Emotional response evoked when looking at and trying a new food product, measured through images and words. A case-study with novel fruit and vegetable smoothies

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15 Abstract

16 Little research has been published on emotional responses evoked by completely new, innovative food
17 products. The objectives of the present study were 1) to assess the emotional response to new
18 products (fruit and vegetable smoothies in a drink pouch) in two different scenarios: looking at the
19 smoothie pouch, or tasting the smoothie with the smoothie pouch alongside; 2) to compare the
20 information obtained when the participants use photographs or use words to express emotions. In the
21 Pack-alone scenario, similar emotional spaces and sample configurations were obtained with both
22 images and words. In the Pack-and-tasting scenario, the richness of the emotional response increased
23 when using images. In both scenarios, the participants used a greater number of negative emotions
24 when these were presented as images rather than as words. This could be considered an advantage, as
25 it enables some negative emotional loads to be portrayed. The present results also demonstrate that
26 evaluating the emotional response allows effective discrimination between samples with similar
27 overall liking scores.

28

29 Keywords: emotion measurement; non-verbal methodology; expectation; pack; tasting; novel food
30 products

31

32 **1. Introduction**

33 Understanding consumer needs is a high-priority strategic objective in new product development
34 (Krystallis, Linardakis, Mamalis, 2010). Failure of new food products is still the prevailing end-result of
35 many firms' product development activities (Horvat, Granato, Fogliano, & Luning, 2019). The food
36 market should connect with and adapt to today's constantly evolving and increasingly demanding
37 consumers by creating enhanced sensory experiences. These affect the way we feel, with mood being
38 a key variable determining food choices (King & Meiselman, 2010). In recent years, assessing emotional
39 responses to foods has gained in popularity (King, Meiselman & Carr, 2013; Jaeger & Hedderley, 2013;
40 Meiselman, 2015) and has become integrated into consumer and sensory research with the purpose of
41 improving the understanding of total consumer experiences and product differentiation (Kenney &
42 Adhikari, 2016; Lagast, Gellynck, Schouteten, De Herdt, & De Steur, 2017).

43 Less research has been conducted on emotional response at the time of purchasing a food product.
44 Emotional responses to visual cues (written information, images, product name and branding, among
45 others) have been reported as playing an important role in adding value and affecting expectations and
46 emotional responses (Ngoenchai, Alonso, & Suwonsichon, 2019). These expectations are especially
47 important for new food concepts and new product launches (Halagarda & Suwala, 2018).

48 The present study was conducted in Spain and evaluated a new concept in smoothies. The smoothies
49 were launched as innovative products because they are made not only with different kinds of fruits but
50 also with vegetables, which is uncommon in the Spanish market. In addition, they are packaged in
51 transparent drink pouches, which are also very innovative for smoothies, at least in Spain. The
52 emotions evoked by the product in the pack (Pack-alone scenario) and after tasting the product (Pack-
53 and-tasting scenario) were studied.

54 Comparing the emotional profiles evoked before and after consuming food products in the same
55 category provides valuable information about the expectations raised and their (dis)confirmation. King
56 (2016) used an online survey to measure emotions elicited by the brand name and flavour description
57 of cooking sauces and compared them to the emotions elicited by the sauces during consumption.
58 Spinelli, Masi, Zoboli, Prescott, and Monteleone (2015) studied the emotions elicited by different
59 commercial chocolate and hazelnut spreads available in the Italian market, comparing the emotions
60 elicited by the photo of the packages and their name with those elicited when tasting the products.
61 The results helped in understanding the differences between formulations within the same category of
62 food products.

63 Most emotion research has focused on explicit verbal self-reported measurements, asking consumers
64 to indicate their emotions when consuming, smelling or seeing food products. This tool for measuring
65 emotional response is used very widely due to its ease of application, cost-effectiveness and
66 discriminative capacity (Dorado, Chaya, Tarrega, & Hort, 2016). The questionnaires used include a list
67 of emotional terms which are rated or only selected (check-all-that-apply or CATA) by consumers in
68 response to their experience.

69 King and Meiselman (2010) developed a pre-determined emotion lexicon known as the EsSense
70 ProfileTM. This widely applied verbal questionnaire consists of a list of 39 emotion terms that
71 consumers associate with food products. EsSense ProfileTM has been shortened to the EsSense25 tool,
72 which consists of 25 emotion terms (Nestrud, Meiselman, King, Leshner, & Cardello, 2016). These and
73 other tools have been further applied to evaluate emotional responses to specific food products such
74 as chocolate (Thomson, Crocker, & Marketo, 2010), coffee (Bhumiratana, Adhikari, & Chambers, 2014),
75 fruit salads (Manzocco, Rumignani, & Lagazio, 2013), beer (Chaya et al., 2015; Mora, Giussani, & Chaya,

2019), wine (Danner, Johnson, Ristic, Meiselman, & Bastian, 2017; Ristic et al., 2019), cheese (Schouteten et al., 2015) and hazelnut spreads (Spinelli et al., 2015) to cite only a few.

Köster and Mojet (2015) stated that consumers do not usually use words to refer to the emotions aroused when consuming food and beverages. As an alternative to emotional lexicons, some visual self-reported methodologies have been developed to describe emotions through images. One of the best-known visual methods is the Product Emotion Measurement Instrument (PrEmo) (Desmet, 2003). This instrument measures 14 emotions represented by expressive cartoon animations. Although this tool was not originally designed for food products, it has been applied to measure emotional responses to foods such as gingerbread and chocolates (den Uijl, Jager, Zandstra, de Graaf, & Kremer, 2014), breakfast drinks (Dalenberg et al., 2014) and food odours (He, Boesveldt, de Graaf, & de Wijk, 2016). A further advantage of non-verbal methods is that translation is not required and they can be used in different countries regardless of language (Köster & Mojet, 2015). Also, these methods facilitate interpretation as well as comparisons across studies (Dalenberg et al., 2014). In this regard, emoji-based questionnaires have recently been studied as emotional profiling methods (Jaeger, Lee, et al., 2017; Jaeger, Vidal, Kam & Ares, 2017; Schouteten, Verwaeren, Lagast, Gellynck, & De Steur, 2018). These authors have demonstrated the descriptive and discriminative power of the emoji-based method and also its capacity to produce repeatable and reproducible data. Jaeger, Lee, et al. (2017) compared the use of emojis with the EsSense25 questionnaire in a study that included tasting a variety of commercially available foods and beverages. They found that word-based responses were more discriminative and were able to determine distinctive emotional profiles for individual samples, and concluded that the emoji-based questionnaire should be considered an alternative tool rather than a substitute for existing word-based emotion questionnaires. Emojis have also been used successfully to

98 measure children's emotions when tasting foods and to discriminate between biscuits (Schouteten et
99 al., 2018).

