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Improvement of an emotional lexicon for the evaluation of beers

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ABSTRACT

Emotional response has been the subject of many studies during the last years. Many studies have shown the importance of using consumers to generate emotional lexicons. Chaya et al (2015) developed a consumer defined (CD) lexicon to assess emotional response elicited by beer products. Shortly after, van Zyl et al. (2015) presented a procedure to ensure that emotional lists were fully composed by emotions. The present research was developed to improve and test the lexicon developed by Chaya et al. (2015) following the approach proposed by van Zyl et al. (2015). The proposed procedure allowed an easy filtering of terms for the study of emotional response. As a consequence, the test was shorter, clearer, and easier to understand and to complete by consumers. The improved emotional lexicon of beer favoured 1) the efficiency of the research in terms of discrimination among samples, 2) the simplicity of use by the consumers.

KEYWORDS

Emotion; Lexicon; Beer; Consumers.

1. INTRODUCTION

The study of consumer emotional response elicited by food products has increased during the last years. Many methods have been developed to study emotions evoked by food and beverages. EsSense Profile™ (King & Meiselman, 2010) was the first emotional lexicon developed to measure emotions related to food products consumption and illustrated a

methodological advance in consumer testing. Although this emotional lexicon was recommended to determine the emotions elicited by food products, authors also recommended to adapt this lexicon to the food category. Since EsSense Profile™ was published, several methods to measure emotional response have been developed and improved. For example, Ng, Chaya, & Hort (2013) highlighted in their study the importance of a consumer defined lexicon as compared with EsSense Profile™. The authors showed that a consumer defined lexicon was a list of positive and negative emotions more specific to the product category than the EsSense Profile™. Spinelli, Masi, Dinnella, Zoboli, & Monteleone (2014) used a list of full sentences for the study of cacao and hazelnuts spreads, instead of a list of specific emotional terms. This method, called EmoSemio, resulted in reduced ambiguity and improved understanding by the consumers.

Regarding the study of emotional response to beer products, different authors have used diverse lexicons and methods to analyse the emotions elicited by beers. Chaya et al. (2015) developed, using consumers' focus groups methodology, the first published beer specific lexicon for the Spanish population and grouped a lexicon of 44 single terms into 12 emotional categories. Using the same approach, Eaton (2015) established an English version for British beer consumers. Ng et al. (2013) had previously developed an emotional lexicon for black currant squashes using direct-one-to-one interviews with individual consumers. The focus groups methodology proved to be more efficient than the method developed by Ng et al.(2013), but the effort needed to generate consumer defined lexicons was still considerable. Silva et al. (2016) also developed consumer led lexicons for beer Dutch and Portuguese consumers by means of focus groups. Cardello et al. (2016) and Jaeger et al. (2017) successfully applied a variant of the 12-point emotion circumplex method of Yik, Russell, & Steiger (2011) in an attempt to reduce the time/effort to capture emotions related to beer.

In addition to the works mentioned above, other authors have developed consumer defined emotional lexicons for specific product categories, such as chocolate spreads (Spinelli et al., 2014), coffee (Bhumiratana, Adhikari, & Chambers, 2014), and wine (Danner et al., 2016;

Silva et al., 2016). Van Zyl (2016) provides a detailed list of lexicons applied in beverages in tables 19.3a to 19.3d.

In general, emotional lexicons are difficult to generate, they have to be understandable and clear to consumers, and relevant to the product category (Gmuer, Guth, Runte, & Siegrist, 2015). One of the clues is to ensure that the terms generated by the consumers are true feelings. Van Zyl & Meiselman (2015) proposed some basic rules for a procedure for the development of consumer defined emotion lists. The authors proposed checking that the terms generated by the consumers are found on the lists of Laros & Steenkamp (2005) and Clore, Ortony, & Foss (1987). However, to date no references can be found using the procedure proposed by van Zyl & Meiselman (2015) as a guide to ensure the suitability of the emotional terms generated by consumers.

