

## Identifying consumers' texture vocabulary of milk desserts. Application of a check-all-that-apply question and free listing

*Identificação do vocabulário de consumidores para a textura de sobremesas lácteas.  
Aplicação de questionário "marque tudo o que aplique" e lista livre*

### Autores | Authors

#### ✉ Gastón ARES

Universidad de la República (UdelaR)  
Facultad de Química  
Departamento de Ciencia y Tecnología de  
Alimentos  
Sección Evaluación Sensorial  
Gral. Flores 2124, C.P. 11800  
Montevideo - Uruguay  
e-mail: gares@fq.edu.uy

#### Ana GIMÉNEZ Fernanda BRUZZONE

Universidad de la República (UdelaR)  
Facultad de Química  
Departamento de Ciencia y Tecnología de  
Alimentos  
e-mail: agimenez@fq.edu.uy  
fbruzzo@fq.edu.uy

✉ Autor Correspondente | Corresponding Author

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### ■ Summary

Taking into account the impact of texture on consumers' liking of milk desserts, it is important for dairy companies to understand how consumers describe it. In this context, the aim of the present study was to identify consumers' texture vocabulary of milk desserts using free listing and a check-all-that-apply question. A free listing task was carried out with 66 consumers, who were asked to list all the positive and negative texture characteristics of milk desserts. Moreover, 65 consumers tried 8 commercial milk dessert samples and answer a check-all-that-apply question with 27 texture terms. Both methodologies enabled the identification of the texture characteristics more relevant for consumers and the texture vocabulary they usually use to describe this type of product. Creaminess and smoothness were the most relevant characteristics, followed by attributes related to thickness. Some similarities and differences were identified between the results of both methodologies.

**Key words:** *Sensory descriptors; Free listing; Check-all-that-apply.*

### ■ Resumo

Tendo em conta o impacto da textura na aceitação dos consumidores de sobremesas de leite resulta importante para as indústrias de laticínios entenderem como os consumidores descrevem este tipo de produtos. Neste contexto, o objetivo do presente estudo foi identificar o vocabulário utilizado pelos consumidores para descrever a textura das sobremesas de leite utilizando as técnicas de *free listing* e *check-all-that-apply*. A técnica de *free listing* foi desenvolvida com 66 consumidores, os quais foram convidados a listar todas as características positivas e negativas da textura das sobremesas de leite. Além disso, 65 consumidores experimentaram 8 sobremesas de leite do mercado e responderam um questionário do tipo *marque todo o que aplique* (*check-all-that-apply*) contendo 27 termos de textura. As duas metodologias permitiram identificar as características de textura mais importantes para os consumidores e o vocabulário utilizado normalmente para descrever este tipo de produtos. A cremosidade e suavidade foram as características mais importantes, seguidas dos atributos relacionados com a consistência. Identificaram-se algumas similaridades e diferenças entre os resultados das duas metodologias.

**Palavras-chave:** *Descritores sensoriais; Lista livre; Marque tudo o que aplique.*

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### 1 Introduction

Food companies increasingly base their product development, positioning, advertisement and communication strategies on consumer perception (FAYE *et al.*, 2006; VAN TRIJP *et al.*, 2007). In this context, understanding how consumers describe the sensory characteristics of food products is highly valuable for food companies.

Traditionally, information about the sensory characteristics of a food product has been obtained using trained assessors' panels. This information is extremely valuable during product development for optimizing the products' formulation (CARR *et al.*, 2001). However, trained assessors could describe the product differently or take into account attributes that may be irrelevant for consumers (TEN KLEIJ and MUSTERS, 2003). Thus, in order to gather a better understanding of consumers' perception of food products it is necessary to study how consumers perceive and describe individual and multi-attribute changes in food products' sensory characteristics (CARR *et al.*, 2001). Moreover, according to Dubois and Giboreau (2006) an inventory of the linguistic resources used in different languages and different senses for different food products is needed in order to better contrast consumers' experiences with trained assessors' data.