100 A number of studies have used emotional lexicons combined with non-verbal representations. The
101 EsSense Profile has been combined and compared with PrEmo in two studies. In a study with breakfast
102 beverages, Dalenberg et al. (2014) showed that using the non-verbal instrument significantly improved
103 food choice prediction compared to mere liking scores. According to these authors, in emotions
104 expressed through images the emotional content is processed more intuitively and consequently more
105 closely resembles intuitively experienced emotions. In the other study, Gutjar, de Graaf, et al. (2015)
106 showed that both methods (PrEmo and EsSense Profile) differentiated successfully between similar
107 groups of breakfast beverages.

108 In the present study, word-based and photograph-based questionnaires were used to compare the
109 emotional response of consumers to novel fruit and vegetable smoothies.

110 The first hypothesis of the present study was that new, innovative food products can evoke different
111 emotions when the product is just observed in its pack and when it is tasted. A second hypothesis was
112 that photographs of people expressing different emotions may be recognized better by consumers, so
113 a photograph-based questionnaire could provide different information to a word-based one and could
114 be easier to use than a list of words.

115 The objectives of the present study were 1) to evaluate consumers' emotional responses to new
116 products (fruit and vegetable smoothies in a drink pouch) in two different scenarios: looking at the
117 smoothie pouch and tasting the smoothie with the smoothie pouch alongside; 2) to compare the
118 information obtained when consumers use images and when they use words to express emotions.

119

120 2. Materials and Methods

121 2.1 Samples

122 Five commercial smoothies, all mainly made with fruits and vegetables (kindly provided by Verdifresh,
123 Valencia, Spain), were evaluated. The smoothies were packed in transparent pouches, so their colour
124 could easily be seen. They all had names composed of an adjective and a noun. The five adjectives
125 positively reinforced the corresponding nouns, which referred to typical Spanish festive events or
126 places that Spanish people know very well (Table 1). The codes adopted to identify the samples were
127 FAS (Fascinating *chupinazo*), BEA (Beautiful *flamenca*); POW (Powerful *masclètà*), BRI (Bright Menorca),
128 and DET (Detox *verbena*). These festivals or places were subtly represented by images (a small white
129 silhouette) on the front of the pouch. The principal characteristics and list of ingredients of each
130 sample and explanations of the names are shown in Table 1.

131

132 2.2 Words and images for assessing emotions

133 An initial lexicon of 50 emotions was generated from Desmet (2003) (14 terms) and King & Meiselman
134 (2010) (39 terms, of which 36 were used because three were already on the Desmet list). The
135 translation from English into Spanish was supported by a native English speaker and previous literature
136 (Mora, Urdaneta and Chaya, 2018). A preliminary session was held in which the samples were shown
137 to 10 participants (see section 2.3 for the participant inclusion criteria), who were asked to indicate
138 which of the 50 terms could describe the emotions evoked by the smoothies and to propose any term
139 not on the initial list that they felt could apply. The resulting list of 24 emotions (words) is shown in
140 Table 2. It includes 5 terms that were not in the initial list (*Indifferent, Rejection, Relaxed, Sad, and*
141 *Undecided*). The final number of emotions was considered appropriate in accordance with the

142 literature (Jaeger & Cardello, 2016). The terms that were not selected by any of the participants were
143 removed from the list (footnote in Table 2).

144 To construct the image-based list of emotions, a number of photographs of three volunteers were
145 taken to represent each emotion term. From the total of 50 images, a set of 24 photographs, one for
146 each emotion (Table 2), was drawn up by consensus between three researchers. To validate each
147 image as representing the corresponding emotion for consumers, a pilot study was performed. One
148 hundred people were presented with the 24 images and asked, for each image in turn, to indicate the
149 word or words from the 24-word list of emotions that best described that image (they were allowed to
150 tick more than one word for each image). The results showed that 16 out of 24 images were mainly
151 matched with the terms they supposedly depicted. For the remaining 8 terms, four other images were
152 matched to not one but a pair of terms by a high percentage of participants (>60%). These four images
153 were selected to represent these pairs of terms: *Satisfied/Good*, *Pleasantly surprised/Admiration*,
154 *Disappointed/Dissatisfied*, and *Enthusiasm/Energy*. The other four images were discarded because they
155 were related to several terms with lower levels of agreement among the participants.

156 Accordingly, the 20 images selected and the corresponding 20 terms comprised the final lists of
157 emotions that were used by the consumers in separate CATA tests.

158

159 2.3 Participants

160 A total of 400 young participants were recruited from the staff and student body of the Institute of
161 Agrochemistry and Food Technology (IATA-CSIC) and the Polytechnic University of Valencia (Spain). The
162 inclusion criteria were consumers who declared that they consumed fruit juice/ smoothies at least
163 once a week and were aged between 18 and 45; people following any restrictive diet and smokers

164 were excluded. Participation was entirely voluntary. Two hundred participants assessed the smoothies
165 by just looking at the pouch, 100 of them using words (56% women; mean age 23.7, SD=6.0) and the
166 other 100 using images (55% women; mean age 23.5, SD=5.3). The other 200 participants assessed the
167 smoothies by tasting the smoothie with the smoothie pouch alongside, 100 of them using words (56%
168 women; mean age 23.3, SD 5.0) and the other 100 using images (55% women; mean age 23.5, SD 5.3).
169 Data acquisition from all the tests was carried out with Compusense Cloud® software (Compusense
170 Inc., Guelph, Canada).

171

172 2.3.1 Emotional response associated with the smoothies: Pack-alone scenario

173 The smoothie pouches were coded with 3-digit numbers and presented monadically. The participants
174 had to answer the question *“Please imagine that you are in the supermarket, standing in front of the*
175 *shelves. Pick the product up and look at it as you would normally do. What emotions does it elicit?*
176 *Please tick the emotions that it evokes in you”*. The participants were presented with the 20-emotion
177 list (in words or images) and were asked to tick the emotions that they felt. The order of both images
178 and terms were randomised across the participants but the same order was kept across samples for
179 the same participant.

180

181 2.3.2 Emotional response associated with the smoothies: Pack-and-tasting scenario

182 The smoothies (30 mL) were served and presented monadically in small plastic cups (50 mL) coded
183 with 3-digit numbers, together with the corresponding pouch (unopened). Mineral water was provided
184 for the consumers to rinse their mouths between samples. The participants were presented with the
185 20-emotion list (in words or images) and were instructed to observe the pouch, taste the sample, and

186 answer the question *“Please observe this pouch and drink the product. What emotions does it elicit?*
187 *Please tick the emotions that it evokes in you”*.

188 All these tests were performed in compliance with Spanish legislation and according to the institutional
189 framework and practices established by the CSIC Ethics Committee.

190

191 2.4 Expected liking, liking and ease of use of the questionnaires

192 After completing the emotion questionnaires for each sample the participants were asked to score
193 their expected liking for them in the Pack-alone scenario, or their actual liking in the Pack-and-tasting
194 scenario, on 9-point hedonic scales.

195 Finally, after completing the questionnaires for all 5 samples, the participant were asked to rate both
196 the ease of use of the questionnaire, on a structured seven-point scale (from “very easy” to “very
197 difficult”).