This study aimed to improve and test the Spanish consumer beer lexicon developed by Chaya et al.(2015), following the procedure proposed by van Zyl & Meiselman (2015).

2. MATERIALS AND METHODS

2.1. Improvement of the emotional lexicon

This research is based on a previous study presented by Chaya et al. (2015). The approach is summarised in figure 1.

2.1.1. Samples

For the present study, samples and sample preparation were the same as reported in Chaya et al. (2015) (table 1). Two samples were 'control' commercial beer samples, one of which was a commercial non-alcoholic beer. The other eight samples were based upon the control samples and were each manipulated in a single sensory property. Several sensory properties were chosen to represent key characteristic properties of beer (e.g. bitterness, hoppiness, etc.) whilst others reflected off-flavours and/or hypothesised drivers of emotional response (e.g. isoamyl acetate, dimethyl sulphide (DMS)). The commercial beers were modified using ethanol (Merck Chemicals Ltd, UK), dextrose (Myprotein, UK), specific flavour capsules (Cara Technology, UK), or controlled decarbonation. All 10 samples had

been evaluated by the University of Nottingham's trained expert beer panel who had rated each sample for the 8 sensory properties of interest (data not shown). The assessments revealed significant differences between the spiked and control samples, indicating that the samples differed in their sensory properties. From these results, it was anticipated that subjects in subsequent studies would perceive the differences in relevant sensory properties across samples. Samples were prepared by adding the relevant materials to samples and 10 ml decanted into transparent closed screw cap universal containers 2–4 h before assessment by consumers. This was with the exception of the Low CO2 samples which was decarbonated by leaving open and refrigerated (4 ± 1 C) for 3 h before re-sealing. Low CO2 samples were then decanted just prior to consumer assessment. Products were presented blind (labelled with three-digit random codes) at 4 ± 1 C. Unsalted crackers (Carrefour, Spain) and mineral water (Fuente Liviana, Spain) were provided as palate cleansers.

2.1.2. Procedure to improve the lexicon and terms grouping

The initial list of the emotional terms generated by the focus groups in Chaya et al. (2015) (table 2) was checked and verified following the method of van Zyl & Meiselman (2015). It was compared with the emotional lists published by Clore et al. (1987) and Laros & Steenkamp (2005) containing 564 and 50 terms respectively. The initial terms not included in those lists were discarded.

After the terms were verified on the emotional list, beer samples were evaluated by a panel of 17 subjects. The subjects tasted the beer samples, and rated each evoked emotional term. A warm-up sample (the same as control) was tasted and rated to minimize first position effect (Dorado, Pérez-Hugalde, Picard, & Chaya, 2016). Then, 10 beer samples were served in random order according to a Balanced Incomplete Block design. Rating was done on a 15 cm continuous line scale anchored at 1.5 cm from the line ends from 'very low' to 'very high'. To minimize bias, emotion terms were presented in a randomised order for each consumer.

A Hierarchical Cluster Analysis was applied on the average ratings for each emotional term of the 10 beer samples (Chaya et al., 2015) to group similar emotions into categories according to the consumers' assessment of the beer samples. Terms were grouped using Euclidean distance and the Ward's criterion of aggregation (XLSTAT Version 2009.6.03, Addinsoft, USA).

2.2. Test of the improved lexicon

2.2.1. Subjects

A panel of 83 Spanish beer consumers (aged 18-60), who consumed beer at least once a week, participated in the tests of the new lexicon. Each consumer rated their liking and their emotional response to the 10 beer samples. Testing procedure

To test the improved lexicon, the warm-up sample and the beer samples were served, randomizing the 10 samples according to a Balanced Incomplete Block design. After tasting each sample, consumers were first asked to rate the overall liking on a 9-point scale. Then, they had to read all of the terms associated with each emotion category, and to rate the intensity of their feelings on a 15 cm linear scale, anchored at 0.5 cm from the line ends from "very low" to "very high". To minimize bias, the order of emotion categories was randomised for each consumer.