In particular, texture is a complex sensory property that involves several widely different parameters (SZCZESNIAK, 2002). Considering the large impact of this sensory characteristic on consumers' liking of several food products (BOURNE, 2002; SZCZESNIAK, 2002) and its complexity, it is crucial to get an insight on consumers' texture vocabulary. Gathering an understanding of consumers' texture vocabulary could allow the elimination of differences between descriptions of products obtained from consumers and trained panels (CARR *et al.*, 2001), which could be used for marketing or communicational purposes.

Obtaining vocabularies directly from consumers has been traditionally considered tedious and difficult to interpret due to several drawbacks such as bias due to the interviewer, consumers' difficulty in describing the product's sensory characteristics and difficulty of analyzing consumers' heterogeneous responses (PIGGOT *et al.*, 1990). However, some simple methodologies, such as free listing and check-all-that-apply questions, have been recently introduced to consumer science, which could be useful to identify consumers' texture vocabulary.

Free Listing is a simple qualitative technique widely used in anthropology (RUSELL BERNARD, 2005) which has been introduced to food consumer science by Hough and Ferraris (2010). It consists of asking participants to "list all the X they know about", where X could be anything from fruits to brands or animals (RUSELL BERNARD, 2005). The aim of this methodology is to get

participants to list as many items as they can in a certain domain. According to several authors, the items with the higher number of mentions are the ones most relevant for consumers (HENLEY, 1969). Although the original application of this methodology was to elicit terms within a certain category, this methodology has been also used to elicit the package features that are considered more relevant by consumers (ARES and DELIZA, 2010).

Furthermore, one of the most novel methodologies that has been developed for gathering information about consumers' perception of the sensory characteristics of food products is the use of check-all-that-apply questions (CATA). A CATA question consists of a list of words or phrases from which respondents should select all the words they consider appropriate to describe a product. This type of question has been used in consumer studies to determine which sensory attributes consumers perceive in a food product (ADAMS *et al.*, 2007; DOOLEY *et al.*, 2010; ARES *et al.*, 2010). Compared to just-about-right or intensity questions, CATA questions seem easier for consumers (ADAMS *et al.*, 2007).

Milk desserts are widely consumed products, which are formulated with milk, sugar, modified starch, hydrocolloids like carrageenans, flavourings and colorants (DE WIJK *et al.*, 2003; GONZALEZ-TOMÁS e COSTELL, 2006). The texture of this product is determinant of consumers' hedonic reaction and therefore it is relevant to study how they perceive it (ELMORE *et al.*, 1999; RICHARDSON-HARMAN *et al.*, 2000). However, most research has focused on studying the texture of milk desserts using trained assessors' panel. De Wijk *et al.* (2003) determined that the texture of milk desserts could be described considering two main dimensions: one running from melting to thick, and the other ranging from rough to creamy-soft. On the other hand, Weenen *et al.* (2005) characterized the texture of milk desserts using descriptors such as creamy, thick, airy, smooth, and fatty. However, not much research has been focused on consumers' vocabulary to describe these products. According to González-Tomás e Costell (2006), consumers used words such as thick, jelly, compact, fluid, liquid, soft, grainy, rough, smooth and thin to describe the texture of milk desserts during a free choice profile task.

The aim of the present work was to identify consumers' texture vocabulary of milk desserts using free listing and a check-all-that-apply-question.

### 2 Material and methods

#### 2.1 Free listing task

Sixty-five participants (63% female and 37% male), ranging in age from 22 to 71 years, were randomly recruited at shopping areas, universities campuses and public places in the city of Montevideo (Uruguay). Participants were recruited considering their interest

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and availability to participate in the study. At recruitment stage, no information about the specific aim of the study was provided.

Participants were given a sheet of paper with written instructions and were asked to complete the task in less than 15 min. They were asked to list all the positive and negative texture characteristics of milk desserts they knew about. Half of the respondents were asked to first list the positive texture characteristics, whereas the other half first provided the list of negative texture characteristics.