198

199 2.5 Data analysis

200 To analyse the emotional response of consumers to the samples in the two scenarios (Pack-alone and
201 Pack-and-tasting), the CATA question procedures proposed by Meyners, Castura, & Carr (2013) were
202 followed. For each scenario, the number of consumers that selected each emotion (expressed with
203 images or words) in response to each smoothie was obtained. Significant differences between samples
204 were evaluated using Cochran’s Q test. A correspondence analysis (CA) was performed on the
205 emotions (expressed with images or words) whose frequency of use was >10% in at least one of the
206 samples and differed significantly between samples ($p < 0.05$). The distribution of the samples by
207 emotional response in the Pack-alone and in the Pack-and-Tasting scenario were compared by

208 computing the RV coefficient between their coordinates in the two first factors of the correspondence
209 analysis (CA) (Abdi, 2010), calculated separately for the words questionnaire and the images
210 questionnaire ($p < 0.05$).

211 Two separate analyses of variance (ANOVA) were applied to evaluate the variations in liking and in the
212 number of terms selected in the CATA question. In both ANOVAs, the effects of type of questionnaire
213 (image- or word-based), scenario (Pack-alone or Pack-and-tasting) and sample (FAS, BEA, POW, BRI,
214 DET) were considered, and their double interaction as fixed factors was applied. A Fisher test was used
215 to analyse significant differences between samples, using a 5% significance level. XLStat version 2016
216 software (Addinsoft, France) was used for all the analyses.

217

218 **3. Results**

219 ***3.1 Emotional response in Pack-alone scenario***

220 ***3.1.1 Emotional profiles using words***

221 The frequency of selection of each emotion (each term) on just observing the pouches was obtained
222 (Supplementary Table 1). Six of the twenty terms (*Eager, Guilty, Angry, Loving, Sad and Worried*)
223 showed very low frequency of selection ($\leq 10\%$ of the participants for all samples) and were discarded
224 for further analysis. The remaining fourteen terms (*Bored, Disgusted, Desirous, Fun, Undecided, Happy,*
225 *Indifferent, Disappointed/Dissatisfied, Enthusiasm/Energy, Rejection, Relaxed, Satisfied/Good,*
226 *Pleasantly surprised/Admiration, and Unpleasantly surprised*) showed a frequency of selection that
227 varied significantly among samples according to the Cochran test (Table 3).

228 The first two dimensions of the plot resulting from the correspondence analysis summarize the
229 differences in the emotional profiles of the samples when evaluated using words in the Pack-alone

230 scenario (Figure 1a). The first factor, which explains most of the variability (90.03% of the total), clearly
231 separates DET (placed towards the positive values of factor 1) from the rest of the samples (all in the
232 negative values of factor 1). DET showed a high frequency of selection of the terms *Unpleasantly*
233 *surprised*, *Rejection*, *Disgusted* and *Disappointed/Dissatisfied*, whereas *Happy*, *Loving* and
234 *Satisfied/Good* generally had a high selection rate for *FAS*, *BEA*, *POW* and *BRI*. Among these latter
235 smoothies, the second factor (which explains only 6.33% of the variability) differentiates sample *POW*,
236 which had a high selection frequency of *Fun* and *Desirous*, from sample *FAS*, which showed a high
237 frequency of the terms *Undecided* and *Indifferent*.

238

239 3.1.2 Emotional profiles using images

240 The frequencies of selection of the images after observing each smoothie pouch were obtained
241 (Supplementary Table 2). Seven out of the twenty images (*Eager*, *Guilty*, *Fun*, *Angry*, *Loving*, *Relaxed*
242 *and Sad*) obtained low frequencies of selection ($\leq 10\%$ for all samples) and were discarded for further
243 analysis. From the 13 remaining images only seven (*Disgusted*, *Desirous*, *Worried*, *Rejection*,
244 *Satisfied/Good*, *Pleasantly surprised/Admiration*, and *Unpleasantly surprised*) showed significant
245 variations in frequency of selection between samples according to the Cochran test (Table 3) and were
246 used for further analysis.

247 The two first factors of the plot resulting from the correspondence analysis summarize the differences
248 in the emotional profiles of the samples when evaluated using images in the Pack-alone scenario
249 (Figure 1b). The first factor, which explains most of the variability (91.65% of the total), separates
250 Sample DET (in the positive values of factor 1) from the rest of the samples. DET showed high
251 frequency of selection for the *Unpleasantly surprised*, and *Disgusted* images. *BRI*, *POW* and *BEA* (in the

negative values of factor 1), in general showed a high frequency of selection for the *Pleasantly surprised/Admiration, Satisfied/Good* and *Desirous* images. FAS appears at values near zero in the first factor and towards the negative values of Factor 2, with a high frequency of selection for the *Worried* image.

3.2 Emotional response in Pack-and-tasting scenario

3.2.1 Emotional profiles using words

The frequencies of selection of the emotion terms when the participants tasted the smoothies with the corresponding pouch alongside were obtained (Supplementary Table 3). Six terms (*Eager, Guilty, Angry, Worried, Loving, and Sad*) showed a very low percentage of selection ($\leq 10\%$ in all samples) and were discarded for further analysis. From the remaining sixteen terms, only eleven (*Bored, Disgusted, Desirous, Fun, Happy, Disappointed/Dissatisfied, Enthusiasm/Energy, Unpleasantly surprised, Rejection, Satisfied/Good, and Pleasantly surprised/Admiration*) showed significant differences in frequency of selection between samples according to the Cochran test (Table 3) and were used for further analysis.

The plot of the first two factors resulting from the correspondence analysis summarizes the differences in the emotional profiles of the samples when assessed through words (Figure 2a). The first factor, which explains most of the variability (93.62% of the total), separates DET and FAS (in the positive values of Factor 2) from the rest of the smoothies. DET showed a high frequency of selection of the terms *Unpleasantly surprised, Rejection, Disgusted, Disappointed/Dissatisfied* and *Bored*. FAS, which was also located in the positive values of Factor 1, had a lower frequency of selection of these emotions than DET. POW and BRI were placed in the negative values of Factor 1, with a high frequency of selection of the terms *Fun, Pleasantly surprised/Admiration, Enthusiasm/ Energy, Desirous* and

274 *Happy*. BEA appeared towards the zero values of this factor, in general with an intermediate frequency
275 of selection of these emotions except for *Satisfied/Good*, which showed a similar frequency to those of
276 BRI and POW.

277

278 3.2.2 Emotional profiles using images

279 The frequencies of selection of the emotion images after tasting the smoothies with the corresponding
280 pouch alongside were obtained (Supplementary Table 4). The image representing *Guilty* was the one
281 with the lowest percentage of selection ($\leq 10\%$) for all the samples and was discarded for further
282 analysis. From the remaining 19 images, fifteen (*Disgusted*, *Desirous*, *Fun*, *Undecided*, *Loving*, *Happy*,
283 *Angry*, *Disappointed/Dissatisfied*, *Enthusiasm/Energy*, *Worried*, *Rejection*, *Relaxed*, *Satisfied/ Good*,
284 *Pleasantly surprised/Admiration*, and *Unpleasantly surprised*) showed significant variations in
285 frequency of selection between the samples according to the Cochran test (Table 3) and were used in
286 further analysis.

