Enhancing assessment of social representations by comparing groups with different cultural and demographic characteristics: A case study on pulses.

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Abstract:

Culture plays an important role in the construction of social representations about food, influencing choices such as when, where, with whom, and how much to eat. Even within Europe, differences in the consumption of pulses may be observed between neighboring countries, such as France and Spain. Moreover, literature suggests different attitudes towards pulses according the level of education. The first aim of this study was to carry out an exploratory comparison of the social representations of pulses for French and Spanish consumers, in relation to their level of education. Another goal was to improve social representation assessment through a free word association task focusing on pulses. Methodological improvements to the structural approach were therefore proposed, combining order of citation with frequency and importance, with adapted cut-off points. The polarity index was modified, and the impact of analyzing words (raw data) or word categories was assessed. The main results from the study highlighted that, for both words and categories, there is a common core in the social representations of pulses of the two groups of participants compared, related to five dimensions: *health*, *pulses*, *nutrition*, *preparation*, and *sensory aspects*. The study also identified a difference in focus between the two countries: French consumers focused on *other foods*; Spanish consumers focused on *appropriateness* and *context*. Overall, in both France and Spain, consumers have a positive attitude towards pulses. The methodological changes proposed in the present study facilitate the comparisons of results across different groups of participants. This research project provides valuable insights for researchers and policymakers seeking to understand the impact of culture on consumer food choices.

Keywords: social representations, structural approach, attitudes, pulses

48 **Introduction**

49 In recent years, there has been substantial interest in alternative protein sources that might reduce the
50 environmental impact of meat production systems. Protein-rich foods such as pulses have great potential
51 for a more sustainable diet. Pulses are defined by the FAO as a type of leguminous crop that is harvested
52 only for dry seed, including lentils, dried peas, and beans, but excluding other crops such as green peas,
53 which are harvested green, and soybeans, used mainly for oil extraction (FAO, 2016). The consumption
54 of pulses across the world varies in relation to climate, agriculture, and consumer food habits. In Europe,
55 pulse consumption is estimated at 2.5 kg per person per year, below the global average consumption of
56 7 kg per person per year (FAOSTAT, 2013). In 2018, the EU Member State with the highest production
57 and consumption of pulses was Spain (Magrini et al., 2019). Pulse consumption in Spain was estimated
58 at 3.2 kg per person for 2018 (MAPA, 2019), while pulse consumption in France, estimated at 1.7 kg
59 per person for 2016 (ANSES, 2017), which was much lower than mean pulse consumption in Europe.
60 The difference between these two neighboring countries shows that pulse consumption is not only linked
61 to availability, but could imply a cultural effect. This observation constitutes an interesting starting point
62 to investigate how culture may influence consumers' food choices.

63 The differences in the demographic profiles of French and Spanish consumers of pulses underline
64 another cultural difference. In France, a recent study highlighted that consumers under 40 years of age,
65 with a high level of education, chose pulses more frequently when constructing a main dish than older,
66 less well-educated consumers (Melendrez-Ruiz et al., 2019). By contrast, in Spain, retired people
67 consume the greatest quantity of pulses (5.2 kg/person/year), couples with young children consume the
68 smallest quantity (1.9 kg/person/year), while consumers from the middle and high social classes
69 consume more pulses than the national average (MAPA, 2019). The level of education and age of
70 consumers thus seem to be factors contributing to explain pulse consumption, in these two countries.
71 France is a clear example of a combination of Northern and Mediterranean diets. In the north of France,
72 people eat more butter, margarine, and potatoes than in the south of the country, where they consume
73 more fresh vegetables and vegetable oils (Dubuisson et al., 2010). By contrast, food habits in Spain
74 correspond to the Mediterranean diet (Varela-Moreiras et al., 2013), which is rich in plant foods (cereals,
75 vegetables, pulses, nuts, seeds, and fruits, including olives), with olive oil as the principal source of
76 added fat (Bach-Faig et al., 2011). Pulses play an important role in this diet (Varela-Moreiras et al.,
77 2013), and a weekly serving of pulses combined with cereals is recommended as a healthy protein source
78 for people eating a Mediterranean diet (Bach-Faig et al., 2011).