2.2.2. Consumer data analysis

Responses to the emotional terms were input to mixed ANOVA using beer samples as a fixed effect and consumer as a random effect. Post-hoc tests for sample effect were conducted using Tukey's HSD (Statgraphics Centurion XVII version).

Principal Components Analysis (correlation matrix) was performed on the average ratings of each emotion category to explore relationships between emotion categories and beer samples (XLSTAT 2014.6.05 version). Liking was used as supplementary (non- active) variable in the analysis.

3. RESULTS

3.1. Improved lexicon

From the 44 terms of the emotional lexicon used in Chaya et al. (2015), a list of 28 words was kept, as shown in table 3.

The terms not included in Clore et al. (1987) and Laros & Steenkamp (2005) and hence excluded from the lexicon of Chaya et al.(2015) were: *Agreeable*, *Appetised*, *Authentic*, *Classic*, *Disenchanted*, *Fresh*, *Intense*, *Lacking in appetite*, *Natural*, *Negative*, *Nice*, *Normal*, *Objectionable*, *Repulsed*, *Traditional*, *Unpleasant* and *Unusual*.

The cluster analysis of mean ratings of the remaining emotional terms resulted in 11 clusters. These clusters were reviewed with the aim of avoiding confusion and ambiguities, and therefore some words or categories were modified. For example INTENSITY category (table 2), with which consumers had some problems in the previous lexicon, was renamed VIGOUR (table 3). The final clusters were: VIGOUR, MILDNESS, DISSATISFACTION, INDIFFERENCE, EXCITEMENT, PLEASURE, NOSTALGIA, FUN, DISSAPOINTMENT, DESIRE and DISGUST.

The initial Chaya et al. (2015) lexicon underwent several changes:

- CLASSIC cluster, consisting of terms *Authentic*, *Classic*, *Natural*, *Normal* and *Traditional*, was discarded.
- Clusters generated with the new data led to the movement of some emotions from one category to another: *Cheated*, *Shocked* and *Unmotivated* moved into the new cluster DISAPPOINTMENT.
- The group named DISILLUSIONMENT was changed into DISSATISFACTION, which included the emotional terms *Disillusioned* and *Dissatisfied*.

3.2. Discrimination power of the improved lexicon

Univariate analysis showed that all emotion categories discriminated between samples. Post hoc analyses identified different groupings for each emotion category among beers (Table 4).

The first two Principal Components of the PCA explained 91.63% of the data variance. Figure 2a shows the correlation plot of emotion categories with the first factorial plot (PC2 *vs* PC1). Liking, not included as active variable in the analysis, is projected in the same plot. In general, the emotional space structure (figure 2a) was compatible with the circumplex models of emotions (Larsen & Diener, 1992; Russel, 1980; Watson & Tellegen, 1985), explained by two dimensions: the horizontal axis was associated with pleasantness, while the vertical axis was related to activation.

Post Hoc analyses allowed identifying the link between emotional categories and sensory properties of beer samples (table 4). Control, Light Struck, and Isoamyl Acetate beer samples elicited higher ratings on DESIRE, EXCITEMENT, FUN, NOSTALGIA, and PLEASURE than the Hoppy sample, which evoked lower scorings in these emotional categories. On the contrary, the Hoppy sample elicited significant higher scores than the Control and Light Struck samples on unpleasant emotion categories: DISSATISFACTION, DISAPPOINTMENT, and DISGUST. PCA confirmed the results of univariate analysis. As seen in figure 2a, PC1 (74.16%) was strongly correlated to the pleasant emotions categories and liking, and negatively correlated to unpleasant emotion categories. Position (figure 2b) of Control, Isoamyl Acetate, and Light Struck samples was associated to DESIRE, EXCITEMENT, FUN, NOSTALGIA and PLEASURE, while Hoppy was projected close to DISSATISFACTION, DISAPPOINTMENT, and DISGUST.