287 The plot of the first two factors resulting from the correspondence analysis summarizes the differences
288 in the emotional profiles of the samples when assessed through images (Figure 2b). The first factor,
289 which explains most of the variability (87.56% of total), separates DET and FAS (in the positive values)
290 from BRI, POW and BEA (in the negative values). DET showed high frequency of selection of the
291 *Unpleasantly surprised*, *Rejection* and *Disgusted* images, whereas BRI, POW and BEA obtained high
292 frequencies of selection for the *Pleasantly surprised/ Admiration*, *Satisfied/Good* and *Desirous* images.
293 FAS appears more centrally in Factor 1 than DET, but also in the negative values of Factor 2, with a high
294 frequency of selection of *Worried*, but also of the *Fun* and *Undecided* images.

295

3.3 Expected liking and liking

As expected, the ANOVA results showed that the type of questionnaire (word- or image-based) used to assess the emotional profile of the smoothies did not significantly affect the expected liking (Pack-alone scenario) or liking (Pack-and-tasting scenario) scores ($p=0.403$). However, sample and scenario did have significant ($p<0.001$) effects on the liking scores. The effect of interaction between these factors was also significant ($p<0.001$), indicating that the differences among samples depended on the scenario and that the differences in liking between scenarios depended on the samples.

Table 4 shows the mean liking and expected liking scores for each sample and scenario. In the Pack-alone scenario, samples POW and BEA were the most liked and sample DET the least liked. BRI and FAS presented intermediate expected liking values. In the Pack-and-tasting scenario, sample BRI was the most liked and DET the least liked.

Regarding the evaluation scenario, the range of liking values was narrower in the Pack-alone scenario (from 4.2 to 6.2) than in the Pack-and-tasting scenario (3.2 to 6.3). The differences in liking scores between scenarios depended on the sample: for FAS, BEA and DET the liking scores were lower when tasted, there was almost no change in the liking for POW, and the mean liking score for BRI after tasting was higher than the expected liking without tasting.

3.4 Number of emotions selected

The ANOVA results show that only the effects of scenario ($p<0.001$) and of sample/scenario interaction ($p=0.004$) were significant for the number of emotions selected in the CATA questionnaires. The number of emotions selected (mean value through words and images) was higher in the Pack-and-tasting scenario (2.9) than in the Pack-alone scenario (2.5). The mean number of emotions selected by

the participants for each sample using the word-based or the image-based questionnaire is shown in Figure 3. When describing the emotions associated with samples POW and BRI, the number of words was significantly higher than the number of images, but when describing sample DET the number of images was significantly higher than the number of words.

For each emotion, the frequency of selection when using words or images was compared across samples for each scenario.

Eight emotions (*Undecided, Unpleasantly surprised, Bored, Happy, Relaxed, Rejection, Pleasantly surprised/Admiration* and *Fun*) showed a difference of $\geq 5\%$ in frequency of selection depending on whether words or images were used in the Pack-alone scenario. Of these terms, the first three had higher frequencies of selection with images than with words.

In the Pack-and-tasting scenario, nine emotions (*Indifferent, Bored, Disgusted, Angry, Undecided, Relaxed, Happy, Fun* and *Pleasantly surprised/Admiration*) showed differences of $\geq 5\%$ in frequency of selection depending on the use of words or images. Of these terms, the first four presented a more frequent use of images than of words.

332

333 **3.5 How easy to use are the questionnaires?**

Regarding the ease of use of the questionnaires, the ANOVA results showed that the effects of the type of questionnaire, scenario and their interaction were not significant ($p > 0.05$), indicating that there was no difference in the ease of use of words or pictures. The mean score across participants on the 7-point scale (from easy to difficult) was 2.4.

338

339 **4. Discussion**

340 The present study shows the relevant emotions that describe the emotional profile of new-concept
341 smoothies in tasting and non-tasting conditions and reveals the differences amongst emotional profiles
342 evoked by products in the same category. Furthermore, the study compares the performance of a
343 word-based questionnaire with that of an image-based one. The image-based questionnaire used
344 photographs of people expressing different emotions; according to Mandal and Awasthi (2014), facial
345 expressions convey emotions better than any other medium. Along the same lines, a recent review on
346 challenges in inferring emotion from human facial movements (Barret, Adolphs, Marsella, Martinez, &
347 Pollak, 2019) recognised the agreement among scientists that facial movements convey a range of
348 information and are important for social communication, emotional or otherwise. However, this
349 review also warned that how people communicate some emotions can vary across cultures and
350 situations, and even across people within a single situation, which would introduce some limitations in
351 the research fields that focus on interpreting how people move their faces to express emotions in a
352 variety of contexts.

353

354 ***4.1 Emotional responses to novel smoothies***

355 In general, when the participants observed the novel smoothies (Pack-alone scenario) the emotions
356 elicited with higher frequencies were the words and images corresponding to *Satisfied/Good, Desirous*
357 and *Undecided*. Some other positive emotions expressed through words (*Pleasantly*
358 *surprised/Admiration, Happy and Fun*) also had a high selection rate. Regarding negative emotions, the
359 word *Rejection* and the images corresponding to *Unpleasantly surprised* and *Disgusted* also had high
360 selection rates. The correspondence analysis showed that the smoothies in their pouches elicited
361 different emotions in the participants. The variation was mainly explained by the first factor, which in

362 general distinguished two groups of smoothies. DET was associated with negative emotions and the
363 rest of the smoothies (BRI, FAS, POW, and BEA) were associated in general with positive emotions.
364 Smaller differences were observed among the emotional responses to these four smoothies; the
365 frequencies of selection of positive emotions were slightly lower for BRI and FAS than for BEA and
366 POW. Particularly in the evaluation of emotions through images, FAS showed more differentiation
367 from the other three smoothies in this group owing to its high frequencies of selection of certain
368 negative emotions (*Worried, Unpleasantly surprised and Disgusted*).