### 2.2 Check-all-that-apply question

Eight samples of milk desserts were evaluated in the present study. The samples corresponded to relevant brands in Uruguayan market and were purchased from local supermarkets.

A consumer study was carried out with 65 consumers (65% female and 35% male), ranging in age between 18 and 75 years. Twenty grams of each of the eight milk desserts was served to consumers at 10 °C in closed odourless plastic containers labelled with three digit random numbers. Samples were presented monadically according to a balanced design. Mineral water was available for rinsing between samples.

Consumers were asked to evaluate the texture of the desserts and to complete a check-all-that-apply (CATA) question comprising 27 texture-related terms. Consumers were asked to check all the terms that they considered appropriate to describe the texture of each of the desserts. The terms were selected based on a previous free listing study in which consumers provided all the texture terms they knew (ANTMANN et al., 2010). From that list, the terms related to the texture of solids or rigid products were excluded, considering only the terms applicable to the texture of milk desserts. The terms considered were the following in English and Spanish: creamy (*cremoso*), smooth (*suave*), rough (*áspero*), hard (*duro*), soft (*blando*), liquid (*líquido*), lumpy (*grumoso*), gelatinous (*gelatinoso*), even (*liso*), thick (*consistente*), sticky (*pegajoso*), chewy (*chiclosos*), greasy (*grasoso*), pasty (*pastoso*), egg-custard like (*aflanado*, a term usually used in Uruguay to describe textures similar than that of egg-custard), consistent (*espeso*), homogeneous (*homogéneo*), firm (*firme*), gummy (*gomoso*), unctuous (*untuoso*), viscous (*viscoso*), airy (*aireado*), adhesive (*adhesivo*), fluid (*fluido*), dense (*denso*), quickly melts (*funde rápidamente*), leaves mouth-coating (*deja recubrimiento bucal*).

### 2.3 Data analysis

#### 2.3.1 Free listing task

All the words elicited by participants were considered for the analysis. First, the elicited words

were qualitatively analyzed. A search for recurrent terms was performed, grouping different word classes for the same term (i.e. adjectives and nouns) in categories. This grouping was done by two of the researchers who authored the study. The frequency in which each category was mentioned was determined by counting the number of participants that used those words. Categories mentioned by more than 10% of the participants were considered (HOUGH and FERRARIS, 2010).

#### 2.3.2 Check-all-that-apply question

Frequency of mention for each word of the check-all-that-apply question was determined by counting the number of consumers that checked that word to describe the texture of each milk dessert. In order to evaluate if the check-all-that-apply question was able to detect differences in consumers' perception of the texture of the desserts, Friedman's test was carried out for each of the terms, considering sample and consumer as sources of variation.

A Multiple Factor Analysis (MFA) was performed on the frequency table containing responses to the CATA question (BÉCUE-BERTAUT e PAGÈS, 2008) using FactoMineR (HUSSON et al., 2007; LÉ et al., 2008) in R language (R DEVELOPMENT CORE TEAM, 2007).

## 3 Results and discussion

### 3.1 Free listing task

Consumers elicited a minimum of 1 word and a maximum of 7 words in the free listing task of positive and negative texture characteristics of milk desserts. The average number of items was 2.8 and 2.6 for the positive and negative texture characteristics respectively; suggesting that on average consumers do not think of a large number of attributes to describe the texture of milk desserts.

The great majority of the elicited words were related to texture, suggesting that consumers had a good understanding of the meaning of this sensory characteristic. Some consumers mentioned flavour and appearance characteristics but the number of mentions of these words was lower than 5%.

For each texture word consumers elicited both nouns and adjectives. Thus, in order to quantitatively analyze results from the free listing task, nouns and adjectives related to the same texture term were considered as a whole to determine frequencies of mention. As shown in Table 1, 6 words related to positive texture characteristics of milk desserts were elicited by more than 10% of the participants, whereas the number of words related to negative texture characteristics elicited by more than this percentage of the consumers was 7.