79 All these elements, which contribute to differences in pulse consumption, may have led to different
80 social representations of pulses between France and Spain. Within any society, social representations
81 are shaped and marked by culture (Abric, 1994). A social representation is a construct from a set of
82 beliefs, opinions, attitudes, and information about a certain object (Abric, 2011). Social representations
83 are prescriptive of behavior and practices. They are collectively constructed and are composed of
84 different elements shared within a group (Abric, 2011; Wolter, 2018). The construction of a social
85 representation seems to be similar across groups, but the resulting representations of different groups
86 vary in relation to cultural differences (Mouret et al., 2013). Social representations that are collectively
87 constructed about food are therefore intrinsically related to the cultures within which they exist (Lo
88 Monaco & Bonetto, 2019). Exploring and understanding social representations will require cognitive
89 and projective approaches. **The first objective of the present study was to compare the social**

90 **representations of pulses for French and Spanish consumers with different levels of education,**
91 **through a free word association task.**

92 A free word association task is one of the projective techniques that provide access to the contents of
93 social representations. It consists in asking people about the words or expressions that come to mind in
94 reference to the object under study (Piermattéo et al., 2018). Several improvements to this method have
95 been proposed, to obtain more precise information. One of the most common additions is to ask
96 respondents to classify each word cited by order of importance (ranking phase). Once the frequencies
97 and the rank of each word cited have been obtained, the analysis by the structural approach consists in
98 creating categories of words, and sort the obtained categories according their frequency of citation and
99 rank (Abric, 2003; Moliner & Lo Monaco, 2017). Different methods have been proposed to calculate
100 the cut-off point between low and high frequencies and ranks. The study of other parameters has also
101 been proposed, such as order of citation, which cut-off point was obtained from mean values (Mäkiniemi
102 et al., 2011). Additional input from the word association test is the polarity index proposed by De Rosa
103 (2002), in which participants have to specify the valence of each word: positive (+), negative (-), or
104 neutral (0). According to Guerrero et al., (2010), categorization into families or dimensions might
105 simplify further analysis of the words cited. This process may also present a challenge when studying
106 social representations through a free word association task, because it is difficult to eliminate researcher
107 subjectivity when separating words into categories (Guerrero et al., 2010; Piermattéo et al., 2018). The
108 structural approach can be used to assess the meaning that a group gives to an object (Moliner & Lo
109 Monaco, 2017), but methodological challenges must be taken into account for adequate statistical
110 analysis.

111 **The second aim of this study was to improve the assessment of social representations through free**
112 **word association, in the context of comparing different social groups.** Various methodological
113 improvements to the structural approach were explored, such as the parameters to be included
114 (frequency, importance, and order of citation) and their corresponding cut-off points. A modified
115 polarity index taking into account the degree of positiveness or negativeness was also tested, and the
116 impact of analyzing words (raw data) or word categories (dimensions) was assessed.

117 **Material and methods**

118 *2.1 Participants in France and in Spain*

119 Two different locations were selected for the study: Dijon in France (FR), and Girona in Spain (ES).
120 These two cities were selected because of their similarity in terms of demographics and their location
121 close to the two research centers involved in the present study (INRA and IRTA). Dijon (FR) had
122 155 090 inhabitants in 2016, with a total surface area of 40.41 km² (INSEE, 2019). Girona (ES) had a
123 population of 100 266 inhabitants in 2018, with a total surface area of 39.12 km² (INE, 2019a). The
124 average income for a consumption unit in 2016 was similar: 20 922 euros for Dijon (INSEE, 2019), and
125 18 828 euros for Girona (INE, 2019b). For purposes of simplification, the study will now refer to the
126 two countries, France and Spain, even though the cities where the data were collected are not necessarily
127 representative of their respective countries.

128 Sixty participants were recruited in France and another sixty in Spain, for a total of 120 participants.
129 The inclusion criteria for participants in both countries were to be resident in that city, aged between 25

and 65 years old, with no specific food diet (e.g. vegetarian or vegan), and without being in a situation of great economic precarity. Thus, only people living in a household where at least one person worked or received a pension, allowance, or annuity were eligible for inclusion. In Dijon, the recruitment process took place at a social center for youth and culture (*Maison des Jeunes et de la Culture*) over a three-week period, in 2019. This Social Center proposes cultural and physical activities for adults and children. In Girona, there was no comparable single center proposing similar activities. Thus, the study was carried out in 2019 at five different locations around the city (two cultural centers, two sports centers, and a language center), to reproduce similar recruitment conditions in both Spain and France.

