

EVALUATION OF SYMPTOMS AND PALATABILITY IN HEALTHY VOLUNTEERS AFTER INGESTION OF AN ICED DESSERT BY USING DIFFERENT FLAVOURS

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It is well-known that digestion has a pivotal role in maintaining a state of wellbeing. The influence of certain foods and some herbal drugs has been ascertained. Epidemiological data show that the Mediterranean diet, with a high consumption of fresh vegetables and fruit, mainly citrus, has a beneficial effect and plays a protective gastrointestinal role. Previously, we assessed the influence on the eventual occurrence of symptoms during digestion of an iced dessert containing a mixture of digestive plant extracts, citrus juices and liquors, showing that its ingestion does not cause significant gastrointestinal symptoms in healthy volunteers. Taking into consideration that sensory properties of food may also influence digestion, we also evaluated the palatability of the product. In order to evaluate the effect of different tastes on the digestive processes, we performed a further similar evaluation with two new flavours. The ingestion of these iced desserts at the end of the meal does not cause significant gastrointestinal symptoms. Moreover, palatability median score shows a good appreciation of the products. Therefore, the combination of digestive herbs, citrus juice and liquors in different flavours gives rise to a product with a positive mix of good palatability, favourable acceptance and herbal constituents, able to maintain a good digestive condition.

It is well-known that digestion can be influenced by several different factors and that it plays a pivotal role in maintaining a state of wellbeing. Recent studies on the physiological aspects have overcome the classical reductive picture mainly based on a mere chemical transformation of the food, and clarified the regulatory aspects of several factors, such as acceptance, palatability, flavour, behaviour, anticipation, etc., including the specific influence of certain foods, as well as some herbal drugs (1).

Digestive herbs, such as citrus juice, and different flowers have been demonstrated to have a gastro-

protective effect which may be associated with the antioxidant and suppression of pro-inflammatory mediators in cytokine production (2). For example *Lippia citriodora* is widely used for gastrointestinal disorders and as a eupeptic in South America; while *Lippia triphylla* (common name *Lemon verbena*) is used in Peru as a spice and a herbal tea for the prevention of arteriosclerosis (3-4). In addition, the *Melissa officinalis* extract used in this study has been reported to produce dose-dependent inhibition of acetic acid-induced visceral pain and is demonstrated to have anti-nociceptive action (5).

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Previously, we assessed the eventual occurrence of symptoms during digestion of an iced dessert, “Ferrero Gran Soleil” (GS), containing a mixture of digestive plant extracts and citrus juices and liquors, showing that its ingestion does not cause significant gastrointestinal symptoms in healthy volunteers (6).

GS is a novel product created in several flavours as an iced dessert to be consumed at the end of the meal. A mixture of extracts of medicinal plants well-known for their digestive effects (i.e. artichoke, verbena odorosa, citronella, melissa, etc.), is present in the composition.

In this work we study the effect on symptoms and palatability of two new flavours: “Ferrero Gran Soleil coffee flavour” and “Ferrero Gran Soleil vanilla flavour”, consumed at the end of the meal by 10 healthy volunteers. These two products contain a mixture of digestive plant extracts (i.e. lemon balm, lemon scented verbena, artichoke), citrus juices and liquor, together with other natural ingredients (additives, softeners, emulsifiers and stabilizing agents).

MATERIALS AND METHODS

Patients and study design

Ten healthy volunteers (5 M, 5 F; median age 35.6: range 24-67) consumed “GS coffee flavour” (Ferrero S.p.A., Alba, Italy) for five days and, in the following five days, “GS vanilla flavour” (Ferrero S.p.A., Alba, Italy) after dinner.

Exclusion criteria were: history of gastrointestinal surgery, gastrointestinal illnesses, other major illnesses, milk protein allergies and other intestinal allergies.

All the subjects gave their written informed consent to participate in the study.

The following morning, i.e. 12 hours after product ingestion, all the participants recorded the severity of six gastrointestinal symptoms (nausea, reflux, heartburn, abdominal pain, bloating, satiety) according to a visual-analogue scale (VAS). The VAS was represented by a 10-cm line, anchored with two verbal descriptors to the extremities, indicating “no pain” (0 cm) and “worst imaginable pain” (10 cm), respectively. The patients were asked to mark the 10 cm-line to indicate pain intensity. The score was measured from the zero anchor to the patient’s mark (7). We calculated the VAS for each symptom, and the cumulative VAS by summing the single symptom VAS.