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The elicited terms suggest that consumers describe the texture of milk desserts considering mainly five groups of texture characteristics; those related to thickness, creaminess, smoothness, homogeneity and gumminess. The elicited words include those evaluated by De Wijk et al. (2003) and Weenen et al. (2005) when working with trained assessors. However, it is interesting to notice that consumers did not mention any word related to fatty or greasy sensations, nor they use words referring to the desserts' melting sensation in mouth. This suggests that even though trained assessors might find these attributes useful for performing a sensory characterization of these products, consumers might not take them into account and not consider them relevant when describing milk desserts. On the other hand, the elicited terms are very similar to those reported by González-Tomás and Costell (2006) when asking consumers to describe milk desserts in a free choice profiling study.

Moreover, it is interesting to notice that the words were spontaneously elicited by consumers, without the influence of an interviewer or milk dessert samples. Therefore, the group of texture-related words might be those more relevant for consumers and most frequently used when describing the texture of milk desserts and therefore might be those which determine their texture perception of these products.

Apart from identifying the terminology used to describe the texture of milk desserts, results from the free listing task also provide information about the importance of each term. According to Guerrero et al. (2010), frequency of elicitation is related to the importance

of a concept in consumers' mind; in this case it could be related to the relevance of each texture term for consumers.

As shown in Table 1, creaminess was the most elicited texture attribute, being mentioned by 68% of the respondents. This suggests that this attribute might be crucial in determining consumers' perception of the texture of milk desserts; in agreement with previous data on the importance of creaminess in consumers' liking of this product (ELMORE et al., 1999; RICHARDSON-HARMAN et al., 2000).

Smoothness was the second most elicited category, being mentioned by 52% of the participants. The high frequency of mention of this term could be explained considering the relationship between creaminess and smoothness (JOWITT, 1974; WOOD, 1974; SZCZESNIAK, 1979; DE WIJK et al., 2003; TOURNIER et al., 2007).

Apart from these texture characteristics, consumers mentioned three words related to the desserts' thickness or viscosity (thick, viscous and firm) and homogeneity as positive texture characteristics.

Regarding texture defects, lumpy was the negative texture characteristics with the highest percentage of mention, being elicited by 53% of the participants. The other most important texture defect was an inadequate thickness since 45% of the respondents mentioned the word liquid. This suggests that dairy companies should avoid milk desserts which are perceived as liquid, and especially lumpy. It is interesting to notice that most of the words mentioned as negative characteristics are opposite to the words listed when asking about positive texture characteristics.

**Table 1.** Frequency of mention of positive and negative texture characteristics of milk desserts mentioned by more than 10% of the participants in the free listing task.

	Texture term [English (Spanish)]	Frequency of mention (%)
Positive texture characteristics	Creamy ( <i>cremoso</i> )	68
	Smooth ( <i>suave</i> )	52
	Thick ( <i>consistente</i> )	18
	Homogeneous ( <i>homogéneo</i> )	17
	Viscous ( <i>viscoso</i> )	14
	Firm ( <i>firme</i> )	11
Negative texture characteristics	Lumpy ( <i>grumoso</i> )	53
	Liquid ( <i>liquido</i> )	45
	Syneresis ( <i>sinéresis</i> )	21
	Hard ( <i>duro</i> ) / Too firm ( <i>demasiado firme</i> )	21
	Heterogeneous ( <i>heterogéneo</i> )	17
	Rough ( <i>áspero</i> )	17
	Gummy ( <i>gomoso</i> )	17

### 3.2 Check-all-that-apply question

Consumers were asked to evaluate the texture of the desserts and to check all the terms that they considered appropriate to describe the texture of each of the desserts using a question comprising 27 texture-related terms. The most frequently selected terms were considered as the most used by consumers to describe the texture of milk desserts.