For each country, an equal number of participants was recruited at higher and lower levels of education (30 in each group). A higher level of education was defined as having a university degree, while a lower level of education indicates participants without a university degree. As demographic characteristics were obtained after data collection, over-recruitment was necessary in each city to ensure this specific distribution of participants. Gender and age balance were ensured by random selection of participants to be excluded when a subgroup (age or gender) was overpopulated. Table 1 shows the personal characteristics of participants included in the analysis, for both countries, with a total of 39 women and 21 men in each country.

Table 1. Personal characteristics of participants in Dijon (France) and Girona (Spain).

Age range / gender	France Level of education			Spain Level of education		
	Low	High	Total	Low	High	Total
25 - 34	**9**	**12**	**21**	**10**	**7**	**17**
Women	7	10	17	5	3	8
Men	2	2	4	5	4	9
35 - 44	**7**	**13**	**20**	**11**	**10**	**21**
Women	4	7	11	9	8	17
Men	3	6	9	2	2	4
45 - 54	**9**	**3**	**12**	**4**	**8**	**12**
Women	5	2	7	3	4	7
Men	4	1	5	1	4	5
55 - 64	**5**	**2**	**7**	**5**	**5**	**10**
Women	3	1	4	4	3	7
Men	2	1	3	1	2	3
Total	**30**	**30**	**60**	**30**	**30**	**60**

2.2 Procedure

The study was conducted in accordance with the Declaration of Helsinki, and was approved by the INSERM ethical committee N°18-506. Institutional Review Board INSERM (CEEI/IRB) (IRB00003888, IORG0003254, FWA00005831).

The study took place in 2019, first in Dijon and then in Girona. The same protocol was used in both cities. One of the principal researchers was present in each country to carry out data collection, translation, and to ensure that the same protocol was followed. This last point was also made possible by writing an interviewer guide containing all the instructions to be given to participants. On the day of the study, the interviewer asked those present at each location about their willingness to participate in the study. Participants who accepted were asked to read and fill out a consent form. The study was conducted

158 individually (one interviewer and one participant at a time) and lasted around 10 minutes. The test
159 consisted of the free word association task and a short questionnaire.

160 (i) Free word association task: A pretest was carried out with the inductor word "car", to ensure that
161 participants understood the task. The task was then repeated with the inductor word "pulses" (*légumes secs*
162 in French and *llegums* in Catalan). Participants were asked to say aloud five words, expressions, or
163 adjectives that came spontaneously to their mind when prompted with the inductor word "pulses". Once
164 participants had cited five words, they were asked to rank each of their words according to perceived
165 relative importance, from 1 to 5 (1 for the word that participants considered the least important and 5 for
166 the most important). Participants then had to rate the valence of each word, by giving a score from -2 to
167 +2: very negative (-2), negative (-1), neutral (0), positive (+1), very positive (+2).

168 (ii) Questionnaire: participants were asked to indicate their level of agreement, using a five-point scale
169 (from (1) totally disagree to (5) totally agree), for two sentences: i) For me, pulses belong to the taste of
170 childhood; and ii) Pulses belong to my cultural traditions. Finally, participants provided socio-
171 demographic information (age range, gender, number of people in their household, and level of education).

172 Instructions and questionnaire were written in French and then translated into Catalan. The documents
173 were then reverse-translated to ensure precision and accuracy. At the end of the study, each participant
174 received a free gift.