In a second questionnaire, all the participants were invited to assess the satisfaction and the palatability of the

tested products, evaluating appearance, smell, flavour and texture. These parameters were measured both by a VAS score (from 0 to 10), and by answers to specific questions. In particular, subjects judged the appearance of the product as inviting, not at all inviting or they responded “I don’t know”; as far as smell is concerned, it could be considered pungent, intense or weak; flavour had to be considered as sweet, acid or bitter and in a second question, it has to be judged as delicious, acceptable or nauseating; texture of the product was considered as granular, mellow or soft; lastly, the subjects were asked to define the sensation derived from the ingestion of the product (pleasantness, freshness, satisfaction, sweetness).

Finally, all the subjects were asked to respond yes/no as to a future purchase of the products.

Product composition

Our healthy volunteers consumed “GS” products containing respectively:

- “GS coffee flavour”: liquid coffee (55.5%), coffee extract, sugar, fibers, modified starch, milk proteins, whey milk powder, alcohol (0.8%), flavouring agents, skimmed milk powder, dextrose, thickening agents, wheat flour, skimmed cocoa, infusion of digestive herbs (i.e. lemon balm 0.02%, lemon verbena 0.03%, artichoke 0.03%);
- “GS vanilla flavour”: water, sugar, fresh pasteurized milk (48%), fresh pasteurized cream (22%), alcohol (1.2%), fibers, modified starch, natural vanilla extract, concentrated lemon juice, thickening agents, salts, infusion of digestive herbs (lemon balm 0.020%, lemon verbena 0.005%).

Digestive plants

Lemon scented verbena (*Lippia citriodora* H.B. et K. = *Verbena tryphylla* L’Her = *Aloysia tryphylla* (L’Her) Britton = *Aloysia citriodora* (Cav.) Ort., fam. Verbenaceae); Processed materials and finished products: enriched extract of dried and chopped leaves from cultivated flowering plants, obtained by ultrasonic methods (ratio 1/9 drug/extract) in EtOH 95°C; Analytical profile: TLC and SIM/GC/MS analysis gives the expected chromatographic behaviour, in particular with absence of thujones and presence of 2-5 mg/L of eucalyptol and 0.25-1.5 g/Kg for citral and limonene < 0.1 g/Kg in the essential oil.

Lemon balm (*Melissa officinalis* L., fam. Lamiaceae). Processed materials and finished products: enriched hydroalcoholic extract, obtained by concentration and pasteurization procedures of infusing twice the fresh flowering tops using the ratio 1:3 solvent/raw material; analytical profile: the SIM/GC/MS analyses give, in particular, methyleugenol <0.5 mg/Kg (inferior to

detectable limit), thujones 2-5 mg/Kg, eucalyptol and methyleugenol < 0.1 mg/g and pulegone 10 ppm, as well as rosmarinic acid 11.97 mg/g.

Artichoke (*Cynara scolymus* L. Sp. Pl. = *Cynara scolymus* L. = *C. cardunculus* subsp. *scolymus* (L.) Hegi = *C. hortensis* Mill, fam. *Compositae Tubuliflorae*). Processed materials and finished products: enriched extract obtained by hydroalcoholic extraction for 1 week (3 days at 40°C and 4 days at room temp. using the ratio 4:1 solvent/raw material) and percolation of first year dried leaves. Analytical profile: content of cynarin in the used extract, as obtained by HPLC analysis, was determined in 5 mg/Kg (\pm 1 mg).

RESULTS

Symptom evaluation

After ingestion of “GS coffee flavour”, only no significant pain (median VAS 0.3), bloating (median VAS 0.26), and satiety (median VAS 0.16) were reported in the entire group during the five days of evaluation; more women than men reported some discomfort and bloating; nevertheless these differences were not significant ($p < 0.05$) (Table I).

Also, after ingestion of “GS vanilla flavour” very mild symptoms were reported. In particular, of the whole group, minimal nausea (median VAS 0.16), reflux (0.08), pain (median VAS 0.12) and bloating (median VAS 0.2) were reported during the five days of evaluation. Also for this flavour, more women than men reported some discomfort and bloating, but again these differences were not significant ($p < 0.05$).

