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Cross-cultural emotional response to food stimuli: Influence of consumption context

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ABSTRACT

Emotional responses elicited by certain types of food can be influenced by past experiences, frequency of consumption, culture, and other personal preferences. The present research aimed i) to investigate the impact of culture (Brazilian and Spaniard) on consumers' emotional responses and acceptability of different food stimuli, and ii) to explore the influence of evoked contexts. Brazilian (n = 437) and Spanish (n = 397) participants were exposed to three visual food stimuli (image of chocolate, potato chips, and yogurt) in an online survey and reported their emotional responses. Sociodemographic data, liking, and frequency of consumption were also collected. The evoked context in our study were designed and proposed, for each product and culture, based on four dimensions (consumption time, location, social setting, and hungry state). The evoked emotional lexicon was different for each food stimulus and was clearly influenced by the cultural factor. However, there are more similarities between cultures when evaluating the same product category. The evoked contexts were appropriated and influenced the citing frequency of some emotion terms, including positive ones. The most cited emotion terms tended to positively impact product liking ratings, acting as drivers of liking. Consumption level was positively related to liking regardless of cultural interactions for both chocolate and potato chips stimuli. In conclusion, the cultural background demonstrated to be an important impact factor to be considered for understanding the effects of product, consumption occasions, and degree of liking, on emotional responses to foods. These findings offer new possibilities to be explored in marketing messages for interventions or stimuli that guide food choices.

1. Introduction

The emotions evoked by food modulate the consumer's experience in a particular context. Although there is not a unique definition of "emotion" (Coppin & Sander, 2016), a well-accepted definition worldwide is that an "emotion" is a multicomponent phenomenon characterized by five components: expression, action tendency, bodily reaction, feeling and appraisal (Coppin & Sander, 2016). An emotion is an "event-focused, two-step, fast process consisting of (1) relevance-based emotion elicitation mechanisms that (2) shape a multiple emotional response (i.e., action tendency, automatic reaction, expression, and feeling)" (Sander, 2013). These emotions influence food preferences and for this reason, measuring emotional responses can assist the industry in product development and in the search for a consumer market (Ng, Chaya, & Hort, 2013). Therefore, they can provide valuable information and become a competitive advantage.

The study of the emotions evoked by foods, being a relatively recent approach to sensory sciences, requires a pre-screening of emotional lexicons. An emotion lexicon is a list of words that can be used to identify each emotion (Mohammad & Turney, 2010). It is suggested that emotion lexicons should be selected from the literature of the native language in order to avoid misinterpretation caused by cultural differences (Jiang, King, & Prinyawiwatkul, 2014; van Zyl & Meiselman, 2016). Due to cultural significance, consumers from different regions may also give their distinct emotional responses toward specific foods (Ferdenzi et al., 2011). Due to this influence, commercial research is increasingly interested in the cross-cultural dimension to understand these emotional connections, especially for large international

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companies (Meiselman, 2015). There are several studies which reported the influence of culture background in different products categories (Gunaratne et al., 2019; Hu & Lee, 2019; Lim, 2016; Torrico, Fuentes, Gonzalez Viejo, Ashman, Gunaratne, Gunaratne, & Dunshea, 2018; Tsai & Chentsova-Dutton, 2003; van Zyl & Meiselman, 2015; 2016). However, the emotional response to particular food between a "greater emotionality" culture like the Brazilian and a supposedly "closed nature" European culture (Rezende, 2008) like Spaniards is still unknown. Emotional cross-cultural studies (i.e., Brazil and Spain) for regular product categories could be crucial for better understanding food choices and designing suitable strategies to attract and maintain customers in a global market scenario.

Moreover, the emotional response is context-dependent (Piqueras-Fiszman & Jaeger, 2015). The context of actual consumption of a product is not always possible or practical for consumer testing (Hein, Hamid, Jaeger, & Delahunty, 2012). Therefore, the use of a written scenario can facilitate the evocation of emotions as each consumer imagines his own personal consumption context for a particular food product (Dorado, Chaya, Tarrega, & Hort, 2016). In this regard, a context freely defined by a large group of people, influenced by learning, culture, may indicate the sharing of the same idealized situation.

Self-reported verbal questionnaires remain one of the most common techniques used to measure emotional response due to their simple, cost-effective and good discrimination approach. The CATA (check-all-that-apply) method, for example, consists of lists of emotions in which consumers classify terms or select only the experienced emotions (Valentin, Chollet, & Lelie, 2012). This type of questionnaire provides more differentiation at the highest levels of emotional frequency for some selected emotions, and the selected emotion terms tend to be the strongest emotions elicited by the stimulus (King, Meiselman, & Carr, 2013).

Therefore, it is important to understand how cultural differences affect the emotional lexicon, perceptions of liking and the contextualization of consumption of different categories of products. Thus, the aim of this study was i) to develop an original emotional lexicon adapted to each culture (Brazil and Spain) for three food stimuli commonly consumed in both cultures: chocolate, potato chips and yogurt ii) to explore and define the most appropriate evoked context for each evaluated food stimulus in each culture iii) to investigate the impact of culture background (Brazilian and Spaniard) on consumer's emotional response to chocolate, potato chips and yogurt stimulus and the effect of pre-designed evoked contexts. In addition, the emotion *drivers of liking* and *disliking* were identified for each product stimulus and culture. Finally, the impact of each product's consumption level on emotional responses was also reported and discussed.

2. Material and methods

2.1. Products stimuli selection

Three categories of commercial products were selected as stimuli based on eating habits of both cultures: chocolate (bar), potato chips (bag) and yogurt (single serve cup). Pictures and name of each food category were used as stimuli (Fig. 1) and presented to the participants in an online survey. Coffee stimulus (picture) has been always used as "warm up" sample in the first position to avoid first position effects (data not shown) (Dorado, Pérez-Hugalde, Picard, & Chaya, 2016a). The three stimuli (pictures) samples were monadically presented in randomized order across participants to minimize systematic carry-over effects. The same protocol was applied for all food stimuli evaluation. The selection of food picture as stimulus was decided based on the reported evidence that consumers' emotional responses/associations are similar between the stimulation by food picture and food consumption (Cardello et al., 2012).

2.2. Subjects

Participants were invited to participate via email and asked to complete an online questionnaire using Google forms (Google L.L.C., Mountain View, California, USA). Prior to recruitment, participants were informed of the purpose of the research, the voluntary nature of participation and an informed consent was obtained. Brazilian students and employees from the Federal University of Paraíba participated in Brazil and Spanish students and employees from the Universidad of Extremadura participated in Spain. Three phases were conducted: i) an online questionnaire to generate the list of emotional terms associated to each stimulus with 60 participants in each country; ii) an online questionnaire using the generated list of terms for validation in the three different foods stimuli with 190 Brazilians and 186 Spaniards; iii) an online questionnaire using a pre-designed written context with 187 Brazilians and 151 Spaniards. Different participants took part in each phase. Demographics data related to gender, age, household compositions, family income, studies level and culture were collected in all sessions. The demographic characteristics of the participants are shown in Table 1.

Participants had to declare to be regular consumers of the studied products (chocolate, chips, and yogurt). This evaluation was carried out using the question of frequency of consumption with a 5-point categorical scale (1 = Less than once a month; 2 = One or more times a month; 3 = Twice or more per week; 4 = Once a week; 5 = Once a day or more) and an additional option "Never". Participants who answered "Never" were excluded from the study.

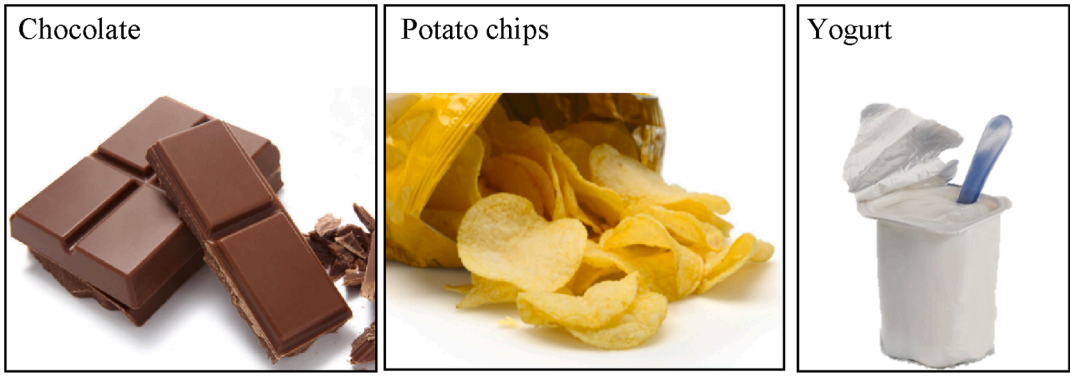

Fig. 1. Images and names displayed for food stimuli on the emotions evoked questionnaires.

Table 1
Socio-demographic characteristics of the subjects participating in the questionnaires.