175 *2.3 Analyses*

176 All the words cited by participants were analyzed both qualitatively and quantitatively (frequencies). In
177 order to facilitate the analysis of the results by researchers from each country, who did not share the same
178 language, the principal researcher translated all words from both French and Catalan into English, in order
179 to avoid possible translator bias. Throughout the process of data analysis, the original words remained
180 visible, in order to ensure that the precise meaning of each word was taken into account. A table was built
181 for each participant, containing the five words cited, associated with their order of citation, and their
182 importance and valence, as indicated by the participant. Data analysis followed two different approaches:
183 (i) by word (raw data) and (ii) by word category (grouping raw data into different dimensions). In raw data
184 analysis, the minimum frequency of citation for each word and city was set at three (5%). This frequency
185 threshold meant that some words were eliminated for some participants. For each of these participants, the
186 order of citation of the remaining words was shift up, and their rank of importance was modified
187 accordingly. For categories, all the words cited in both countries, regardless of frequency, were
188 independently grouped into categories by three researchers (pseudo-triangulation). The same three
189 researchers together examined the categories thus obtained, and a final list of identical categories was
190 agreed upon for both countries (Guerrero et al., 2010). Data analysis was performed on words (raw data)
191 and on word categories (grouping raw data into different dimensions), first by country, and then by
192 education level within each country. Based on the frequencies obtained, a simple Correspondence Analysis
193 (CA) was run twice, once for words and once for word categories, to visualize the relationships between
194 countries by level of education

195   2.3.1   *Structural approach analyses*

The prototypical analysis adapted by Abric (2003) is often used to study social representations. This analysis is performed on frequency of citation and average importance to create a table (2x2) with four zones. The first zone is the central core of the representation, which contains the elements most frequently cited and considered most important. The first periphery contains elements frequently cited but considered less important. Low frequency elements of high importance are located in the contrast zone, while elements cited with low frequency and considered less important can be found in the second periphery (Moliner & Lo Monaco, 2017).

We performed analyses complementary to the classical structural approach. First, ranks of importance were transformed into a parametric measure. The Cognitive Salience Index (CSI), proposed by Sutrop (2001), was calculated for the analysis of word categories. This index uses frequency and average position, without taking into account the length of the word list. For the analysis of raw data, since words cited less than three times were eliminated, the modified participants' lists did not contain the same number of words, so the Salience Index (SI) (defined by Smith and Borgatti (1997) was preferred. SI allowed us to take into account the length of each participant's modified word list when calculating the frequency of citation and the rank order. We multiplied SI (or CSI when appropriate) by the importance that each participant had given to each word. We therefore obtained a relevance value, from 0 to 1, for each of the words cited by each participant. From these results, we could calculate the average relevance for words and word categories. This relevance measure took into account not only the importance of the word or category, but also the order in which it was mentioned, and the length of the list (only for words where the SI index was computed). Separate SI or CSI indexes were constructed for the analysis of words, and categories of words.

To locate elements (words or categories) in the structural approach, the cut-off points are generally determined for frequency by dividing by two the most frequent category, and for importance by calculating the average of importance (Abric, 2003). In our study, the distribution of data was not symmetrical, and some extreme values were detected in the frequency of words and categories. Consequently, using average values was not appropriate. Therefore, we decided to calculate the median value for both frequency and relevance (which includes importance, as explained in the previous paragraph), and not the break point proposed by Abric (2003). Once the cut-off points were established, the elements (words or categories) were then assigned to one of the four zones forming the social representation.

2.3.2   Polarity degree index

De Rosa (2002) proposed using a positive, negative, or neutral polarity index (P) to assess attitudes implicit in the social representation. We used an adaptation of this polarity index, by asking for a score for each word on a five-point scale. In order to assess more precisely the positivity or negativity of the word or category, we took into account the score given to each word, according to the following formula:

$$\text{Polarity Degree index (PD)} = \frac{\sum S}{O \times M}$$

where S = score given to each word or category by all subjects, O = occurrence (frequency) of the specific word or of the total number of words within a category, M = maximum value of the scoring scale (to ensure that the index can only range from -1 to +1). This index range can be interpreted similarly to the one used by De Rosa, who used the scores obtained on a scale going from -1 to +1. In our case, considering M value

234 increased the precision of PD. Separate polarity degree indexes were constructed for the analysis of words,
235 and categories of words.

236 To distinguish between neutral and positive or negative scores, Rosa proposed a neutral zone from -0.04
237 to +0.04. We decided to apply a more stringent rule, and to extend the neutral zone from -0.1 to +0.1. PD
238 values between +0.1 and +1 were considered to indicated a general positive attitude towards the word or
239 word category. Similarly, PD values between -0.1 and -1 were considered to indicated a general negative
240 attitude towards the word or word category.