369 The expected liking values for the smoothies were in agreement with the different emotional
370 responses to them. The characteristics of the smoothies in their pouches (the colour of the smoothie
371 or the ingredients declared on the front of the pouch) could be responsible for the differences in the
372 expectations and emotions evoked. Smoothie DET elicited negative emotions and obtained the lowest
373 expected liking scores. This dark green smoothie contains pear, cantaloupe, kale, celery and matcha
374 tea (Table 1); vegetables such as kale and celery, and also the matcha tea, could probably have
375 generated expectations of bitter/ savoury tastes that are unexpected in smoothies, which in Spain are
376 mostly made with fruit. Appleton et al (2019) ascribed the low consumption of vegetables, at least in
377 part, to unappealing sensory properties such as bitter tastes. In addition, Brassica vegetables like kale,
378 which contain organosulphur compounds, have undesirable sensory properties and tend to be
379 particularly disliked (Cox, Melo, Zabarar, & Delahunty, 2012). Smoothie FAS was a brilliant red, which is
380 a normal colour for a smoothie, but it contained ginger, which apart from being an unusual ingredient
381 in Spain can also create expectations of spiciness that would explain the negative emotional response
382 of some participants and could elicit dislike for this smoothie. Smoothies POW (orange colour) and BEA
383 (dark red colour), which elicited positive emotions in most participants, were expected to be the most

384 liked. They contained fruits such as pineapple, orange and berries that are typically found in Spanish
385 smoothies. In addition, the vegetables declared on the front of the pouches were carrot, pumpkin and
386 beetroot, which have sweeter/ blander tastes and are not rare ingredients in smoothies. Dinnella et al
387 (2016) reported that a sweet taste, delicate flavour and bright appealing colours are the characteristics
388 of the best-liked vegetables. Smoothie BRI (yellow colour) also contained fruit such as coconut,
389 pineapple and mango, but was declared to contain lettuce, which some participants could find strange,
390 and this could explain why it was slightly less liked than POW and BEA.

391

392 When the participants tasted the product and observed the pouches (Tasting-and-pack scenario) the
393 emotions more frequently selected were the words and images corresponding to *Satisfied/Good*,
394 *Disgusted*, *Undecided*, *Unpleasantly surprised* and *Disappointed/Dissatisfied*, but also the positive
395 words *Pleasantly surprised/Admiration*, *Fun*, *Enthusiasm/Energy* and *Happy* and the negative images
396 for *Indifferent and Rejection*. The Correspondence Analyses showed greater differences in the
397 smoothies' emotional profiles when the participants tasted the samples than in the Pack-alone
398 scenario; these differences can also be related to liking. Smoothie DET was again the most disliked
399 sample and was differentiated by the high frequencies of selection of negative emotions. Smoothie FAS
400 in the pouch elicited mainly positive emotions (and some negative ones), but when the participants
401 tasted this sample they did not like it and it elicited mainly negative emotions. BRI and MAS were the
402 smoothies that the participants liked the most when they tried them, and the ones with the highest
403 frequencies of selection of positive emotions after tasting. Smoothie BEA, whose pouch elicited the
404 highest frequencies of selection of positive emotions, showed an intermediate position after tasting

405 because although it evoked mainly positive emotions, these were selected with lower frequencies than
406 for BRI and MAS.

407

408 The sample configuration by emotional profile varied more between scenarios (the RV coefficients
409 between the two scenarios were 0.725 when using words and 0.812 when using images) than between
410 type of questionnaire (the RV coefficient between questionnaires was 0.932 for Pack-alone and 0.988
411 for Pack-and-tasting). The differences in emotional response to each smoothie between the Pack-alone
412 and the Pack-and-tasting scenarios can be observed in the plot from an additional correspondence
413 analysis (Supplementary Figure 1) that was run jointly for both scenarios. In the Pack-alone expected
414 liking scenario (sample codes followed by the letter P) the positive emotional response to the
415 smoothies was related to *Desirous* and *Pleasantly surprised*, while in the Pack-and-tasting actual liking
416 scenario (sample codes followed by the letter C) it was related to *Satisfied/Good*, *Happy* and
417 *Enthusiasm/Energy*. Regarding negative responses, the Pack-alone scenario was associated with
418 *Undecided*, *Bored* and *Unpleasantly surprised* while *Disappointed/Dissatisfied* and *Rejection* were
419 associated with tasting.

420 These changes in the emotional profiles of the samples after tasting seem to be related to the
421 differences between the expected and actual liking values obtained for each smoothie. When tasted,
422 smoothie BRI was liked more than expected and the number of participants that felt *Satisfied/Good*,
423 *Enthusiasm/Energy* and *Happy* increased. The participants liked the POW smoothie as much as
424 expected and the number of participants that felt *Happy* and *Enthusiasm/Energy* increased. The liking
425 for smoothie BEA decreased after tasting (a 0.9 point difference), and this disconfirmation of the
426 participants' expectations caused a decrease in the frequencies of selection of some positive emotions.

427 Finally, the liking value for smoothie FAS was much lower than expected (a 1.2 point difference); in this
428 case the frequencies of selection of positive emotions decreased and those of negative emotions
429 increased.

430 The participants' poor expectations of smoothie DET in the pouch were confirmed after tasting, which
431 increased some negative sensations. Similarly, Spinelli et al (2015), working with chocolate and
432 hazelnut spreads, found changes in emotional profiles in blind, expected and informed conditions. In a
433 study on wines, Danner et al. (2017) found that an elaborate information level evoked higher
434 expectations before tasting and also resulted in higher liking ratings and elicitation of more intense
435 positive emotions and less intense negative ones compared to the blind scenario. Similarly, in the
436 present study, in general, observation of these novel smoothies' pouches created higher (expected)
437 liking values than the actual liking values after tasting, which brought a concomitant decrease in the
438 frequencies of selection of positive emotions and an increase in the negative ones.

439

440 The total number of emotions selected was higher in the Pack-and-tasting scenario than in the Pack-
441 alone scenario for all the types of questionnaire, indicating that even in the present case, in which the
442 pack was very innovative, tasting the smoothies is possibly a more emotional experience than
443 observing them in the pouches. This result is in line with those of Ng, Chaya and Hort (2013), which
444 showed a clear disconnection between the package and blind/informed emotional terms,
445 demonstrating that emotional response was influenced more by sensory characteristics than packaging
446 cues in blackcurrant squash. Working with breakfast drinks in blind, package, and package-and-taste
447 conditions, Gutjar, Dalenberg, et al. (2015) also found differential emotional profiles elicited by sensory
448 and extrinsic product properties (packaging). In a set of beers, Chaya, Pacoud, Ng, Fenton, and Hort

449 (2015) found that packaging characteristics were very influential on the consumers' emotional
450 response but some sensory attributes were able to modulate this response. All these results obtained
451 for different products highlight the need to evaluate the food (or beverage) and their packaging would
452 contribute a better understanding of the product emotional fingerprint.

453 The present results also highlight that information related to the emotions elicited by both the food
454 package and the food's sensory characteristics is relevant in the design of new products that will match
455 consumers' expectations successfully. In the case of smoothies, it is important for package
456 characteristics to make consumers feel a pleasant surprise and a desire to consume while avoiding
457 sensations of doubt or unpleasant surprise. On the other hand, optimising the sensory characteristics
458 of the product to maximise liking is of course crucial for achieving satisfaction, enthusiasm and
459 happiness, the most relevant emotions evoked by these products in the Pack-and-tasting scenario. In
460 the above mentioned study by Gutjar, Dalenberg et al (2015), the authors highlighted that differences
461 in the emotional response to package and product can be used to tailor specific product elements to
462 the emotional needs of different consumers in the early stages of product development.