As seen in table 4, the Low CO_2 sample elicited significantly higher intensities on the MILD category; the High Alcohol sample produced the contrary effect on that category. VIGOUR ratings were significantly higher on High Alcohol sample, and significantly lower on Sweet sample. MILDNESS and VIGOUR were emotional categories related to engagement, but their correlation to PC2 was opposite: positive and negative respectively. PC2 explained 17.46% of data variability (figure 2a). Low CO_2 and Sweet samples were associated with unengagement or low activation. The high Alcohol sample was associated to VIGOUR and related to high activation (figure 2b).

Finally, Sweet, Low CO_2, and High Alcohol samples evoked significantly higher ratings on INDIFFERENCE, while Light Struck evoked lower ratings on that emotion category (table 4). INDIFFERENCE showed a relatively slight linear correlation to unpleasant emotions (0.645 DISSATISFACTION; 0.638 DISAPPOINTMENT; 0.575 DISGUST) while it was not correlated to MILD (0.072) or VIGOUR (0.231). However, it was important for the discrimination by the univariate analysis of Light Struck sample on the one hand, *versus* Sweet, Low CO_2, and High Alcohol samples on the other hand (table 4). These results revealed the importance of using emotional lexicons better than the models based on the circumplex model of emotions (pleasure/displeasure; high/low activation) as the ones used by Cardello et al. (2016) and Jaeger et al. (2017). In fact, INDIFFERENCE was independent of the pleasantness and engagement axes, building its own third dimension. This result shows an important contribution of the consumer defined lexicons.

In summary, as compared to the previous version by Chaya et al. (2015), the importance of the category INDIFERENCE has been emphasized. As a result of the proposed lexicon improvement, the relative position of samples was different. We hypothesize that the reduction of the number of categories and the replacement of the category name INTENSITY by VIGOUR could be related to this improvement.

To conclude, the improved proposed lexicon has been tested with unbalanced beer samples, spiked with different flavours, which made them suitable for eliciting different emotional responses. The previous version of the lexicon was also applied to commercial beer products (Chaya et al., 2015), where 5 out of 12 categories were discriminant among commercial beers and helped to explain the differences in hedonic response (unpublished results). According to these previous findings, the improved lexicon would also be suitable for explaining the differences in evoked feelings during consumption of commercial beers.

4. CONCLUSION

Following the procedure of van Zyl & Meiselman (2015) allowed for an easy filtering of terms for the study of the emotional response. As a consequence, the test was shorter,

clearer, and easier to understand and to complete by consumers. The interpretation of the emotional map obtained after the improvement of the lexicon was clearer than the one obtained from the complete-non reduced lexicon. The new emotional lexicon of beer improved 1) the efficiency of the research in terms of discrimination among samples, 2) the simplicity of use by the consumers.

Using both univariate and multivariate statistical analysis complemented each other in the understanding of emotional response to beer products.

Caution should be taken concerning the representativeness of consumers' sample. Although the method has improved the initial lexicon, the number of respondents in this study is relatively low and more research is needed to guarantee the generation of sufficiently robust data.

Future research is needed to test the improved lexicon in commercial beers. The real benefit would be to understand how this emotion lexicon can be used to differentiate between commercially available beers and whether it can give an insight about consumers' liking/disliking reasons.

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TABLES CAPTIONS

Table 1. Samples and treatments used

Table 2. Original emotion lexicon proposed by Chaya et al. (2015) in Spanish and English.

Table 3. Modified emotion lexicon in Spanish and English.

Table 4. Means scores and p-values for the 11 emotion categories and liking across 10 samples.