241   *2.3.3   Questionnaire*

242 A two-way ANOVA was performed for each quantitative variable (household composition, scores for
243 *belonging to the taste of childhood*, and *the role of pulses in cultural traditions*), including as fixed
244 factors: country (France or Spain), level of education (high or low), and interaction between the two.
245 When significant differences were detected, a multiple paired comparison *ad hoc* Tukey test was
246 performed. For the qualitative variables in the questionnaires (country, age, gender, and education), Chi-
247 square cell-per-cell tests were performed for country (FR – ES), and education level (high – low).

248 All the analyses used the XLSTAT for Windows software (Addinsoft, France, version 2018-1).

249 **Results**

250   *3.1. Analysis of words*
251   *3.1.1. Structural approach and polarity degree index*

252 The 60 participants in each country cited a total of 300 words (5 words per participant, 600 words in
253 total for the two countries). The total number of different words was 146 in France and 134 in Spain. Of
254 these initial words, 79% in France and 78% in Spain were eliminated, because they were cited no more
255 than twice. A total of 30 words was retained for France (Table 2), with a similar total of 29 words for
256 Spain (Table 3), of which 10 were common to both (marked with an asterisk in Table 2 and Table 3),
257 resulting in a total of 48 different words, with a maximum frequency of 25 citations for France and 24
258 for Spain.

259 To compare results for the two countries, and for the two levels of education, we decided to focus on
260 words cited with higher frequency, and considered of higher relevance, located in the central core of the
261 social representations. The other three zones were not included in analysis. To characterize the results
262 for each country, we considered that the most frequent and relevant words were those located in the
263 central core, for all participants, and for each subgroup (high and low levels of education).

264 Five words were used in both countries, by participants at both levels of education (high and low): *beans,*
265 *chickpeas, good, health*, and *lentils*. Other words were specific to a country, at both levels of education:
266 *legumes* and *rice* were in the central core for all French participants; *food*, *healthy*, *needed*, and *protein*
267 appeared in the central core for all Spanish participants.

Other more frequent and relevant words were located in the central core for only one country, at a specific level of education. We considered that the most frequent and relevant words at subgroup level would be those found in the central core for that subgroup, as well as for all participants from that country. Thus, for French participants with a higher level of education, the most frequent and relevant words were *food, protein,* and *white beans*, while *eating* and *taste* were the most frequent and relevant words for French participants with a lower level of education. For Spanish participants with a higher level of education, the most frequent and relevant words were *cooked, lunch,* and *variety*, while *cocido* and *meal* were more frequent and relevant for Spanish participants with a lower level of education. We then examined words located in the central core for a specific subgroup of participants within a country, by level of education. By contrast, with the words previously mentioned, these words characterize representations that are specific to the subgroup of participants but not to the country as a whole. Specific words located in the central core only for French participants with a higher level of education are *apricots* and *nutrient*, while *balance, cooking, green,* and *green beans* are only in the central core for French participants with a lower level of education. Spanish participants with a higher level of education were the only ones to place the words *eating, fiber*, and *tasty* in the central core. Spanish participants with a lower level of education were the only ones to place *diet, digestion*, and *garden* in the central core.

In addition to frequency and relevance, the polarity degree index (PD in Tables 2 and 3) reveals a generally positive attitude toward pulses. Differences across countries and at different levels of education were also identified by this index. In France, the word with the most negative value was *long cooking* for all French participants, particularly for those with a higher level of education. In addition, in France, the word *digestion* has a negative connotation for participants with a higher level of education, while the word *walnuts* has a negative connotation for those with a lower level of education. In Spain, the word *tasteless* was considered negative by participants at both levels of education. The word *flatulence* has a negative connotation for all Spanish participants, even more so for those with a higher level of education. The word *cocido* (a traditional dish) was also negatively perceived by Spanish participants with a higher level of education.

Table 2. Word distribution for France over the four zones of the structural approach (QSA): the central core (CORE), the first periphery (1st PERI), the second periphery (2nd PERI), and the contrast zone (CONTRA).