463

464 ***4.2 Words or images?***

465 The number of words used to describe emotional responses for the smoothies POW and BRI was
466 significantly higher than the number of images (Figure 4) in both scenarios. These samples were the
467 best-liked smoothies and were the ones that met the expectations raised by observing the pouches
468 (Pack-alone scenario), as their liking values either did not change significantly or were higher after
469 tasting (Table 4). In addition, the significantly higher number of words selected for these two samples

470 than for samples DET and FAS across both scenarios would indicate that liked experiences are
471 emotionally richer than disliked experiences.

472 These results indicate that both word- and image-based questionnaires possess a good ability to
473 measure the emotions triggered by observing the smoothie pouches, as the emotions listed or shown
474 were selected distinctively by the participants, depending not only on the sample but also on the
475 scenario (only looking at the product or both looking and tasting it). Mora, Urdaneta and Chaya (2018)
476 reported on the good performance of a modified emotional lexicon applied to wines. However, the
477 results of the present study showed that the participants used words and images differently for
478 describing emotions. The participants did not use the words *Eager*, *Guilty*, *Angry*, *Loving*, *Relaxed* or
479 *Sad* very much. The images corresponding to these emotions were not used in the Pack-alone scenario
480 but all the images (except *Guilty*) were used in the Pack-and-tasting scenario, indicating that the
481 participants were more consistent in the use of words than in the use of images, the number of which
482 varied depending on the scenario.

483 From the analysis of the frequency of selection of each significant emotion using words or images
484 (Figure 4), it is clear that the emotions selected more frequently when using images than when using
485 words were all negative or neutral. In general, consumers tend not to use negative-type emotions in
486 response to food products, or these emotions are used to a lesser extent than positive emotions. This
487 hedonic asymmetry, previously described for food by Desmet and Schifferstein (2008), was related to
488 people only being willing to taste or eat products that they expect to have a pleasant emotional
489 impact. Food products evoke a wide range of emotional responses that tend to be mainly positive
490 (Calvo-Porrà, Ruiz-Vega, Lévy-Mangin, 2018). In the present study, the participants selected a higher
491 number of negative emotions when these were represented by photographs, perhaps in part because

492 they found that choosing images was more polite or less disturbing than verbalizing negative-type
493 emotions.

494 The DET smoothie obtained the lowest liking value in both scenarios (actual liking was even
495 significantly worse than expected liking). This sample was the only one for which the number of images
496 used to describe the emotional response was significantly higher than the number of words.

497 In principle, the use of words or images led to similar sample configurations associated with the same
498 type of emotions (positive or negative). Comparing the results of the PrEmo (non-verbal) and EsSense
499 Profile (verbal) methods, Gutjar, de Graaf, et al., (2015), working with breakfast drinks, found that both
500 methods were able to differentiate between samples from the same product category, resulting in
501 similar distinguishable groups of products. However, when observed in more detail, the emotional
502 maps obtained through images showed some more subtle differences that helped to explain the
503 differences in liking between samples.

504 In the Pack-alone scenario, sample FAS was expected to be significantly less liked than POW and BEA
505 but showed an emotional profile that did not differ greatly from those of the two latter samples when
506 obtained from the word-based questionnaire. However, the emotional profile of FAS obtained from
507 the image-based questionnaire moved towards more negative emotions, especially *Worried*, which
508 would explain the lower expected liking value of this sample. In the Pack-and-tasting scenario, sample
509 POW, which was less liked than sample BRI, showed a similar emotional response to the latter in the
510 plot obtained from the word-based questionnaire but appeared slightly displaced towards less positive
511 (and more negative) emotions in the plot obtained through images, thus explaining the difference in
512 liking scores between these two smoothies. This higher discrimination ability of images could come
513 from a greater ease in using images rather than words to express negative emotions.

514 In the word-based questionnaire, the weight of positive emotions was higher and the discriminating
515 ability was lower than for the image-based questionnaire, but the differences between samples that
516 had a generally positive emotional profile were more detailed.

517

518 Regarding the secondary hypotheses that the use of images could make the evaluation task easier, the
519 participants indicated that it was as just easy to use images as words to indicate their feelings
520 regardless of scenario (Pack-alone or Pack-and-tasting). The scores obtained indicated that, in general,
521 the participants found the task of evaluating the samples easy.

522 According to the present results, using a non-verbal method would bring certain advantages in that it
523 might discover negative emotional aspects that people do not want to express in words. Taking into
524 account that, in general terms, emotions expressed using images are perceived similarly by people in
525 different cultures due to empathic reactions, cross-cultural differences in how consumers interpret
526 images could be smaller than the influences of culture and language on word-based methodologies.

527 Supplementary Figure 1 shows the differences in the emotional profiles of the samples when assessed
528 in both scenarios through words (Supplementary Figure 1a) and through images (Supplementary Figure
529 1b). Comparing the two plots, it can be seen that in general, the first factor separates the smoothies in
530 a similar way to the individual correspondence analyses for each scenario (Figures 1a and 2a), and the
531 second factor separates the smoothies by scenario: Pack-alone is placed in the negative values of
532 factor 2 and Pack-and-tasting towards the positive values of this factor. The smoothies placed in the
533 negative values of factor 1 show higher frequencies of selection of positive emotions. Conversely, the
534 smoothies placed in the positive values of Factor 1 show higher frequencies of selection of negative
535 emotions.

536

537 **5. Conclusions**

538 The present study shows which of the emotions that can describe the emotional profile of new-
539 concept-smoothies in tasting and non-tasting conditions are the most important. It also reveals the
540 differences amongst emotional profiles evoked by products of the same category.

541 This study has shown that these new, innovative commercial smoothies containing vegetables were
542 well differentiated by the emotional responses they evoked, principally by their positive/negative
543 valences. Relevant differences in the sample configurations and emotional spaces were found between
544 the scenarios of only observing the pack and of observing the pack and tasting the product.

545 The emotional profiles of the samples were found to be roughly similar within the same scenario (Pack-
546 alone or Pack-and-tasting) when using the verbal or the non-verbal approach. However, the image-
547 based approach was able to unveil subtle differences in emotional responses to samples that reflect
548 the differences between expected and actual liking more efficiently.

549 Especially in the Pack-and-tasting scenario, the consumers selected unpleasant emotions more
550 frequently when they were presented as images rather than words. This would make the image-based
551 questionnaire more advantageous when assessing emotional responses to foods that evoke some
552 negative emotions, since it seems that consumers tend not to verbalize negative-type emotions. In
553 addition, as emotions are intuitive, images can provide an easy way to express emotions in a food
554 context, because they limit the rational or cognitive thought process that is required to understand
555 verbal cues. In this way, the photograph-based approach could represent an opportunity to develop a
556 non-verbal questionnaire to evaluate some negative food-related emotions (for example, the use of

557 insects). Finally, the present results did not succeed in proving that the use of images for evaluating the
558 emotions evoked by the smoothies would be easier than the use of words.