	Emotional lexicon		Without context		With context	
Gender	Brazil (%) N = 60	Spain (%) N = 60	Brazil (%) N = 190	Spain (%) N = 186	Brazil (%) N = 187	Spain (%) N = 151
Female	60	55	66	62	38	44
Male	40	45	34	38	62	56
Age						
18 to 30 years	60	35	80	29	58	26
31 to 40 years	40	30	20	22	38	21
41 to 50 years	0	5	0	20	4	23
>50 years	0	30	0	29	0	30
People living in household						
1	25	30	7	22	16	8
2	35	25	27	20	37	17
3	0	10	22	18	14	15
4	30	25	24	24	23	18
5	10	10	13	13	6	42
+5	0	0	7	2	6	0
Family income						
Less than a salary	0	0	11	4	3	2
Up to two salaries	0	45	29	36	7	23
Between 2 and 3 salaries	20	25	13	22	21	42
Between 3 and 5 salaries	25	20	16	22	17	17
Between 5 and 7 salaries	10	0	11	9	11	11
More than 7 salaries	45	10	20	7	41	6

2.3. Emotional lexicon generation

Two steps for emotional lexicon generation were performed. The checklist format has been applied as it is considered not too exhaustive as each participant had to complete multiple emotion questionnaires. In both steps, the food pictures and names were presented to the participants and they were requested to respond the CATA questionnaire by the following sentence: "Please tick all the emotions you remember feeling when you consume (chocolate or potato chips or yogurt)". They could also suggest additional terms. In the first step the list of emotional terms presented was the emotional lexicon included in the EsSense25 methodology (Nestrud, Meiselman, King, Lesher, & Cardello, 2016) and also some additional terms based on specific emotional lexicon previously developed for each food category: yogurt (Mojet et al., 2015; Schouteten et al., 2017), chocolate (Gunaratne et al., 2019; Schouteten et al., 2017; Thomson, Crocker, & Marketo, 2010; Torrico, Fuentes, Gonzalez Viejo, Ashman, & Dunshea, 2019) and potato chips (Cardello et al., 2012). All emotional terms were translated from English to Portuguese and Spanish by bilingual researchers and consumers, following the methodology applied by Hu and Lee (2019). A total of 79 emotional terms were listed for chocolate, 64 for potato chips and 65 for yogurt (Table 1SM). The order of emotion terms presentation was randomized among participants, to avoid terms presentation order bias effect.

In the first step, the emotions cited by >5% of the participants were selected (Piqueras-Fiszman & Jaeger, 2014b). Using this criteria, 38 emotions for chocolate, 37 for potato chips and 27 for yogurt were selected by the Brazilians and 42 for chocolate, 33 for potato chips, and 36 for yogurt were selected by the Spanish participants. The selected emotions were applied to the second step to validate the terms following the same evaluation protocol. The results of the second step were also filtered according to the most frequent terms (>5% of citation). With the results obtained in this step (the first one), it was possible to validate the emotional terms and generate a short list of emotions to be applied in the "without context" and "with context" tests. This study did not consider an established list of general terms related to food consumption, as we believe that emotion terms should be customized for each product category and culture.

2.4. Emotional response without scenario (validation of list of emotional terms)

Once the demographic data (Table 1) of the participants were collected, at the beginning of each product-specific questionnaire, a food picture and name (chocolate, potato chips or yogurt) was displayed to participants and the frequency of consumption was requested using a 5-point categorical scale. Then, participants were instructed to select all the applicable emotions (CATA approach) by the following sentence: "Please tick all the emotions you remember feeling when you consume (chocolate or potato chips or yogurt)". The order of emotion presentation was randomized among participants, but, in order to ease the task, the same order was maintained in each product category for the same participant (King & Meiselman, 2010). Five minutes was the estimated time to complete the questionnaire. After validation procedure, Brazilian participants elected 32 terms for chocolate, 25 for potato chips and 20 for yogurt. Spanish participants elected 29 terms for chocolate, 18 for potato chips and 15 for yogurt. Finally, participants were asked to rate their liking using a 7-point hedonic scale, anchored from "I dislike very much" to "I like very much". The list of emotions were presented before hedonic scale to avoid any effect of liking on the emotional responses (King et al., 2013).

2.5. Design and selection of the evoked contexts

After the validation of emotional list terms and the collection of the emotional responses for the different food stimuli (section 2.4), participants (Brazilians and Spaniards) were asked, in a new online questionnaire, to answer a series of questions to indicate the most common consumption occasions for each evaluated food stimulus. This questionnaire aims to obtain the most common consumption scenarios elicited for each culture and product. Different items were included as the consumption time, location, social setting (company) and hungry state, in order to generate an elicited context for each product stimulus and culture (Table 2). According to Dorado et al. (2016b), the presence of these dimensions in an elicited scenario encourages greater emotional association by the participant. The most frequent occasions (>50%) were selected to create a consumption written context for each food stimulus. These collected responses indicated differences between the frequency of citation of each dimension in relation to the product, therefore considering the most frequent dimensions, different consumption contexts were formulated for each product stimulus and each culture. The elicited contexts for Brazilians were (1) "It is afternoon, you are at home, you are alone, you are not hungry, and you are eating milk chocolate"; (2) "It is the afternoon, you are at the restaurant with your friends or family, you are hungry and you are eating salted potato chips" and (3) "It is morning, you are having breakfast at home, you are alone or with your family, you are hungry and you are eating a yogurt", for chocolate, potato chips and yogurt consumption respectively. The elicited contexts formulated by Spaniard were (1) "It is afternoon, you are at home with your family, you are hungry and you are eating milk chocolate"; (2) "It is afternoon, you are at home with some friends or family, you are hungry and you are eating salted potato chips"; (3) "It is night, you are having dinner at home with your family, you are hungry and you are eating a yogurt" for chocolate, potato chips and yogurt respectively.

2.6. Emotional response under the elicited context

Once the demographic data (Table 1) of the participants were collected, at the beginning of the product-specific questionnaire, a food

Table 2
Dimensions (Location, social setting, time, hungry state) evaluated for context selection by culture and the % of options selection for each product category stimulus.

Dimension	Question	Options	Brazil			Spain		
			Chocolate	Potato Chips	Yogurt	Chocolate	Potato Chips	Yogurt
Time	I usually eat chocolate for…	a. Breakfast	0	0	74	12	0	16
	I usually eat potato chips for…	b. Lunch	9	23	0	12	21	27
	I usually eat yogurt for…	c. Dinner	7	50	19	17	26	86
		d. Between hours	89	24	48	83	74	24
Location	When I'm eating chocolate, I'm usually at (the)…	a. Home	93	27	100	92	63	95
		b. Work	20	0	14	12	0	7
	When I'm eating potato chips, I'm usually at (the)…	c. Food center (bar, restaurant, etc.)	34	80	9	28	46	0
			43	33	1	7	21	0
	When I'm eating yogurt, I'm usually at (the)…	d. Leisure Center (cinema, theater, etc.)						
Social setting	When I'm eating chocolate, I'm usually with…	a. Nobody (alone)	71	9	71	55	16	41
		b. My friends	51	73	12	35	74	7
	When I'm eating potato chips, I'm usually with…	c. My family	51	53	47	70	74	65
	When I'm eating yogurt, I'm usually with…							
Hungry state	I usually eat chocolate when I'm…	a. Hunger	23	89	90	54	79	57
	I usually eat potato chips when I'm…	b. Full	79	14	15	34	14	40
	I usually eat yogurt when I'm…							

picture and name (chocolate, potato chips or yogurt) was displayed to participants and the frequency of consumption was requested using a 5-point categorical scale. Then, participants were introduced to the consumption context and were requested to imagine the food consumption experience under the specific context by showing the following sentence: "Imagine that you are experiencing the following situation and answer the questions as realistically as possible". Then, participants were requested to select all elicited emotional terms applicable under the corresponding context following CATA procedure. To evaluate the adequacy of the performed consumption scenario, participants were asked about the appropriateness of the context by answering the following question: "Is this scenario appropriate for the consumption of this product?" using a 7-pt categorical scale (1 = Not at all appropriate; 2 = Inappropriate; 3 = Slightly inappropriate; 4 = Neither appropriate nor inappropriate; 5 = Slightly appropriate; 6 = Appropriate, and 7 = Very appropriate). Right after, they were instructed to check all applicable terms (CATA) while imagining consuming each food under different occasion: "What are the emotions you feel when consuming (chocolate; potato chips; yogurt) in this context?". Participants could also suggest additional terms using the "other" option. The same list of emotional terms used in the previous step (validation test without context) for each product and culture was applied. The order of emotion presentation was randomized among participants. Finally, participants were asked to indicate how much they liked the food using a 7-point hedonic scale (1 = I dislike very much, 7 = I like very much). Five minutes was the estimated time to complete the questionnaire.

2.7. Data analysis

Frequency of each emotion term from CATA questionnaire was calculated in percentage for each food stimulus (chocolate, potato chips and yogurt) for Brazilians and Spaniard under evoked and no-context situations. In order to investigate the effect of the evoked contexts on the emotional responses, Cochran Q-tests were performed on each of the emotions to explore differences among evaluation conditions (with *vs* without context) for each food stimulus and culture (Brazilians and Spaniards). Moreover, Correspondence Analysis allowed to obtain the emotional profile associated to each culture in the two evaluation conditions and Principal Coordinate Analyses (PCoA) were applied to assess the differences among the food stimuli relative to the selection of the emotion terms and liking levels of each culture. Pearson correlation coefficients (r) among the consumption level and overall liking responses were estimated. A Kruskal-Wallis non-parametric test ($p < 0.05$) was applied to no normal appropriateness of the context data (Shapiro-Wilk test) followed by a multiple paired comparisons test (Dunn procedure) for comparing the mean differences between products or cultures. Regarding answers on consumption level and liking (normal data, Shapiro-Wilk test) an analysis of variance (ANOVA) using the 5% level of significance was applied, considering the effects of culture (Brazilian and Spanish participants) and evaluation conditions (without and with context) on each product stimulus (chocolate, potato chips and yogurt). All statistical analyses were performed using XLSTAT 2014 (Addinsoft, Paris, France).