As regards “GS coffee flavour”, the palatability median score was moderate; in particular the

reported values were 5.88 as regards appearance, 5.7 for smell, 6.56 for flavour and 6.68 for texture. A summary of the answers to specific questions on the sensory properties of the products are illustrated in Fig. 1. 60% of subjects expressed a sensation of freshness and 40% of pleasantness. Finally, 50% of the participants asserted that, in future, they will favourably purchase the tested food.

For “GS vanilla flavour”, the palatability median score was a little higher; in particular it resulted 7.36 as regards appearance, 6.45 for smell, 7.64 for flavour and 7.42 for texture. A summary of answers to specific questions is reported in Fig. 2. Finally, 80% of the participants expressed favourably to purchasing the product in future, in accordance with higher palatability and lower ingestion symptoms as compared to “GS coffee flavour”.

DISCUSSION

Our study shows that ingestion after dinner of two new GS flavours (coffee and vanilla) does not cause significant gastrointestinal symptoms in our healthy volunteers. In particular, women complained more of discomfort, both with coffee and vanilla, but the differences were not significant, and in general the symptoms score was very mild.

These two new flavours contain some herbs widely known and reported for their digestive activity, such as *Melissa officinalis*, *Lippia citriodora* and *Cynara scolymus*. It is known that extracts of plants rich in citral and limonene, like *Melissa officinalis*, can be indicated for functional bowel diseases, being

Table I. Median VAS relative to single symptoms and cumulative VAS.

	<i>Nausea</i>	<i>Reflux</i>	<i>Heartburn</i>	<i>Abdominal pain</i>	<i>Meteorism</i>	<i>Satiety</i>	<i>Cumulative VAS</i>
COFFEE							
Men	0	0	0	0	0.12	0.32	0.44
Women	0	0	0	0.6	0.4	0	1
VANILLA							
Men	0.12	0	0	0	0	0	0.12
Women	0.2	0.16	0	0.24	0.4	0	1

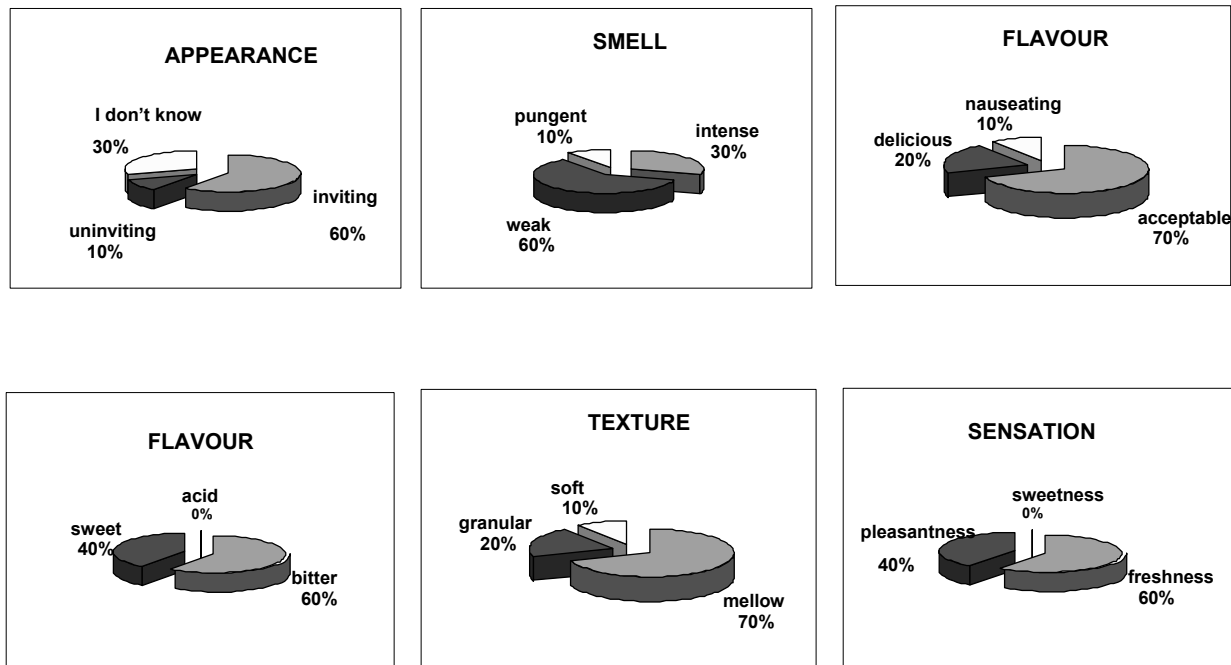


Fig. 1. Evaluation of palatability of "GS coffee flavour".