Table 1. Samples and treatments used

	Sample	Treatment
1	Control	Commercial lager
2	Hoppy	0.75 mg kettle hop extract (AROXA™)/litre commercial lager
3	Light struck	0.3 µg 3-methyl-2-butene-1-thiol (AROXA™)/litre commercial lager
4	Isoamyl acetate	10.5 mg isoamyl acetate (AROXA™)/litre commercial lager
5	DMS	0.9 mg dimethyl sulphide (AROXA™)/litre commercial lager
6	Bitter	25 mg iso-α-acids (AROXA™)/litre commercial lager
7	Sweet	25 g dextrose/litre commercial lager
8	Low CO_2	Commercial lager decarbonated to ~1.6 units
9	Non-alcohol control	Commercial non-alcohol lager
10	High alcohol	96% ethanol added to commercial non-alcohol lager (8% ABV)

Table 2. Original emotion lexicon proposed by Chaya et al. (2015) in Spanish and English.

Spanish		**English**	
Suave	Ligero/suave/flojo	Mildness	Mild
Indiferencia	Aburrido/ Indiferente	Indifference	Bored/ indifferent
Placer	Agradable/amistoso/ Apetecible/placentero/ Positivo/relajado/ tranquilo/ fresco/ satisfecho/conforme	Pleasure	Nice/friendly/ appetized/ agreeable/ positive/relaxed/ fresh/pleasant/ satisfied
Clásico	Auténtico/esperado/ clásico/natural/ normal/tradicional	Classic	Authentic/ classic/natural/ normal/ traditional
Diversión	Alegre/contento/animado chispeante/divertido curioso/festivo /	Fun	Happy/lively/ curious/festive/ enjoyment
Deseo	Deseoso/ansioso	Desire	Eager
Disgusto/ Negatividad	Asqueado/disgustado/ contrariado/ desagradable/ desmotivado/ engañado/ indeseable/ mal/negativo/ reacio/rechazo/ Repulsion	Disgust/ Negative feelings	Disgusted/ annoyed/ unpleasant/ unmotivated/ cheated/bad/ objectionable/ negative/ repulsed/ shocked
Desilusión	Desilusionado/ extrañado desencantado/inesperado Sorprendido negativamente/ raro/ atípico/inapetente	Disillusionment	Disillusioned/ disenchanted/ unusual lacking in appetite
Decepción	Decepcionado/ incómodo/ Inatifecho	Disappointment	Disappointed/ uncomfortable/ dissatisfied
Intensidad	Fuerte/potente/ Intenso	Intensity	Strong/ powerful/ intense
Nostalgia	Nostalgico	Nostalgia	Nostalgic
Entusiasmo	entusiasmado/ Emocionado	Excitement	Excited

Table 3. Modified emotion lexicon in Spanish and English.

Spanish		**English**	
Ligereza	Ligero/suave/flojo	Mildness	Mild
Indiferencia	Aburrido/ Indiferente	Indifference	Bored/ indifferent
Placer	Amistoso/ Placentero/positivo/ tranquilo/relajado/ satisfecho	pleasure	Friendly/ pleasant/ positive/ relaxed/ satisfied
Diversión	Alegre/contento/ Chispeante/animado/ Curioso/divertido/ festivo	Fun	Happy/lively/ curious/ festive/ enjoyment
Deseo	Deseoso	Desire	Eager
Disgusto	Asqueado/disgustado, Contrariado/ Mal	Disgust	Disgusted/ annoyed/ bad
Decepción	Decepcionado/ Incómodo/ Desmotivado/ Engañado/ inesperado/ Sorprendido/ negativamente	Disappointment	Disappointed/ uncomfortable/ unmotivated/ cheated/ shocked
Insatisfacción	Desilusionado/ insatisfecho	Dissatisfaction	Disillusioned/ dissatisfied
Entusiasmo	Emocionado	Excitement	Excited
Nostalgia	Nostálgico	Nostalgia	Nostalgic
Vigor	Fuerte/potente	Vigour	Strong/ powerful

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