3. Results

3.1. Emotional lexicon elicited by Brazilians and Spaniards for different foods stimuli: Vocabulary development

Table 1SM shows all emotional terms used to develop the lexicon evoked by Brazilians and Spanish participants in the evaluation of each product stimulus, translated from English to Spanish and to Portuguese. Brazilian participants elected 32 terms for chocolate, 25 for potato chips and 20 for yogurt. Food stimuli had in common the following emotion terms: *active, affectionate, calm, craving, eager, friendly, good-natured, lazy, pleasant, relaxed, satisfied* and *warm*. Spanish participants elected 29 terms for chocolate, 18 for potato chips and 15 for yogurt. Food stimuli had in common the following emotion terms: *active, calm, carefree, comfortable, happy, friendly, joyful, pleasant* and *satisfied*. In general, Spanish participants selected fewer emotional terms than Brazilian participants for the same product stimuli, but similarities were found in the election of the same 23 emotion terms for chocolate (*affectionate, active, calm, comforting, craving, eager, enthusiastic, friendly, fun, good-natured, guilty, happy, interested, irresistible, lazy, lonely, loving, luxurious, nostalgic, pleasant, satiating, satisfied, sociable, warm*), 13 emotion terms for potato chips (*active, calm, comfortable, craving, eager, enthusiastic, free, friendly, guilty, pleasant, relaxed, satisfied, young*), and 12 emotion terms for yogurt (*active, calm, carefree, comfortable, happy, friendly, joyful, pleasant, relaxed, reliable, satisfied* and *steady*).

3.2. Appropriateness of the freely elicited context

The formulation of the freely elicited contexts aimed at obtaining the context best suited to consumers in each culture. Moreover, results of context appropriateness revealed that more than 50% of participants in Brazil and Spain indicated that the context was between slightly appropriate (5) and very appropriate (7), with no significant differences neither between products ($p = 0.0997$) nor between countries ($p =$

0.3814) by the Kruskal-Wallis test. The means presented by the Brazilian participants for chocolate was 4.65 ± 1.85, for potato chips 4.13 ± 1.99 and for yogurt 4.72 ± 2.13, and by Spanish participants was 4.01 ± 2.02 for chocolate, 4.36 ± 2.06 for potato chips and 4.40 ± 1.99 for yogurt.

3.3. Emotional response to chocolate, potato chips and yogurt stimuli by Brazilians and Spaniards under non-context and context scenario

Results from the emotional response (% of frequency of mention) of Brazilians and Spaniards to the evaluated food stimuli (chocolate, potato chips and yogurt) using the validated lexicon list of emotions under the two evaluation conditions (with and without context) are presented in Tables 3–5.

Table 3 summarizes the results obtained by comparing the sum of mentions of the emotional terms reported for chocolate under the two studied conditions (with and without context), evaluated by Brazilians and Spaniards. Among the emotion terms evaluated, the sum of mentions of terms *active, calm, enthusiastic, fun, good-natured, loving, sociable* and *uncomplicated*, were significantly higher in the non-context compared to context condition for Brazilians, as well as the terms *good, happy* and *nostalgic* for Spaniards.

Fig. 2 shows the results of the correspondence analysis for Brazilians and Spaniards under the two evaluation conditions (with and without context) for chocolate stimulus in relation to the emotional response (CATA questionnaire). The principal components one (PC1) and two (PC2) explaining a total of 95.84% of the data variability. Clearly the attributes most associated with chocolate evaluated for Brazilians participants under non-context situation were *fun, loving, enthusiastic, active, friendly, adventurous, confident, good-natured, suffering, trustworthy, uncomplicated* and *understanding*, whereas under the evoked context condition were *craving, eager, happy, lazy, satisfied, easygoing,*

Table 3
Total number of mentions of selected emotions for the chocolate stimulus with and without context conditions.

Emotion term	Brazil		Emotion term	Spain	
	Without context N = 68	With context N = 68		Without context N = 46	With context N = 46
Active*	30	13	Active	9	6
Adventurous	6	1	Affectionate	7	2
Affectionate	6	10	Calm	7	8
Calm*	20	8	Carefree	6	4
Comforting	11	7	Comfortable	20	15
Confident	12	7	Comforting	10	7
Craving	12	17	Craving	5	4
Eager	12	17	Joyful	8	6
Easygoing	21	16	Eager	5	1
Enthusiastic*	15	5	Enthusiastic	6	1
Friendly	18	10	Friendly	6	4
Fun*	21	9	Fun	3	1
Good-natured*	14	5	Good*	22	11
Guilty	6	6	Guilty	6	6
Happy	44	39	Happy*	23	13
Interested	5	2	Interested	3	1
Irresistible	6	5	Irresistible	5	6
Lazy	8	8	Lazy	5	1
Lonely	6	4	Lonely	3	1
Loving*	24	7	Loving	6	2
Luxurious	8	3	Luxurious	3	4
Nostalgic	11	6	Nostalgic*	9	2
Pleasant	21	15	Pleased	12	7
Powerful	6	3	Pleasant	18	14
Relaxed	30	31	Satiating	8	6
Satiating	17	15	Satisfied	21	14
Satisfied	38	37	Sensual	3	3
Sociable*	14	4	Sociable	38	5
Suffering	8	2	Warm	7	5
Trustworthy	8	4			
Uncomplicated*	9	1			
Understanding	5	1			
Warm	6	10			

Emotion terms which sum of mentions differ significantly across the without and with context conditions according to Cochran Q-test are highlighted marked with * at a significance level of $p < 0.05$.

Table 4
Total number of mentions of selected emotions for the potato chips stimulus with and without context conditions.

Emotion term	Brazil		Emotion term	Spain	
	Without context N = 62	With context N = 62		Without context N = 50	With context N = 50
Active	7	9	Accompanied	10	18
Adventurous	5	1	Active *	7	1
Affectionate	5	3	Calm	3	3
Bad	4	3	Carefree	6	7
Calm	5	3	Comfortable	13	18
Comfortable	23	17	Craving	7	4
Craving	11	10	Eager	5	5
Eager	11	10	Enthusiastic	4	2
Enthusiastic	8	13	Free	4	1
Free	7	7	Friendly	12	8
Friendly*	17	7	Guilty	13	11
Good	8	3	Happy	17	12
Guilty*	8	18	Joyful*	15	6
Hungry	23	21	Pleasant	10	11
Lazy	4	7	Pleased	5	8
Pleasant *	5	19	Relaxed	13	19
Nostalgic	4	2	Satisfied	8	10
Relaxed*	23	10	Young	3	0
Satisfied	31	29			
Steady	7	4			
Warm	5	3			
Whole	7	4			
Worried	4	10			
Young	8	13			

Emotion terms which sum of mentions differ significantly across the without and with context conditions according to Cochran Q-test are highlighted marked with * at a significance level of $p < 0.05$.

Table 5
Total number of mentions of selected emotions for the yogurt stimulus with and without context conditions.

Emotion term	Brazil		Emotion term	Spain	
	Without context N = 57	With context N = 57		Without context N = 53	With context N = 53
Active	5	4	Active	7	3
Affectionate	4	3	Bored	4	2
Calm	9	15	Calm	10	4
Carefree	8	10	Carefree	7	4
Comfortable	24	20	Comfortable*	22	9
Craving*	4	0	Confident	7	2
Eager*	4	0	Friendly*	7	1
Friendly	6	2	Good	24	17
Good-natured	6	5	Happy	11	4
Happy	17	20	Joyful	5	1
Interested	4	1	Kind*	7	1
Joyful	17	20	Pleasant	8	15
Lazy	8	3	Relaxed	14	9
Pleasant	9	12	Reliable	5	6
Polite	5	3	Satisfied	14	16
Understanding	5	2	Steady	3	3
Relaxed	14	11	Healthy	24	27
Reliable	6	10			
Satisfied	37	33			
Steady	9	5			
Warm	4	3			
Young	8	7			

Emotion terms sum of mentions differ significantly across the without and with context conditions according to Cochran Q-test are highlighted marked with * at a significance level of $p < 0.05$.

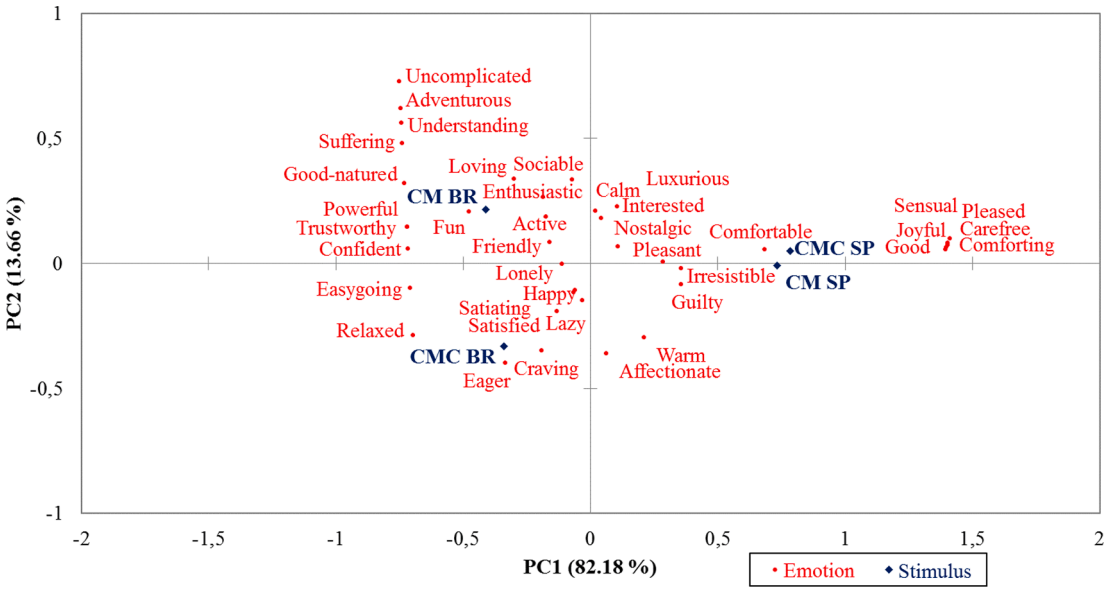

Fig. 2. Correspondence analysis (CA) of CATA terms (emotions) frequencies for chocolate stimulus (CM) in both cultures (Brazil-BR and Spain-SP) under both evaluation conditions (without and with evoked context-C).