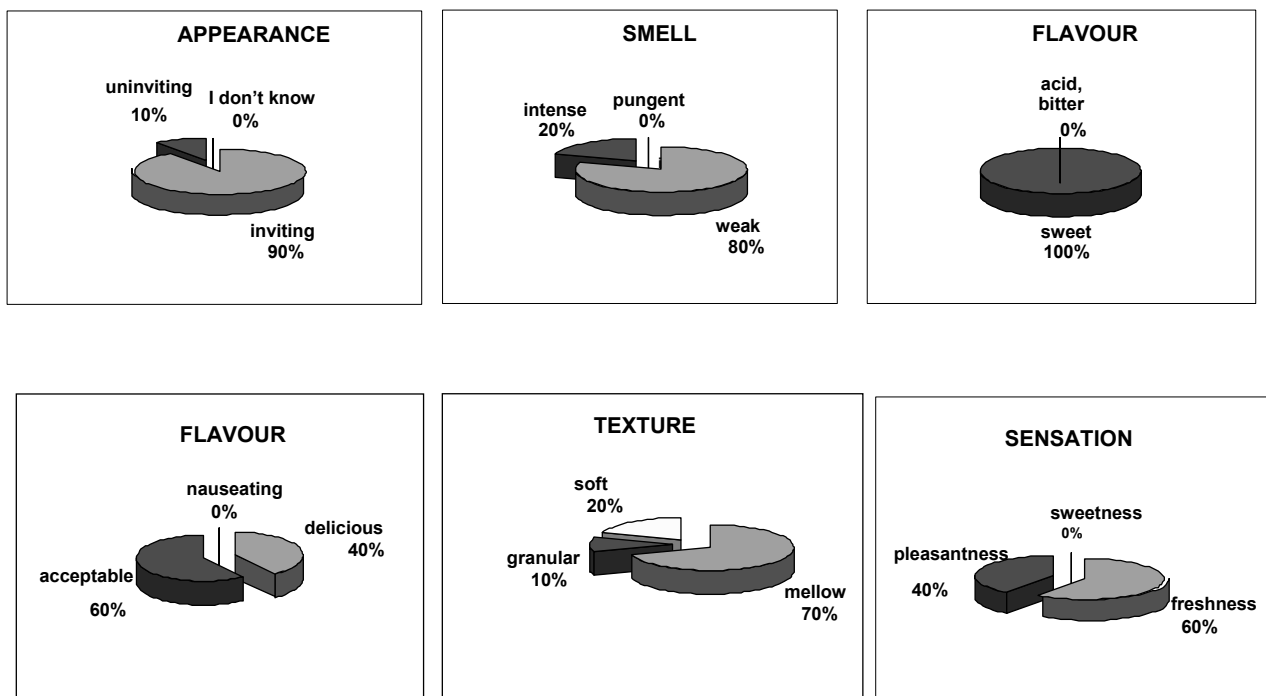


Fig. 2. Evaluation of palatability of "GS vanilla flavour".

able to neutralize the discomforting effect of gas produced in the stomach and intestine during the digestive processes (8-9). In addition, it is thought that the essential oils contained in digestive herbs act by stimulating the nervous terminals of flavour and smell receptors (10-11).

It is known that foods and beverages stimulate multiple nervous fibres, for example tactile sensations, such as texture, stimulate mechanoreceptors, while the temperature of foods and beverages stimulate the thermoreceptors (12). Moreover, it has been recently reported that bitter compounds, like caffeine, can suppress or enhance sweet and sour tastes and interact with volatile flavour molecules (13). Humans possess many bitter taste receptors, and transduction of bitter taste may differ between one compound and another. In particular, it is thought that caffeine, used as a flavouring agent, may enhance the sensory appeal of beverages (13).

We find that both the tested products resulted as having a good palatability, even if GS vanilla flavour was more appreciated. Moreover, as assessed by our volunteers, the particular composition of these products guaranteed favourable sensations of freshness and pleasantness.

In conclusion, by this new evaluation, we can assert that in these different tested GS flavours the combination of digestive herbs, citrus juice and liquors in different flavours gives rise to a product with a positive mix of good palatability and favourable acceptance, able to maintain a good digestive condition, thus people can choose the flavour they prefer with very similar results.

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