Consumers checked between 1 and 16 terms of the check-all-that-apply (CATA) question to describe the texture of the evaluated milk dessert samples. As shown in Table 2, the most frequently used term was creamy, followed by smooth; which were also the most frequently mentioned words in the free listing task about positive texture characteristics in milk desserts. The other most frequently selected terms in CATA question included homogeneous, even, soft and thick. It is interesting to notice that, in the free listing task, the terms thick and homogeneous were listed by more than 10% of the consumers, whereas the terms even and

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soft were not relevant for the consumers. These results suggest that both methodologies identified creaminess, smoothness, homogeneity and thickness as relevant texture characteristics of milk desserts.

Table 2 shows the frequency in which each of the terms of the check-all-that-apply question was used to describe the evaluated milk dessert samples. Significant differences were found in 23 out of the 27 terms of the CATA question, finding non-significant differences for the terms chewy, greasy, unctuous and viscous. Moreover, the significance at which difference in the frequency of mention between the samples was higher for the terms adhesive, egg-custard like, and gelatinous than for the rest of the terms; indicating lower discriminative ability. This suggests that the abovementioned terms were less able to describe differences in consumers' perception of the texture of the evaluated milk desserts.

Multiple factor analysis was carried out on CATA counts in order to study the relationships between the

terms. The first two dimensions of the MFA accounted for 77.3% of the variance of the experimental data; representing 60.8 and 16.5% of the variance for the first and second dimension respectively. Thus, most of the variance was explained by the first dimension.

Figure 1 shows the representation of the terms from the CATA question in the first and second dimensions of the MFA of CATA counts. The first dimension of the MFA was positively correlated to terms related to the desserts' thickness or viscosity, being positively correlated to terms such as consistent, thick, hard, firm, dense, adhesive, pasty and leaves mouth coating; and negatively correlated to the terms soft and quickly melts. On the other hand, the second dimension was mainly negatively correlated to the term chewy and positively correlated to the term unctuous, both not checked with a high frequency by consumers. Besides, the terms viscous, gummy, egg-custard like, fluid, liquid, airy, smooth, homogeneous, creamy, and even were correlated to both dimensions.

**Table 2.** Frequency in which each of the terms from the check-all-that-apply was selected to describe the texture of the evaluated milk desserts.

Term	Sample								Total
	A	B	C	D	E	F	G	H	
Creamy***	29	55	45	55	53	24	54	45	355
Smooth***	41	50	22	53	42	15	52	50	325
Rough***	5	1	24	2	2	18	0	1	53
Hard***	0	2	6	4	5	21	3	1	42
Soft***	27	31	26	22	22	9	27	39	203
Liquid***	41	25	3	0	1	0	4	20	94
Lumpy***	5	1	7	1	3	14	2	2	35
Gelatinous*	0	1	2	4	2	7	4	1	21
Even***	27	35	16	28	31	9	28	32	206
Thick***	8	6	22	37	30	40	18	7	168
Sticky***	4	1	5	2	6	11	3	0	32
Chewy <sup>ns</sup>	3	1	0	0	1	3	0	1	9
Greasy <sup>ns</sup>	5	5	8	7	9	7	3	2	46
Pasty***	4	5	9	10	14	23	6	2	73
Egg-custard like**	5	6	6	18	7	14	11	10	77
Consistent***	4	2	21	24	24	41	8	4	128
Unctuous <sup>ns</sup>	8	8	9	12	8	7	8	12	72
Homogeneous***	26	29	28	29	29	13	25	34	213
Firm***	0	2	17	24	18	32	15	4	112
Gummy**	0	1	2	4	2	7	4	1	32
Viscous <sup>ns</sup>	5	5	9	12	10	8	9	3	61
Airy***	14	5	0	4	3	2	8	6	42
Adhesive*	2	0	6	4	6	7	3	1	29
Fluid***	33	31	7	3	5	0	8	29	116
Dense***	1	4	17	17	21	27	14	3	104
Quickly melts***	12	20	11	9	6	6	12	21	97
Leaves mouth-coating***	15	9	27	18	18	28	21	6	143

\*\*\*Indicates significant differences at  $p \leq 0.001$ , \*\*indicates significant differences at  $p \leq 0.01$ , \*indicates significant differences at  $p \leq 0.05$ , whereas <sup>ns</sup>indicates no significant differences ( $p > 0.05$ ) according to Friedman's test.