relaxed and *satiating*. The emotions associated with chocolate stimulus evaluated by Spanish participants under the evoked context condition were *powerful, comforting, joyful, carefree, comfortable, good, sensual, pleased, calm, luxurious, interested, nostalgic,* and *pleasant*, while under the non-context situation were *irresistible, guilty, warm, affectionate* and *satisfied.*

Results obtained for the sum of mentions of the emotional terms reported under context and no-context conditions for potato chips evaluated by Brazilians and Spaniards is shown in Table 4. In the evaluation of Brazilians, the sum of mentions of the emotion terms *friendly, relaxed* was significantly higher for the non-context condition, while *guilty* and *pleasant* was significantly higher in the evoked context condition. In the assessment of Spaniards, *active, joyful* presented a significantly higher frequency of citations in evoked context compared to the no-context condition.

Fig. 3 shows the results of the correspondence analysis for Brazilians and Spaniards under the two evaluation conditions (with and without context) for potato chips stimulus in relation to the emotional response (CATA questionnaire). The principal components one (PC1) and two (PC2) accounted for 79.39% and 12.56%, respectively, explaining a total of 91.95% of the data variability. Emotional response to potato chips evaluated by Brazilians participants in the non-context condition was characterized by emotions like *adventurous, affectionate, bad, eager, good, nostalgic, satisfied, steady, warm, whole,* while under evoked context condition the emotions *active, craving, enthusiastic, free, lazy, worried, young* were the most frequently cited. Regarding Spanish participants emotional response, the emotion terms *friendly, guilty, happy, joyful* were the most cited under non-context condition whereas *accompanied, calm, carefree, comfortable, pleased, relaxed* characterized the emotional responses under the evoked context condition.

Table 5 shows the results obtained by comparing the sum of mentions of the emotion terms selected for the yogurt stimulus under context and no-context conditions obtained by Brazilians and Spanish participants. Among the emotion terms evaluated, only for *craving* and *eager*

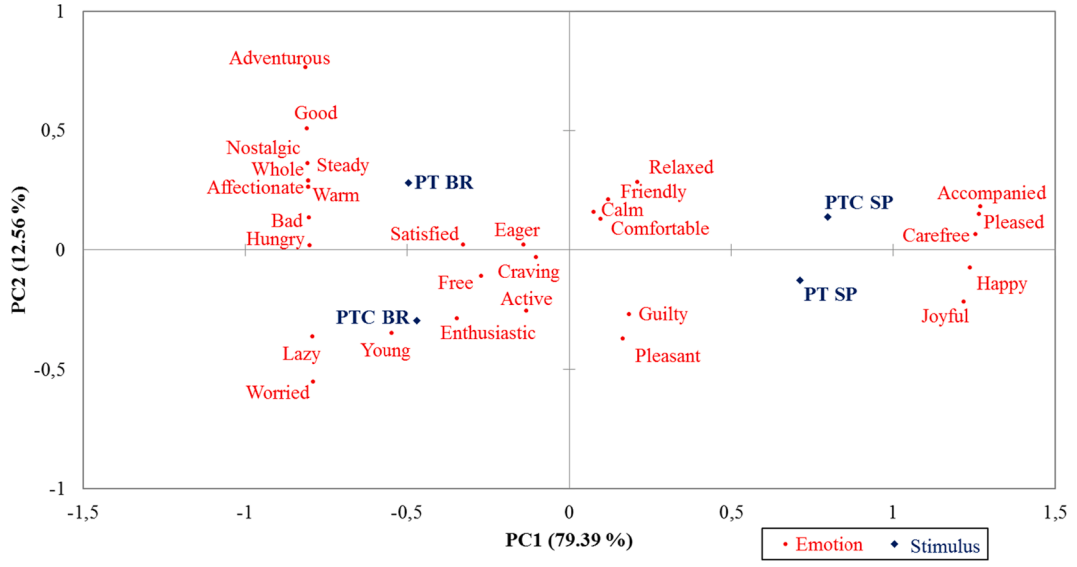

Fig. 3. Correspondence analysis (CA) of CATA terms (emotions) frequencies for potato chips (PT) stimulus in both cultures (Brazil-BR and Spain-SP) under both evaluation conditions (without and with evoked context-C).

emotions significant differences in the sum of mention between the two evaluations conditions were obtained. For Spanish participants, significantly higher frequencies for *comfortable, friendly* and *kind* were found in the non-context situation.

Fig. 4 shows the results of the correspondence analysis for Brazilians and Spaniards under the two evaluation conditions (with and without context) for yogurt stimulus in relation to the emotional response (CATA questionnaire). The principal component one (PC1) accounted for 83.99% and with component two (PC2) explaining a total of 92.27% of the data variability. The emotion terms associated with yogurt evaluated by Brazilian under the non-context condition were *affectionate, comfortable, craving, eager, good-natured, interested, lazy, polite, understanding, steady, warm,* whereas in the evoked context condition were *active, calm, carefree, happy, joyful, satisfied, young.* For Spanish participants, the emotion terms associated with yogurt stimulus were *bored, confident, friendly, good, kind, relaxed, healthy* in the non-context condition and *pleasant, satiating* and *reliable* in the evoked context condition.

3.4. Consumption level and liking

Table 6 shows the ANOVA results (F and p values) for the responses (liking and consumption level) to product stimulus (chocolate, potato chips and yogurt) depending on the effects of participant, culture, context, and the culture*context interaction. The participant effect did not have a significant impact on consumption level ($p > 0.05$), but this effect was significant on liking for chocolate and potato chips ($p < 0.05$). The culture effect was significant ($p < 0.05$) for the liking response of chocolate and for consumption level in the evaluation of yogurt and potato chips. The context effect was significant ($p < 0.05$) only for potato chips. The effects of the interaction (culture*context) were significant ($p < 0.05$) for all responses, except for liking in potato chip. The mean values of the consumption level and sensory liking for each food stimulus in each culture (Brazilian and Spaniard) were calculated. For both cultural groups, chocolate displayed scores above "One or more times a month" (2.55 ± 1.03 *vs* 2.63 ± 1.23 for Brazilian and Spaniard respectively) in the frequency of consumption scale (5-pt). Conversely, the mean of consumption level of potato chips for Brazilians (1.82 ± 0.72) was significantly lower ($p < 0.05$) compared to the Spaniard (2.18 ± 0.85) with averages above "Less than once a month" and "One or more times a month" respectively. Spanish participants reported significant ($p < 0.05$) higher consumption level scores for yogurt compared to Brazilian participants (3.29 ± 1.28 *vs* 2.47 ± 1.11, respectively).

In general, with respect to liking scores, all food stimuli presented high average scores with values above "like slightly" in a 7-pt scale. The average presented by Brazilians for chocolate (6.05 ± 1.09) was significantly higher ($p < 0.05$) compared to Spaniard responses (5.12 ± 1.62). On the other hand, the liking scores presented by Brazilians and Spaniards in the evaluation of potato chips and yogurt showed no significant differences between them (5.67 ± 1.12 *vs* 5.47 ± 1.01 and 5.14 ± 1.57 *vs* 4.97 ± 1.14, respectively).

Table 6
ANOVA* table for the liking and consumption level parameters of the products stimuli.

Effects*	Chocolate			
	Liking		Consumption level	
	F Value**	Pr > F**	F Value**	Pr > F**
Participant	1.601	0.009	0.976	0.538
Culture	**15.734**	**0.000**	0.201	0.654
Context	**29.102**	**< 0.0001**	**8.474**	**0.004**
Culture*Context	**19.746**	**< 0.0001**	**2.981**	**0.032**
	Potato chips			
Participant	1.505	0.022	1.364	0.062
Culture	1.225	0.270	**6.756**	**0.010**
Context	1.313	0.253	0.013	0.908
Culture*Context	1.209	0.308	**3.538**	**0.016**
	Yogurt			
Participant	1.021	0.4514	1.180	0.207
Culture	0.463	0.497	**17.773**	**< 0.0001**
Context	**10.332**	**0.002**	**23.669**	**< 0.0001**
Culture*Context	**3.634**	**0.014**	**15.414**	**< 0.0001**

* ANOVA = Analysis of variance [culture groups (Brazilian and Spanish participants), 2 situations of context (without and with context)].
** F value = Mean square/Mean square error. Effects were considered significant when the probability Pr > F was < 0.05 (Bolded F-values and probabilities).

Significant Pearson (r) correlation ($p < 0.05$) coefficients between consumption level and liking scores given by Brazilians were obtained for chocolate (r = 0.47), potato chips (r = 0.27) and yogurt (r = 0.58), while for Spanish participants only significant correlations ($p < 0.05$) were found for chocolate (r = 0.33) and potato chips (r = 0.23). All reported correlations were positive.