559

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563

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573

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710

711 Figure captions

712 Figure 1. Pack-alone scenario. Correspondence analysis plots of emotions selected by more than 10%
713 of the participants and with significantly different ($p < 0.05$) frequencies of use between samples. a)
714 word-based questionnaire; b) image-based questionnaire. FAS: Fascinating *chupinazo*; BEA: Beautiful
715 *flamenca*; POW: Powerful *mascletà*; BRI: Bright Menorca; DET: Detox *verbena*

716 Figure 2. Pack-and-tasting scenario. Correspondence analysis plots of emotions selected by more than
717 10% of the participants and with significantly different ($p < 0.05$) frequencies of use between samples. a)
718 word-based questionnaire; b) image-based questionnaire. FAS: Fascinating *chupinazo*; BEA: Beautiful
719 *flamenca*; POW: Powerful *mascletà*; BRI: Bright Menorca; DET: Detox *verbena*

720 Figure 3. Mean number of emotions selected for each sample across scenarios (Pack-alone and Pack-
721 and-tasting). White bars: image-based questionnaire; black bars: word-based questionnaire. FAS:
722 Fascinating *chupinazo*; BEA: Beautiful *flamenca*; POW: Powerful *mascletà*; BRI: Bright Menorca; DET:
723 Detox *verbena*. Letters on top of the bars indicate significant differences; values that do not share
724 letters are significantly different ($p < 0.05$).

725 Figure 4. Frequency of selection of emotions with differences greater than 5% across all the samples,
726 by use of words (dashed line) or use of images (solid line). a) Pack-alone scenario; b) Pack-and-tasting
727 scenario.

728 Supplementary Figure 1. Correspondence analysis plots of emotions with significantly different
729 ($p < 0.05$) frequencies of use between samples, combining the data from the two scenarios (Pack-alone:
730 letter “P” after sample code; Pack-and-tasting: letter “T” after sample code). a) word-based
731 questionnaire; b) image-based questionnaire. FAS: Fascinating *chupinazo*; BEA: Beautiful *flamenca*;
732 POW: Powerful *mascletà*; BRI: Bright Menorca; DET: Detox *verbena*.

733 Table 1: Product name, smoothie colour, front-of-pack information, and list of ingredients on the
734 smoothie pouch

Sample code	Product name	Smoothie colour	Fruits and vegetables declared on front of pack	List of ingredients
FAS	<i>Fascinating chupinazo</i> [<i>Chupinazo</i> is a firework rocket that opens some traditional Spanish festivals]	Bright red	Beetroot; pineapple; apple; lemon	Apple (41%), beetroot juice (28%), pineapple (24%), lemon juice (5%), lemon puree, ginger (0.1%), citrus fibre, natural flavourings
BEA	<i>Beautiful flamenca</i> [<i>Flamenca</i> is a woman wearing a traditional Andalusian dress at some Spanish festivals]	Dark red	Raspberry; strawberry; currant; beetroot	Strawberry (41%), banana, apple juice from concentrate, beetroot juice (10%), raspberry (6%), currant (4%), agave syrup (2%), pea protein, citrus fibre, concentrated carrot, hibiscus
POW	<i>Powerful mascletà</i> [<i>Mascletà</i> is a very noisy daylight firework exhibition which is typical of some Spanish festivals]	Orange	Orange; carrot; pineapple; pumpkin	Orange juice (39.5%), apple, carrot (15%), pineapple (11%), pumpkin (7%), agave syrup, citrus fibre, guarana (0.2%)
BRI	<i>Bright Menorca</i> [<i>Menorca</i> is a beautiful, quiet Mediterranean island]	Yellow	Pineapple; coconut; lettuce; mango	Apple, pineapple juice (24%), apple juice from concentrate, mango (7.7%), banana, lettuce (5%), coconut milk (4%), carrot, sweetcorn, kiwifruit, hemp seeds (0.8%), citrus fibre, natural flavourings
DET	<i>Detox verbena</i> [<i>Verbena</i> is a modest local dance party in the street that takes place on some summer evenings in Spain]	Green	Pear; cantaloupe; kale; celery	Apple, apple juice, grape juice from concentrate, cantaloupe juice from concentrate (8%), pear (6.5%), lettuce, celery (3%), spinach (2.5%), kale (2.5%), citrus fibre, matcha green tea powder (0.5%)

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737 Table 2: List of 20 terms* and photographs used for emotion assessment

1. Bored	2. Eager	3. Disgusted	4. Guilty

5. Desirous	6. Fun	7. Undecided	8. Loving

9. Unpleasantly surprised	10. Sad	11. Worried	12. Rejection

13. Happy	14. Angry	15. Indifferent	16. Relaxed

17. Satisfied/ Good	18. Pleasantly surprised/Admiration	19. Enthusiasm/ Energy	20. Disappointed/ Dissatisfied

738 *The terms that were discarded from the initial list of 50 emotions were: Affectionate – Adventurous - Aggressive – Calm –
739 Contempt – Daring – Fascination – Free – Friendly – Glad – Good-natured – Inspired – Interested – Joyful – Merry – Mild –
740 Nostalgic – Peaceful – Pleased – Pleasant – Polite – Quiet – Secure – Steady – Tame – Tender – Understanding – Warm –
741 Wild – Whole

743 Table 3: Statistical p-values of Cochran's Q tests indicating the significance of variations in the
744 frequency of selection of each emotion among samples in each scenario (Pack-alone and Pack-and-
745 tasting)
746

Emotion	Pack-alone scenario		Pack-and-tasting scenario	
	Word	Image	Word	Image
Bored	<0.001	0.201	<0.001	0.188
Eager	0.279*	0.145*	0.373*	0.433
Rejection	<0.001	<0.001	<0.001	<0.001
Guilty	0.558*	0.092*	0.071*	0.031*
Desirous	<0.001	<0.001	<0.001	<0.001
Fun	<0.001	0.107*	<0.001	<0.001
Undecided	0.012	0.581	0.252	0.025
Loving	0.024*	0.545*	0.089*	0.031
Happy	<0.001	0.051	<0.001	<0.001
Angry	0.558*	0.467*	0.475*	<0.001
Indifferent	0.007	0.673	0.718	0.493
Disappointed/Dissatisfied	0.001	0.139	<0.001	<0.001
Enthusiasm/Energy	0.001	0.076	<0.001	0.021
Worried	0.273*	0.027	0.007*	0.025
Disgusted	<0.001	0.044	<0.001	<0.001
Relaxed	0.018	0.572*	0.061	0.005
Satisfied/Good	<0.001	<0.001	<0.001	<0.001
Pleasantly surprised/Admiration	<0.001	0.009	<0.001	0.006
Unpleasantly surprised	<0.001	<0.001	<0.001	<0.001
Sad	0.028*	0.700*	0.004*	0.213

*Terms that were discarded because their frequencies of selection were $\leq 10\%$ for all samples

749 Table 4. Mean values for expected liking (Pack-alone scenario) and liking (Pack-and-tasting
750 scenario) for all samples