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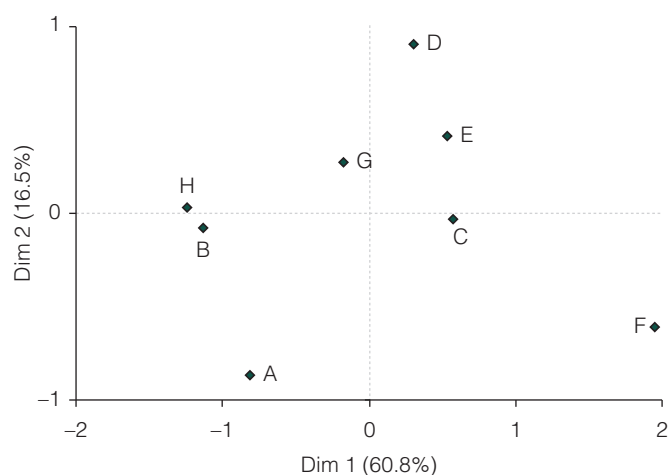
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**Figure 1.** Representation of the terms from the CATA question in the first two dimensions of the multiple factor analysis of CATA counts.

Figure 1 enables the identification of terms that are used in a similar way by consumers and therefore might provide similar information. As shown in Figure 1, the terms fluid and liquid were highly correlated to each other. Besides, these terms were negatively correlated to the terms viscous and thick, suggesting that they might be considered opposites by consumers. Therefore, when selecting vocabulary for consumers' evaluation, terms which are used similarly should not be considered. Moreover, in order to select terms it is also relevant to consider the frequency in which they were selected to describe the evaluated milk desserts. The terms related to the desserts' thickness were all correlated to each other. As shown in Figure 1 the terms consistent, pasty, hard, gelatinous, firm, thick, viscous and dense were highly correlated to each other; of which the term thick was the most selected by consumers to describe the evaluated milk desserts (cf. Table 2). This same behaviour could be observed for the terms even, smooth and homogeneous, which are similarly used by consumers; being smooth the most frequently used.

Figure 2 shows the representation of the eight milk desserts in the first two MFA dimensions. Although the samples were mainly sorted along the first dimension of the MFA samples were sorted in four main groups, samples A, D and F were clearly separated from the rest of the samples in the second dimension. According to consumers' perception samples B and H corresponded



**Figure 2.** Representation of the eight milk desserts in the first two dimensions of the multiple factor analysis of CATA counts.

to the softest and had the highest melting rate, whereas sample F was the hardest, stickiest and lumpiest.

## 4 Conclusions

Free listing and a check-all-that-apply question allowed the identification of consumers' texture vocabulary of milk desserts. According to both methodologies, the most relevant positive texture characteristics of these products are creaminess, smoothness, thickness and homogeneity.

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The main advantage of the free listing task is that it enables the identification of the words consumers would normally use in their everyday conversations. On the other hand, a check-all-that-apply question allowed the identification of the real texture defects that causes consumers' rejection of the product. Besides, it enables the selection of terms based on their ability to discriminate samples with different texture characteristics.

Considering results from the present work, it could be concluded that free listing and check-all-that-apply questions consist of interesting methodologies to identify consumers' texture vocabulary and relevant texture characteristics of food products. This approach could minimize differences between consumers' and trained assessors' vocabulary, which could be useful for the design of communication strategies.

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