The Principal Coordinate Analysis (PCoA) of the emotion terms elicited in relation to the liking scores is shown in Figs. 5–7 for each culture. For chocolate stimulus in Brazilians participants (Fig. 5A) liking was associated with *good-natured, happy, relaxed, warm* and *affectionate*, and in Spanish participants (Fig. 5B) liking of chocolate stimulus was characterized by emotions as *fun, happy, pleasant, comfortable and*

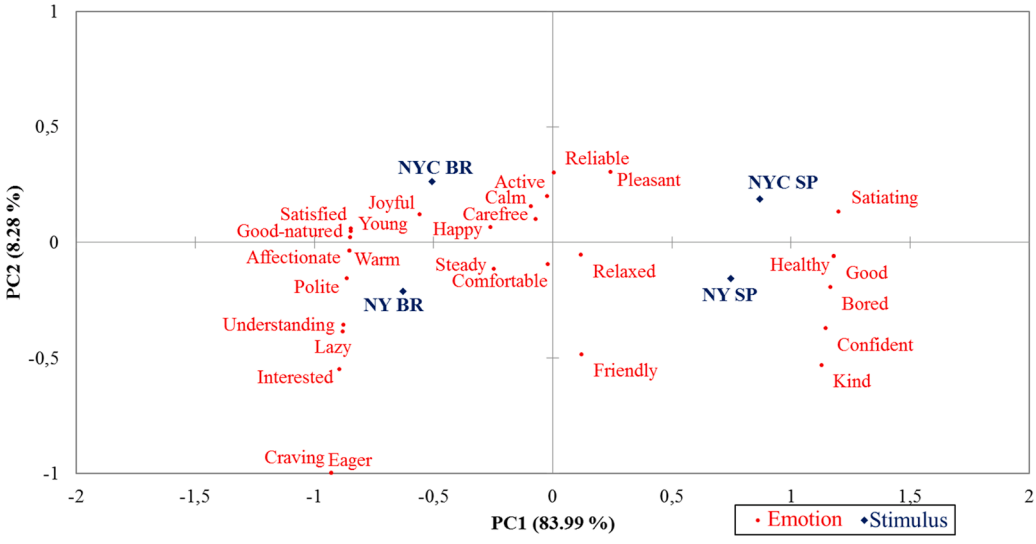

Fig. 4. Correspondence analysis (CA) of CATA terms (emotions) frequencies for yogurt stimulus (NY) in both cultures (Brazil-BR and Spain-SP) under both evaluation conditions (without and with evoked context-C).

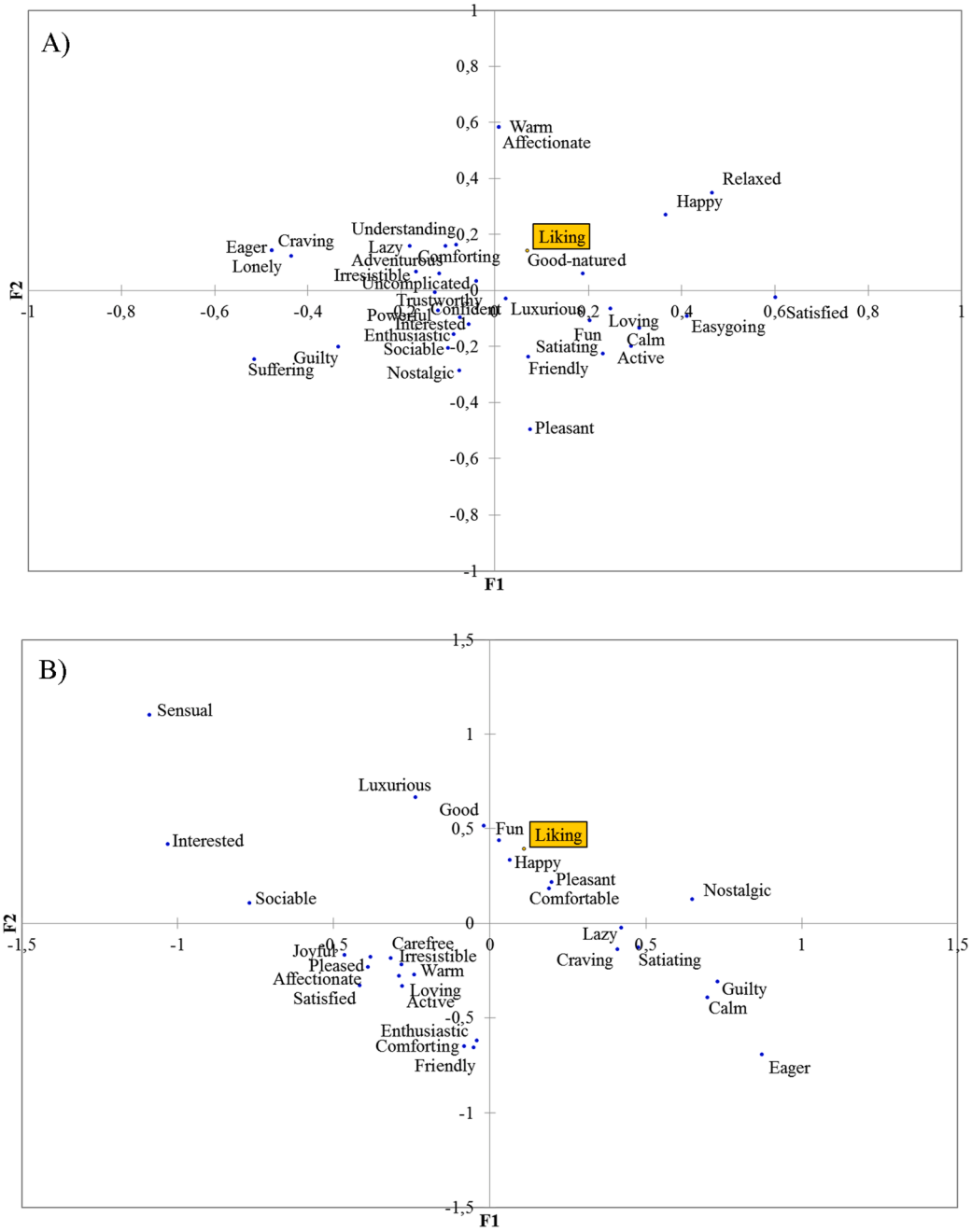

Fig. 5. Principal coordinate analysis of the emotion terms with the liking scores for chocolate stimulus for Brazilians (A) and Spaniards (B).

nostalgic. For potato chips stimulus, Brazilian participants associated liking with *hungry* and *active* (Fig. 6A), and Spanish participants with *accompanied* and *guilty* (Fig. 6B). Finally, for yogurt stimulus, Brazilian participants (Fig. 7A) associated liking with *reliable, satisfied, comfortable, calm*, and Spanish participants (Fig. 7B) with *kind, friendly, confident* and *good*.

4. Discussion

4.1. Influence of cultural background on the evoked emotional response to different food stimuli

The development of the emotional lexicon, using the CATA approach, allowed participants to intuitively select the emotional terms that they considered relevant when they were stimulated by the picture and name of the selected food categories. According to the emotional lexicon developed by Brazilian and Spanish participants, the idiosyncratic nature of the emotional responses evoked by the different food categories was highly impacted by culture. The less emotional response obtained for Spaniards compared to Brazilians participants could respond to the previously reported "emotionally closed-off" nature of the Spaniards against the "emotionally expressive" nature of Brazilians.

First, comparing the emotional response to the different stimuli, some particular foods seemed to be "more emotional" than others. For example, the magnitude of the emotional response to 'chocolate' and 'potato chips' stimuli (name and picture) was greater than that evoked by the 'yogurt' stimulus, regardless of the culture. This can be explained because these products (chocolate and potato chips) are not necessarily consumed for their nutritional value, but rather, as an emotional eating strategy or to satisfy cravings (Parker, Parker, & Brotchie, 2006). On the other hand, the 'yogurt' stimulus had possibly a lower magnitude of the emotional response as it has been associated with healthy connotations.