Sample*	Expected liking (Pack-alone scenario)	Liking (Pack-and-tasting scenario)
FAS	5.5 c	4.3 d
BEA	6.2 a	5.3 c
POW	6.1 ab	5.9 b
BRI	5.8 bc	6.3 a
DET	4.2 d	3.2 e

751 *FAS: Fascinating *chupinazo*; BEA: Beautiful *flamenca*; POW: Powerful *mascletà*; BRI: Bright Menorca; DET: Detox *verbena*
752 **Different letters within the same column denote significant differences between values according to the Fisher test ($p <$
753 0.05).
754
755

a) Words

b) Images

756 Figure 1

757

a) Words

b) Images

762

763

764

765 Figure 3

766

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a)

b)

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769 Figure 4

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772 Supplementary Table 1. Pack-alone scenario. Frequency of mention of each emotion for each sample
 773 using the word-based questionnaire, and Cochran's Q test p-values, indicating the significance of
 774 variations in the frequency of selection of each emotion among samples
 775

Word	Sample*					p-value
	FAS	BEA	POW	BRI	DET	
Bored	6	3	0	5	14	0.000
Eager	3	6	6	7	2	0.279
Disgusted	4	3	6	11	29	0.000
Guilty	1	0	0	0	1	0.558
Desirous	18	29	33	29	5	0.000
Fun	29	27	50	37	8	0.000
Undecided	27	18	14	16	29	0.012
Loving	6	9	10	8	1	0.024
Happy	15	24	29	21	3	0.000
Angry	0	0	1	1	0	0.558
Indifferent	14	15	4	11	2	0.007
Disappointed/ Dissatisfied	5	3	4	4	14	0.001
Enthusiasm/ Energy	18	16	25	19	5	0.001
Worried	2	2	1	1	5	0.273
Rejection	7	11	12	14	46	0.000
Relaxed	12	19	15	20	7	0.018
Satisfied/ Good	26	34	39	30	12	0.000
Pleasantly surprised/Admiration	40	46	46	35	14	0.000
Unpleasantly surprised	4	2	1	5	20	0.000
Sad	3	2	3	2	9	0.028

776 *FAS: Fascinating *chupinazo*; BEA: Beautiful *flamenca*; POW: Powerful *mascletà*; BRI: Bright Menorca; DET: Detox *verbena*
 777

778 Supplementary Table 2. Pack-alone scenario. Frequency of mention of emotions for each sample using
779 the image-based questionnaire, and Cochran's Q test p-values, indicating the significance of variations
780 in the frequency of selection of each emotion among samples
781

Image	Sample*					p-value
	FAS	BEA	POW	BRI	DET	
Bored	18	16	13	8	17	0.201
Eager	9	4	4	6	2	0.145
Disgusted	11	8	8	9	38	0.000
Guilty	0	1	0	2	4	0.092
Desirous	19	30	28	20	5	0.000
Fun	7	3	8	10	3	0.107
Undecided	43	36	39	34	36	0.581
Loving	1	3	3	2	1	0.545
Happy	7	11	14	15	6	0.051
Angry	4	1	3	2	5	0.467
Indifferent	18	16	16	12	19	0.673
Disappointed/ Dissatisfied	7	9	6	8	15	0.139
Enthusiasm/ Energy	12	16	16	10	6	0.076
Worried	11	8	6	2	7	0.027
Rejection	6	7	7	8	16	0.044
Relaxed	4	6	6	9	5	0.572
Satisfied/Good	28	47	35	42	11	0.000
Pleasantly surprised	11	17	18	16	4	0.009
Unpleasantly surprised	20	13	12	18	43	0.000
Sad	2	3	2	5	4	0.700

782 **FAS: Fascinating *chupinazo*; BEA: Beautiful *flamenca*; POW: Powerful *masclètà*; BRI: Bright Menorca; DET: Detox *verbena*
783
784

785 Supplementary Table 3. Pack-and-tasting scenario. Frequency of mention of each emotion for each
786 sample using the word-based questionnaire, and Cochran's Q test p-values, indicating the significance
787 of variations in the frequency of selection of each emotion among samples

788

Word	Sample*					p-value
	FAS	BEA	POW	BRI	DET	
Bored	6	5	1	1	13	0.000
Eager	5	2	4	8	6	0.373
Disgusted	31	14	7	9	48	0.000
Guilty	1	4	0	0	2	0.071
Desirous	4	14	17	21	3	0.000
Fun	17	20	40	38	4	0.000
Undecided	25	23	20	14	25	0.252
Loving	6	6	7	10	1	0.089
Happy	13	14	27	39	2	0.000
Angry	3	4	1	3	5	0.475
Indifferent	16	11	14	11	11	0.718
Disappointed/ Dissatisfied	30	19	7	7	35	0.000
Enthusiasm/ Energy	16	14	31	33	5	0.000
Worried	7	4	0	3	10	0.007
Rejection	34	14	6	9	37	0.000
Relaxed	9	15	14	18	7	0.061
Satisfied/ Good	15	40	49	41	10	0.000
Pleasantly surprised/ Admiration	19	32	45	50	13	0.000
Unpleasantly surprised	26	19	7	8	30	0.000
Sad	6	8	1	0	9	0.004

789 *FAS: Fascinating *chupinazo*; BEA: Beautiful *flamenca*; POW: Powerful *mascletà*; BRI: Bright Menorca; DET: Detox *verbena*

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792 Supplementary Table 4. Pack-and-tasting scenario. Frequency of mention of each emotion for each
793 sample using the image-based questionnaire, and Cochran's Q test p-values, indicating the significance
794 of variations in the frequency of selection of each emotion among samples
795

Image	Sample*					p-value
	FAS	BEA	POW	BRI	DET	
Bored	19	16	11	12	9	0.188
Eager	11	9	7	6	5	0.433
Disgusted	33	22	16	8	61	0.000
Guilty	1	4	1	1	7	0.031
Desirous	8	17	21	31	4	0.000
Fun	12	3	10	13	0	0.000
Undecided	34	31	26	26	15	0.025
Loving	3	5	6	12	4	0.031
Happy	8	14	14	26	1	0.000
Angry	9	6	4	5	23	0.000
Indifferent	21	16	26	24	21	0.493
Disappointed/ Dissatisfied	20	12	15	6	45	0.000
Enthusiasm/ Energy	12	13	19	23	9	0.021
Worried	8	10	4	6	16	0.025
Rejection	24	13	10	4	39	0.000
Relaxed	2	11	8	10	2	0.005
Satisfied/ Good	21	40	43	51	13	0.000
Pleasantly surprised/Admiration	12	9	16	16	3	0.006
Unpleasantly surprised	19	18	14	10	47	0.000
Sad	5	8	4	5	11	0.213

796 *FAS: Fascinating *chupinazo*; BEA: Beautiful *flamenca*; POW: Powerful *mascletà*; BRI: Bright Menorca; DET: Detox *verbena*
797

a)
Words

b)
Images