Word	Global FR				High level of education FR				Low level of education FR			
	N	Mean SI	QSA	PD	N	Mean SI	QSA	PD	N	Mean SI	QSA	PD
Beans *	21	0.550	*CORE*	0.55	10	0.501	*CORE*	0.40	11	0.581	*CORE*	0.68
Chickpeas *	13	0.296	*CORE*	0.58	4	0.175	*CORE*	0.50	9	0.418	*CORE*	0.61
Good *	8	0.172	*CORE*	0.81	6	0.214	*CORE*	0.92	2	0.133	*CORE*	0.50
Health *	6	0.219	*CORE*	0.92	3	0.244	*CORE*	0.83	3	0.158	*CORE*	1.00
Legumes	5	0.222	*CORE*	0.60	2	0.146	*CORE*	0.25	3	0.300	*CORE*	0.83
Lentils *	25	0.630	*CORE*	0.68	14	0.696	*CORE*	0.68	11	0.491	*CORE*	0.68
Rice	4	0.106	*CORE*	0.88	2	0.125	*CORE*	1.00	2	0.089	*CORE*	0.75
Protein *	4	0.090	*CORE*	0.88	3	0.183	*CORE*	1.00	1	0.011	*2nd PERI*	0.50
Food *	6	0.138	*CORE*	0.75	5	0.267	*CORE*	0.70	1	0.017	*2nd PERI*	1.00
White beans	4	0.092	*CORE*	0.50	3	0.107	*CORE*	0.33	1	0.075	*2nd PERI*	1.00
Taste	5	0.119	*CORE*	0.70	3	0.102	*1st PERI*	0.67	2	0.146	*CORE*	0.75

Word	N	Mean SI	QSA	PD	N	Mean SI	QSA	PD	N	Mean SI	QSA	PD
Eating*	6	0.165	*CORE*	0.83	1	0.067	*2nd PERI*	1.00	5	0.262	*CORE*	0.80
Nutrient	3	0.089	*CONTRA*	1.00	2	0.111	*CORE*	1.00	1	0.067	*2nd PERI*	1.00
Apricots	3	0.063	*2nd PERI*	0.67	3	0.125	*CORE*	0.67	-	-	-	-
Green beans	3	0.088	*CONTRA*	0.67	-	-	-	-	3	0.175	*CORE*	0.67
Spinach	3	0.100	*CONTRA*	0.67	-	-	-	-	3	0.200	*CORE*	0.67
Balance	3	0.079	*2nd PERI*	0.83	1	0.033	*2nd PERI*	1.00	2	0.111	*CORE*	0.75
Walnuts	3	0.083	*2nd PERI*	0.17	1	0.033	*2nd PERI*	1.00	2	0.133	*CORE*	**-0.25**
Cooking	4	0.079	*1st PERI*	0.25	2	0.050	*1st PERI*	0.00	2	0.111	*CORE*	0.50
Green	5	0.044	*1st PERI*	0.30	-	-	-	-	5	0.089	*CORE*	0.30
Kitchen	4	0.051	*1st PERI*	0.63	2	0.050	*1st PERI*	0.75	2	0.036	*1st PERI*	0.50
Organic	4	0.056	*1st PERI*	0.75	3	0.083	*1st PERI*	1.00	1	0.017	*2nd PERI*	0.00
Almonds	3	0.039	*2nd PERI*	0.33	2	0.042	*1st PERI*	0.00	1	0.033	*2nd PERI*	1.00
Digestion *	3	0.031	*2nd PERI*	0.33	1	0.008	*2nd PERI*	**-0.50**	2	0.058	*1st PERI*	0.75
Grapes	3	0.078	*2nd PERI*	0.33	1	0.133	*CONTRA*	0.50	2	0.044	*1st PERI*	0.25
Healthy *	3	0.071	*2nd PERI*	0.83	1	0.075	*2nd PERI*	1.00	2	0.067	*1st PERI*	0.75
Long cooking	3	0.030	*2nd PERI*	-0.50	3	0.059	*1st PERI*	-0.50	-	-	-	-
Potatoes	3	0.028	*2nd PERI*	1	-	-	-	-	3	0.056	*1st PERI*	1.00
Starch	3	0.067	*2nd PERI*	0.67	2	0.083	*1st PERI*	0.50	1	0.044	*2nd PERI*	1.00
Vitamins	3	0.078	*2nd PERI*	1	2	0.075	*1st PERI*	1.00	1	0.067	*2nd PERI*	1.00
Median	**4**	**0.085**	-	-	**2**	**0.105**	-	-	**2**	**0.089**	-	-

N: Frequency; SI: Mean of relevance using the Salience Index; PD: Polarity degree index.