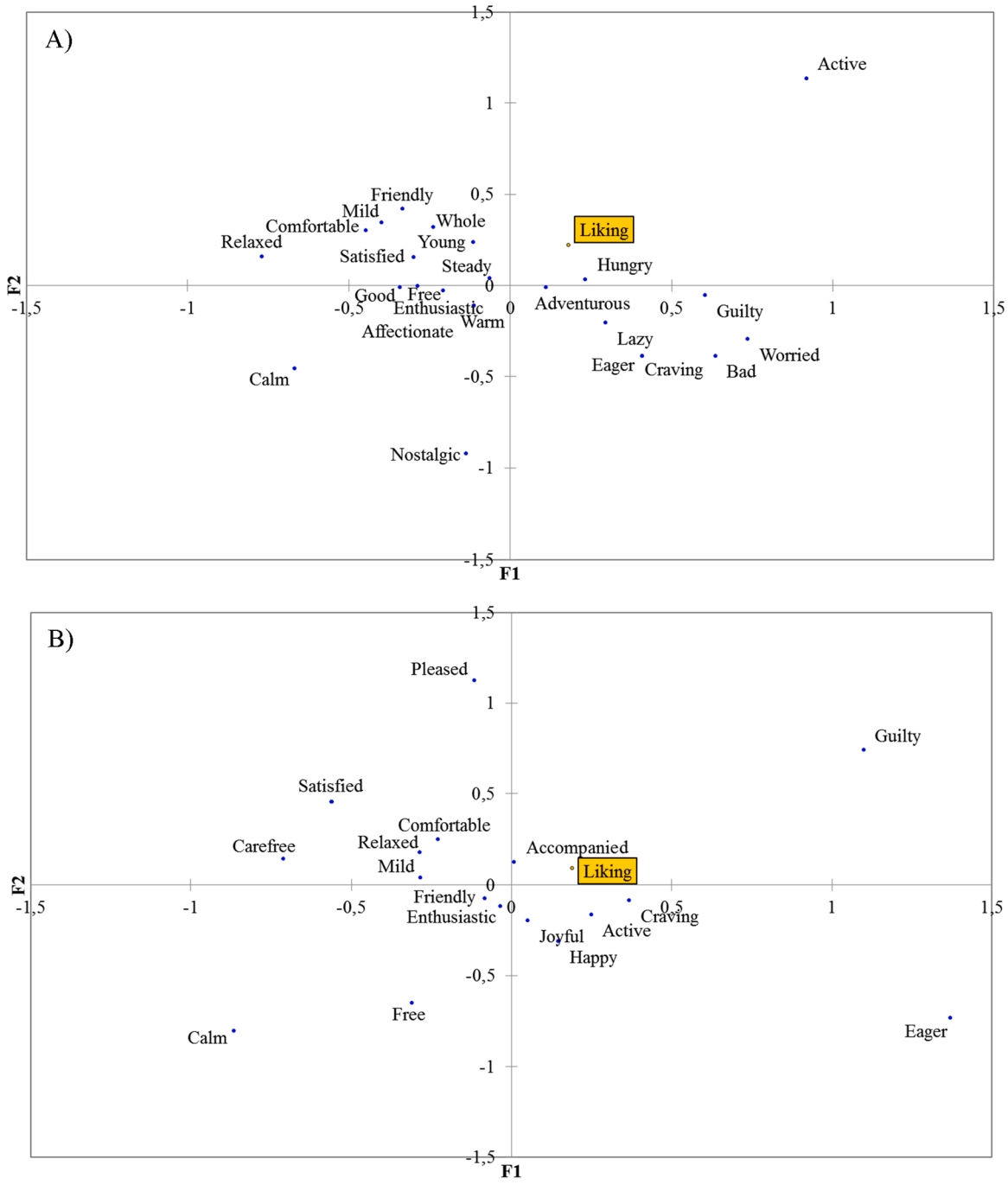

Fig. 6. Principal coordinate analysis of the emotion terms with the liking scores for potato chips stimulus for Brazilians (A) and Spaniards (B).

In fact, and particularly for Spaniards, the emotion term *healthy* was highly mentioned in yogurt emotional profile.

Among the emotional terms evaluated, 15 were common to all food stimuli, but only 6 were also common to both cultures (*active, calm, carefree, friendly, pleasant, satisfied*). The emotion term *friendly* for example, is not present in the published EsSense25® emotions list, but it has been extensively reported in previous studies evaluated similar products, as apple and chocolate brownie by Spaniards (Piqueras-Fiszman & Jaeger, 2014c), fruit salad by Italian participants (Manzocco, Rumignani, & Lagazio, 2013), potato chips by New Zealand participants (Piqueras-Fiszman & Jaeger, 2014a), and yogurt by Dutch (Mojet et al., 2015). The absence of this term in this procedure reveal a potential lack of efficiency of this list of emotional terms to fully compile the elicited emotional response to food. For that reason, we would recommend a previous validation step of the list of emotional terms even if the purpose is to apply a pre-defined list as the Esense25. It is obvious that the creation of an own emotional lexicon allows obtaining a more complete and realistic description of the emotional response. Therefore, it would be highly recommended to include a lexicon development step particularly in studies with different culture background participants as in the present study.

In a study carried out by Cardello et al. (2012) the name 'chocolate' significantly evoked greater intensities of emotional response to the terms *active*, *affectionate*, *happy*, *loving* and *satisfied*. In the present study, these terms were also noticeably present in the evoked chocolate emotional profile reported by both cultures, Brazilians and Spaniards. *Pleased* and *happy* emotions, for example, were also cited by Australian participants with high frequency for 'chocolate' and 'potato chips'

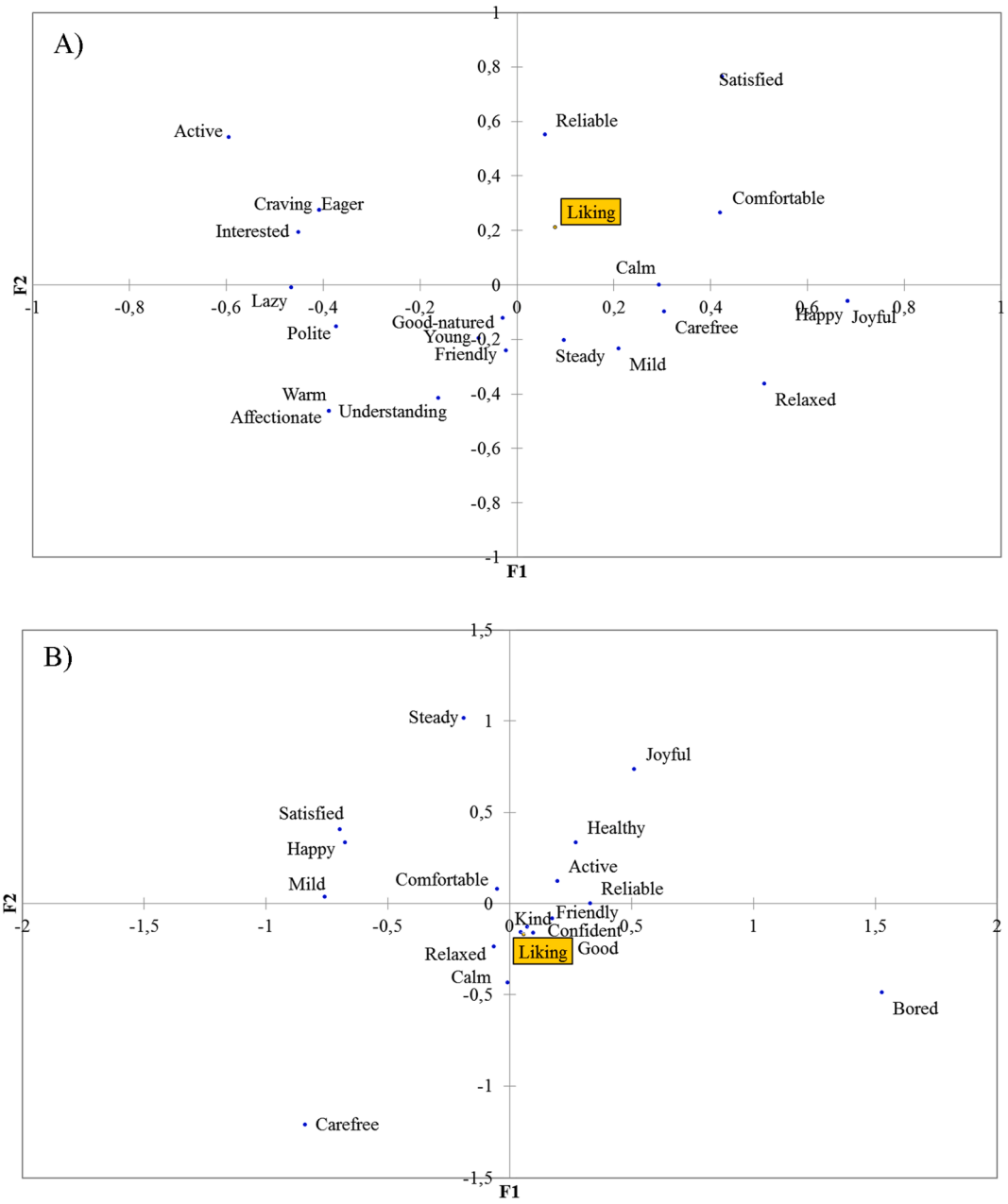

Fig. 7. Principal coordinate analysis of the emotion terms with the liking scores for yogurt stimulus for Brazilians (A) and Spaniards (B).

(Torrico et al., 2019). However, in the present study, these previous emotions varied according to the product or were simply not selected by at least one culture. In the studies carried out by Piqueras-Fiszman and Jaeger (2014c) the emotion terms *adventurous, disgusted, happy, joyful*, and *steady* were highly cited by New Zealand participants for potato chips. In the present study, *adventurous* and *steady* were present in the emotional lexicon elicited by the Brazilian participants and *happy* and *joyful* in the vocabulary elicited by Spanish participants.

It is noticeable that although almost all of the most frequent emotional terms are positive, each culture developed a different emotional profile. According to the evidences stated in the review published by Lindert, Bain, Kubzansky, and Stein (2015), positive feelings are an important dimension of well-being, especially when investigating well-being in relation to food and beverages (Sulmont-Rossé, Drabek, Almli, van Zyl, Silva, Kern, & Ares, 2019). This scenario is also evidenced by a study described by Ares et al. (2015), where Brazilians and Spanish participants reported affection-related emotion terms such as *pleasure*, *happiness*, *enthusiasm*, *satisfaction* and *calm* when asked to describe emotional terms related to well-being.

4.2. *Free elicited contexts contribute to the emotional response evoked by different food stimuli*

The developed contexts for each product category were judged to be appropriate by participants of both cultures. This is convenient because, although the freely defined scenario seems to be highly individual, large groups of people can share the same idealized situation, as they can be commonly influenced by learning, culture and society (Dorado et al., 2016). This was an advantage of the present study, as it is known that a predefined scenario exhibits the risk that participants will not consider this specific scenario appropriate to the consumption of the evaluated foods and, therefore, the emotional response may vary (Piqueras-Fiszman & Jaeger, 2015).

