50% by weight of the caffeine is provided by the tea solids.
4. The product as claimed in any one of the preceding claims wherein the amount of caffeine is at least 75 mg.
5. The product as claimed in any one of the preceding claims wherein the amount of black tea solids is from 2 to 50% by dry weight of the product.
6. The product as claimed in any one of the preceding claims wherein the amount of the exogenous protein is from 0.5 to 50% by dry weight of the product.
7. The product as claimed in any one of the preceding claims wherein the product additionally comprises fat.
8. The product as claimed in claim 7 wherein the amount of the fat is from 0.1 to 30% by dry weight of the product.
9. The product as claimed in claim 7 or claim 8 wherein at least part of the fat is present as emulsified particles.
10. The product as claimed in any one of the preceding claims additionally comprising one or more sugars in an amount of from 20 to 90% by dry weight of the product.
11. The product as claimed in any one of the preceding claims which is a beverage.
12. The product as claimed in any one of claims 1 to 10 which is a beverage precursor.
13. Use of a product according to any one of the preceding claims for reducing tension and/or increasing relaxation in an individual.
14. A method of reducing tension and/or increasing relaxation in an individual, comprising administering a product according to any one of claims 1 to 12 to the individual.