Table 3. Word distribution for Spain over the four zones of the structural approach (QSA): the core (CORE), the first periphery (1st PERI), the second periphery (2nd PERI) and the contrast zone (CONTRA).

Word	Global ES				High level of education ES				Low level of education ES			
	N	Mean SI	QSA	PD	N	Mean SI	QSA	PD	N	Mean SI	QSA	PD
Beans *	12	0.227	*CORE*	0.67	7	0.198	*CORE*	0.57	5	0.264	*CORE*	0.60
Chickpeas *	15	0.558	*CORE*	0.63	8	0.655	*CORE*	0.69	7	0.461	*CORE*	0.57
Food *	4	0.190	*CORE*	0.75	2	0.233	*CORE*	0.75	2	0.150	*CORE*	0.75
Good *	7	0.172	*CORE*	0.71	4	0.156	*CORE*	0.63	3	0.187	*CORE*	0.83
Health *	8	0.169	*CORE*	1.00	5	0.181	*CORE*	1.00	3	0.161	*CORE*	1.00
Healthy *	24	0.524	*CORE*	0.94	11	0.450	*CORE*	1.00	13	0.594	*CORE*	0.88
Lentils *	15	0.225	*CORE*	0.63	8	0.310	*CORE*	0.69	7	0.142	*CORE*	0.57
Needed	4	0.133	*CORE*	1.00	2	0.139	*CORE*	1.00	2	0.117	*CORE*	1.00
Protein *	9	0.211	*CORE*	0.83	5	0.282	*CORE*	0.80	4	0.138	*CORE*	0.88
Cooked	4	0.102	*CORE*	0.25	3	0.139	*CORE*	0.33	1	0.067	*2nd PERI*	0.00
Lunch	5	0.120	*CORE*	0.50	4	0.200	*CORE*	0.63	1	0.033	*2nd PERI*	0.00
Variety	6	0.087	*CORE*	0.67	3	0.111	*CORE*	0.50	3	0.065	*1st PERI*	0.63
Cocido	4	0.150	*CORE*	0.13	2	0.100	*1st PERI*	**-0.50**	2	0.200	*CORE*	0.75
Meal	5	0.202	*CORE*	0.80	1	0.067	*2nd PERI*	1.00	4	0.336	*CORE*	0.75
Eating*	3	0.133	*CONTRA*	0.33	2	0.167	*CORE*	0.25	1	0.100	*2nd PERI*	0.50
Fiber	3	0.078	*2nd PERI*	0.67	3	0.156	*CORE*	0.67	-	-	-	-
Tasty	3	0.084	*2nd PERI*	0.50	2	0.111	*CORE*	0.50	1	0.050	*2nd PERI*	0.50
Diet	3	0.078	*2nd PERI*	0.50	-	-	-	-	3	0.156	*CORE*	0.50
Digestion *	3	0.082	*2nd PERI*	1.00	1	0.050	*2nd PERI*	1.00	2	0.113	*CORE*	1.00

9

	N	SI		PD	N	SI		PD	N	SI		PD
Garden	3	0.078	*2nd PERI*	0.83	1	0.033	*2nd PERI*	0.50	2	0.125	*CORE*	1.00
Cheap	3	0.067	*2nd PERI*	0.33	1	0.033	*2nd PERI*	0.00	2	0.100	*1st PERI*	0.50
Flatulence	5	0.058	*1st PERI*	**-0.20**	2	0.047	*2nd PERI*	**-0.75**	3	0.069	*1st PERI*	0.17
Nature	4	0.061	*1st PERI*	0.88	1	0.017	*2nd PERI*	1.00	3	0.107	*1st PERI*	0.83
Salad	4	0.075	*1st PERI*	0.38	3	0.083	*1st PERI*	0.50	1	0.067	*2nd PERI*	0.00
Soil	5	0.065	*1st PERI*	0.80	1	0.050	*2nd PERI*	1.00	4	0.084	*1st PERI*	0.75
Energy	3	0.068	*2nd PERI*	0.83	1	0.044	*2nd PERI*	1.00	2	0.090	*1st PERI*	0.75
Iron	3	0.059	*2nd PERI*	0.50	1	0.033	*2nd PERI*	0.50	2	0.083	*1st PERI*	0.50
Peas	3	0.063	*2nd PERI*	0.67	2	0.075	*1st PERI*	0.75	1	0.050	*2nd PERI*	0.50
Tasteless	3	0.025	*2nd PERI*	-0.50	2	0.039	*1st PERI*	-0.50	1	0.011	*2nd PERI*	**-0.50**
Median	**4**	**0.087**	-	-	**2**	**0.111**	-	-	**2**	**0.110**	-	-

N: Frequency; SI: Mean of relevance using the Salience Index; PD: Polarity degree index.