Interestingly, even considering different cultures, the evoked

contexts have in common the dimension social setting 'family' (except for chocolate for Brazilians), the dimension location 'home' (except for potato chips for Brazilians), suggesting that for both cultures the family interactions are important. In addition, the dimension of hungry state 'hunger' (except for chocolate for Brazilians), which are present at the beginning of snack consumption, is an obvious physiological reason that determines the dietary pattern of a living organism in a particular environment (Bellisle, 2014).

The results indicate that the evocation of a context would influence the emotional responses to different product stimuli. However, not many emotion terms showed a significant difference in the frequency of selection between conditions (with and without context). This may indicate that at the time of the non-context evaluation assessment, the participants associated the evoked emotional terms with the food stimuli by recalling their previous experiences in contexts that possibly contained similar or equal dimensions described in the context condition. On the one hand, the context itself may have influenced the frequency of citing some emotion terms, and on the other hand, the stimulation of a four-dimensional context may have caused the inadequacy of at least one dimension, changing the profile of emotions recalled between the two conditions. In the one dimension approach, for example 'time' (e.g., breakfast, lunch, or dinner), the emotion associations can greatly differ when the products are imagined to be consumed in one context or another (Piqueras-Fiszman & Jaeger, 2015).

In the evaluation of chocolate stimulus, 8 terms were significantly most cited by Brazilians and three by Spanish participants in the no-context condition, whereas the rest of the emotion terms showed no significant difference between the evaluation conditions. This means that the impact of the evoked context on the frequencies of the emotional responses of the Brazilian participants is greater in relation to the Spaniards' responses. It is worth mentioning that the frequency of the negative emotion terms, *suffering* and *lonely*, decreased even though there was no significant difference between the conditions. This whole scenario was easily visualized in the correspondence analysis (Fig. 2), where even though each condition was positioned in different quadrants, the conditions evaluated by the Spaniards were close. Another divergence in the impact of the context between both cultures was in relation to the number of associated terms for each condition. While in the evaluation carried out by Brazilians, fewer emotions were associated with chocolate in the evoked context situation, the opposite result was found for Spanish participants, who reported more emotion terms associated with chocolate under the context condition. However, it does not mean that the context negatively influenced the emotions reported by Brazilians, because the terms remained mostly positive.

The impact of context evocation on the evaluation of potato chips curiously led to a significant decrease in *friendly* and *relaxed* citation by Brazilians and in *active* and *joyful* mention by Spanish participants. The reduction in the frequency of these positive terms may have been caused by the inadequacy of some dimension that made up the context. In the correspondence analysis (Fig. 3) the emotional profile, besides the culture, was found to be influenced by the context evocation. In addition, it is possible to see that negative terms as *lazy* and *worried* were more associated by Brazilians with potato chips in the evocation context condition although most of the terms associated to this situation were positive emotions.

The effect of context evocation on the evaluation of yogurt by Brazilians was different in relation to the other food stimuli. Two terms (*eager* and *craving*) were never cited under this condition. Moreover, under context condition, Brazilians more frequently selected positive emotion terms and less negative ones (non-significant differences). The correspondence analysis (Fig. 4) illustrates that for both cultures, only positive terms were associated with yogurt under context condition, while *lazy* and *bored* (negative) were cited by Brazilians and Spaniard respectively in the non-context situation. All of these results indicate that the presence of the context may have caused a more positive effect on the emotional responses evoked by this food stimulus, mainly due to the absence of associated negative terms.

According to literature (Mojet et al., 2015), the prediction of the influence that a given consumption context could have on the emotional profile of a product is not always feasible and some discrepancies regarding the context effect has been described. However, our findings emphasize that the use of a context freely elicited by participants from different cultural backgrounds, according to the product's stimulus, can positively assist in this prediction.

It is important to notice that the low frequencies (<5%) shown for several of the emotion terms in the evoked context condition, do not suggest that these terms are irrelevant for this product category, but under this consumption context. Therefore, they should still be considered for the construction of future questionnaires related to emotion for these product categories.

4.3. Emotions as "drivers" of liking and correlation with consumption level

We consider that a key factor to measure the emotions associated with a product or product category is to know whether the consumer is a frequent consumer of this product. This is because previous studies indicate that the emotion evoked by the food is a crucial factor in predicting the consumer's food preference (Kaneko, Toet, Brouwer, Kallen, & van Erp, 2018). For this reason, in this research we measure the level of liking and the level of consumption. The liking of the evaluated products presented scores ≥ 5 (7-pt scale) for both cultures, indicating that participants 'liked very much' all products. A significantly higher consumption level of chocolate among Brazilians, compared to Spaniards, showed a significant impact of culture on the consumption level of this product. A high consumption level was already expected for sweet and savory products like chocolate and potato chips, for both cultural groups, due to a universal consumer trend, even though there are individual differences between people based on the degree of personal interest in certain foods (Birch, 1999; Xie, Bagozzi, & Østli, 2010).

The relationship between liking and the emotional terms was affected by the food stimuli evaluated and the culture (Figs. 5–7). Participants expressed positive emotions for the chocolate stimulus, neutral and positive for potato chips, and positive for yogurt, in relation to the degree of liking. Overall, liking was clearly associated with positive emotions for all products. However, these terms are not necessarily the most frequently cited emotions for each food stimulus. Previous studies indicate that the expected liking (name of stimulus) appears to have no effect on the projected mood after consumption (tasting of stimulus) (Spinelli & Jaeger, 2019). This indicates that the emotional associations obtained in this study of each culture have a strong influence of memory, and therefore, the emotions measured with the stimuli of the product (name and picture) may be able to predict the expected liking of a given product.

Consumption levels were influenced by culture in potato chips and yogurt stimuli. The correlations between liking degree and consumption level were significantly positive regardless of the culture for chocolate and potato chips. However, it was dependent on the culture for the yogurt product, presenting the same correlation profile only for Brazil. For both cultures, Brazilians and Spaniards, the higher the level of consumption, the higher the degree of liking for chocolate and potato chips. As they are common and culturally appropriate foods, it is proved that the previous sensory experiences were enough for the process of learning to accept these food products, as suggested by Tan et al. (2015).

5. Conclusions

Results from the present work provide the emotional lexicon and elicited contexts of consumption for three product categories (chocolate, potato chips and yogurt) in a cross-cultural approach. The same food stimulus was associated with different emotional profiles depending on the culture and the elicited contexts. For both cultures, the presence of

an evoked context affected the frequency of mention for some terms without influencing the positive profile of emotional associations. In addition, degree of liking and consumption level was positively correlated regardless the cultural interactions for chocolate and potato chips. In general, this study revealed the need for the development of an emotional lexicon for different product categories and different cultures and that the presence of a context can help to obtain emotional responses closer to those that consumer would feel in a real condition. Therefore, these findings can assist in predicting consumer choices and preferences, offering new possibilities to be explored in marketing messages for interventions or product stimuli that drive food choices. The dimensions which have been used in this study for describing the elicited contexts (alone, afternoon, at restaurant, hungry etc..) for each product (milk chocolate, potato chips and yoghurt) could be useful to design advertisement in each culture (Brazil and Spain) assisting to product marketers to generate a pertinent emotional response. Further research should be developed to assess the impact of different versions of the same product category and the scenario (real and imagined) with a cross-cultural perspective.

CRediT authorship contribution statement

Lary Souza Olegario: Methodology, Validation, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization. **Mario Estevéz:** Resources, Supervision, Writing - review & editing. **Alberto González-Mohino:** Validation, Formal analysis, Data curation, Writing - review & editing. **Marta Suely Madruga:** Resources, Writing - review & editing, Supervision, Project administration, Funding acquisition. **Sonia Ventanas:** Conceptualization, Resources, Writing - review & editing, Supervision, Project administration, Funding acquisition.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Compliance with ethics requirements

All procedures performed in this study involving human participants were approved on the ethical standards of the Delegation of the Bioethics and Biosafety Commission of the University of Extremadura (Delegación de Comision de Bioética y Bioseguridad de la Universidad de Extremadura) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards with the register number 71/2016.7.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodres.2021.110194.

References

Ares, G., Saldamando, L. De, Giménez, A., Claret, A., Cunha, L. M., Guerrero, L., … Deliza, R. (2015). Consumers ' associations with wellbeing in a food-related context: A cross-cultural study. *Food Quality and Preference, 40*, 304–315. https://doi.org/10.1016/j.foodqual.2014.06.001.

Bellisle, F. (2014). Meals and snacking, diet quality and energy balance. *Physiology and Behavior, 134*(C), 38–43. https://doi.org/10.1016/j.physbeh.2014.03.010.

Birch, L. L. (1999). Development of food preferences. *Annual Review of Nutrition, 19*(1), 41–62. https://doi.org/10.1146/annurev.nutr.19.1.41.

Cardello, A. V., Meiselman, H. L., Schutz, H. G., Craig, C., Given, Z., Lesher, L. L., & Eicher, S. (2012). Measuring emotional responses to foods and food names using questionnaires. *Food Quality and Preference, 24*(2), 243–250. https://doi.org/10.1016/j.foodqual.2011.12.002.

Coppin, G., & Sander, D. (2016). Theoretical approaches to emotion and its measurement. *Emotion Measurement*. https://doi.org/10.1016/B978-0-08-100508-8.00001-1.

Dorado, R., Pérez-Hugalde, C., Picard, A., & Chaya, C. (2016a). Influence of first position effect on emotional response. *Food Quality and Preference, 49*, 189–196. https://doi.org/10.1016/j.foodqual.2015.12.009.

Dorado, R., Chaya, C., Tarrega, A., & Hort, J. (2016b). The impact of using a written scenario when measuring emotional response to beer. *Food Quality and Preference, 50*, 38–47. https://doi.org/10.1016/j.foodqual.2016.01.004.

Ferdenzi, C., Schirmer, A., Roberts, S. C., Delplanque, S., Porcherot, C., Cayeux, I., … Grandjean, D. (2011). Affective dimensions of odor perception: A comparison between swiss, British, and singaporean populations. *Emotion, 11*(5), 1168–1181. https://doi.org/10.1037/a0022853.

Gunaratne, T. M., Fuentes, S., Gunaratne, N. M., Torrico, D. D., Viejo, C. G., & Dunshea, F. R. (2019). Physiological responses to basic tastes for sensory evaluation of chocolate using biometric techniques. *Foods, 8*(7), 1–16. https://doi.org/10.3390/foods8070243.

Hein, K. A., Hamid, N., Jaeger, S. R., & Delahunty, C. M. (2012). Effects of evoked consumption contexts on hedonic ratings: A case study with two fruit beverages. *Food Quality and Preference, 26*(1), 35–44. https://doi.org/10.1016/j.foodqual.2012.02.014.

Hu, X., & Lee, J. (2019). Emotions elicited while drinking coffee: A cross-cultural comparison between Korean and Chinese consumers. Food Quality and Preference, 76(August 2018), 160–168. https://doi.org/10.1016/j.foodqual.2018.08.020.

Jiang, Y., King, J. M., & Prinyawiwatkul, W. (2014). A review of measurement and relationships between food, eating behavior and emotion. *Trends in Food Science and Technology, 36*(1), 15–28. https://doi.org/10.1016/j.tifs.2013.12.005.

Kaneko, D., Toet, A., Brouwer, A. M., Kallen, V., & van Erp, J. B. F. (2018). Methods for evaluating emotions evoked by food experiences: A literature review. *Frontiers in Psychology, 9*(JUN). https://doi.org/10.3389/fpsyg.2018.00911.

King, S. C., & Meiselman, H. L. (2010). Development of a method to measure consumer emotions associated with foods. *Food Quality and Preference, 21*(2), 168–177. https://doi.org/10.1016/j.foodqual.2009.02.005.

King, S. C., Meiselman, H. L., & Carr, B. T. (2013). Measuring emotions associated with foods: Important elements of questionnaire and test design. *Food Quality and Preference, 28*(1), 8–16. https://doi.org/10.1016/j.foodqual.2012.08.007.

Lim, N. (2016). Cultural differences in emotion: Differences in emotional arousal level between the East and the West. *Integrative Medicine Research, 5*(2), 105–109. https://doi.org/10.1016/j.imr.2016.03.004.

Lindert, J., Bain, P. A., Kubzansky, L. D., & Stein, C. (2015). Well-being measurement and the WHO health policy Health 2010: Systematic review of measurement scales. *European Journal of Public Health, 25*(4), 731–740. https://doi.org/10.1093/eurpub/cku193.

Manzocco, L., Rumignani, A., & Lagazio, C. (2013). Emotional response to fruit salads with different visual quality. *Food Quality and Preference, 28*(1), 17–22. https://doi.org/10.1016/j.foodqual.2012.08.014.

Meiselman, H. L. (2015). A review of the current state of emotion research in product development. *Food Research International, 76*, 192–199. https://doi.org/10.1016/j.foodres.2015.04.015.

Mohammad, S., & Turney, P. (2010). Emotions Evoked by Common Words and Phrases. In *Proceedings of the NAACL-HLT* (pp. 26–34).

Mojet, J., Dürrschmid, K., Danner, L., Jöchl, M., Heiniö, R. L., Holthuysen, N., & Köster, E. (2015). Are implicit emotion measurements evoked by food unrelated to liking? *Food Research International, 76*(P2), 224–232. https://doi.org/10.1016/j.foodres.2015.06.031.

Nestrud, M. A., Meiselman, H. L., King, S. C., Lesher, L. L., & Cardello, A. V. (2016). Development of EsSense25, a shorter version of the EsSense Profile®. *Food Quality and Preference, 48*, 107–117. https://doi.org/10.1016/j.foodqual.2015.08.005.

Ng, M., Chaya, C., & Hort, J. (2013). The influence of sensory and packaging cues on both liking and emotional, abstract and functional conceptualisations. *Food Quality and Preference, 29*(2), 146–156. https://doi.org/10.1016/j.foodqual.2013.03.006.

Parker, G., Parker, I., & Brotchie, H. (2006). Mood state effects of chocolate. *Journal of Affective Disorders, 92*(2–3), 149–159. https://doi.org/10.1016/j.jad.2006.02.007.

Piqueras-Fiszman, B., & Jaeger, S. R. (2014a). Emotion responses under evoked consumption contexts: A focus on the consumers' frequency of product consumption and the stability of responses. *Food Quality and Preference, 35*, 24–31. https://doi.org/10.1016/j.foodqual.2014.01.007.

Piqueras-Fiszman, B., & Jaeger, S. R. (2014b). The impact of evoked consumption contexts and appropriateness on emotion responses. *Food Quality and Preference, 32*(PA), 277–288. https://doi.org/10.1016/j.foodqual.2013.09.002.

Piqueras-Fiszman, B., & Jaeger, S. R. (2014c). The impact of the means of context evocation on consumers' emotion associations towards eating occasions. *Food Quality and Preference, 37*, 61–70. https://doi.org/10.1016/j.foodqual.2014.04.017.

Piqueras-Fiszman, B., & Jaeger, S. R. (2015). The effect of product-context appropriateness on emotion associations in evoked eating occasions. *Food Quality and Preference, 40*(PA), 49–60. https://doi.org/10.1016/j.foodqual.2014.08.008.

Rezende, C. B. (2008). Stereotypes and National Identity: Experiencing the "Emotional Brazilian". *Identities, 15*(1), 103–122. https://doi.org/10.1080/10702890701801866.

Sander, D. (2013). Models of emotion: The affective neuroscience approach. In J. Armony & P. Vuilleumier (Eds.), The Cambridge handbook of human affective neuroscience (Cambridge, pp. 5–53). https://doi.org/https://doi.org/10.1017/CBO9780511843716.003.

Schouteten, J. J., Gellynck, X., De Bourdeaudhuij, I., Sas, B., Bredie, W. L. P., Perez-Cueto, F. J. A., & De Steur, H. (2017). Comparison of response formats and concurrent hedonic measures for optimal use of the EmoSensory® Wheel. *Food Research International, 93*, 33–42. https://doi.org/10.1016/j.foodres.2016.12.015.

Spinelli, S., & Jaeger, S. R. (2019). What do we know about the sensory drivers of emotions in foods and beverages? *Current Opinion in Food Science, 27*, 82–89. https://doi.org/10.1016/j.cofs.2019.06.007.

Sulmont-Rossé, C., Drabek, R., Almli, V. L., van Zyl, H., Silva, A. P., Kern, M., … Ares, G. (2019). A cross-cultural perspective on feeling good in the context of foods and beverages. Food Research International, 115(July 2018), 292–301. https://doi.org/10.1016/j.foodres.2018.12.012.

Tan, H. S. G., Fischer, A. R. H., Tinchan, P., Stieger, M., Steenbekkers, L. P. A., & van Trijp, H. C. M. (2015). Insects as food: Exploring cultural exposure and individual experience as determinants of acceptance. *Food Quality and Preference, 42*, 78–89. https://doi.org/10.1016/j.foodqual.2015.01.013.

Thomson, D. M. H., Crocker, C., & Marketo, C. G. (2010). Linking sensory characteristics to emotions: An example using dark chocolate. *Food Quality and Preference, 21*(8), 1117–1125. https://doi.org/10.1016/j.foodqual.2010.04.011.

Torrico, D. D., Fuentes, S., Gonzalez Viejo, C., Ashman, H., & Dunshea, F. R. (2019). Cross-cultural effects of food product familiarity on sensory acceptability and non-invasive physiological responses of consumers. Food Research International, 115 (July 2018), 439–450. https://doi.org/10.1016/j.foodres.2018.10.054.

Torrico, D. D., Fuentes, S., Gonzalez Viejo, C., Ashman, H., Gunaratne, N. M., Gunaratne, T. M., & Dunshea, F. R. (2018). Images and chocolate stimuli affect physiological and affective responses of consumers: A cross-cultural study. Food Quality and Preference, 65(October 2017), 60–71. https://doi.org/10.1016/j.foodqual.2017.11.010.

Tsai, J. L., & Chentsova-Dutton, Y. (2003). Variation among European Americans in emotional facial expression. *Journal of Cross-Cultural Psychology, 34*(6), 650–657. https://doi.org/10.1177/0022022103256846.

Valentin, D., Chollet, S., & Lelie, M. (2012). Invited review Quick and dirty but still pretty good : a review of new descriptive methods in food science. 1–16. https://doi.org/10.1111/j.1365-2621.2012.03022.x.

van Zyl, H., & Meiselman, H. L. (2015). The roles of culture and language in designing emotion lists: Comparing the same language in different English and Spanish speaking countries. *Food Quality and Preference*. https://doi.org/10.1016/j.foodqual.2014.12.003.

van Zyl, H., & Meiselman, H. L. (2016). An update on the roles of culture and language in designing emotion lists: English, Spanish and Portuguese. Food Quality and Preference. https://doi.org/10.1016/j.foodqual.2016.02.019.

Xie, C., Bagozzi, R. P., & Østli, J. (2010). Cognitive, emotional, and sociocultural processes in consumption. *Psychology & Marketing, 30*(6), 12–25. https://doi.org/10.1002/mar.