3.1.2. Correspondence analysis (CA) for words

Correspondence analysis was used to visualize the associations between citation frequency for each word and the two levels of education in each country (Figure 1). The first axis represents 49% of the total inertia, with 33% for the second axis. The first axis characterizes countries and the second axis differentiates between education levels in France. French participants cited food products (e.g. *legumes, white beans, potatoes,* and *spinach*) more frequently than participants in Spain, who cited conceptual words (e.g. *variety, cooked, soil, lunch, health,* and *fiber*) more frequently than participants in France.

In France, the words most frequently cited by participants with a lower level of education were *potatoes, green beans, spinach, green,* and *eating*, while French participants with a higher level of education cited the words *apricots, long cooking, white beans, organic, food,* and *good*. By contrast, in Spain there was no difference between participants based on their level of education.

Please insert here Figure 1

3.2. Analysis of word categories

All 600 words cited by the 120 participants from the two countries were then divided into 17 categories (Table 4).

Table 4. Word categories after triangulation, with examples of words for each category, and total number (N) of words in each category.

Categories	Examples	N
Agriculture	field, garden, nature, plant, soil	18
Appropriateness	good, recommended, interesting, important	26
Context	dinner, lunch, house, meal, table, share, winter	24
Convenience	comfortable, available, easy to prepare, long cooking, non-perishable, practical	23
Digestion	digestion, flatulence, guts, swollen, stomach heaviness	16
Habits	twice a week, unknown, discover, weekly, usual, trend	10
Health	good for health, health, vitality, well-being	48
Legumes	green beans, legumes, peas, peanuts, soya	17

Nutrition	balance, basic food, calories, diet, energetic, nourishment, fiber, iron, needed, protein, starch,	91
Other foods	almonds, apricots, bananas, carrots, cashews, chorizo, corn, food, grapes, potatoes, rice, spinach, walnuts	66
Preparation	boiled, *cocido*, cooked, kitchen, pot, salad, stew, side dish, recipe	53
Pulses	beans, chickpeas, coral lentils, lentils, white beans	110
Purchasing	cheap, economical, money, market, price, sachet, supermarket	12
Quality	fresh, natural, organic, quality	12
Sensory aspects	tasteless, brown, delicious, green, I love it, it's good, juicy, round, smell, soft, taste	54
Tradition	childhood, family, grandmother, culture, traditional	8
Variety	choice, options, possibility, variety	12

323

324   *3.2.1.Structural approach and Polarity degree index*

325   Table 5 for France and Table 6 for Spain show the distribution of word categories for each subgroup of
326   participants. Five dimensions were identified as most frequent and relevant for participants in both
327   countries and at both levels of education: *health, nutrition, preparation, pulses*, and *sensory aspects*.
328   Other dimensions, although specific to a subgroup (high or low level of education), were considered to
329   be particularly frequent and relevant when they were located in the central core not only for that
330   subgroup but also for all participants from that country. This is the case for *appropriateness* and *legumes*
331   for French participants with a lower level of education, *convenience* for French participants with a higher
332   level of education, with *agriculture* and *other foods* for Spanish participants with a lower level of
333   education, and *digestion* for Spanish participants with a higher level of education.

334   Regarding the polarity degree index, French and Spanish participants generally have a positive attitude
335   toward all dimensions. Negative attitudes were identified only among participants with a higher level of
336   education, in France and/or Spain: *digestion* was the only common dimension with a negative value in
337   both countries, more prominently in France than in Spain, while the dimensions *purchasing* and *habits*
338   were negative only in France.

339   **Table 5**. Category distribution for France over the four zones of the structural approach (QSA): the
340   central core (CORE), the first periphery (1st PERI), the second periphery (2nd PERI) and the contrast
341   zone (CONTRA).
342

		Global FR			High level of education FR				Low level of education FR			
Category	N	Mean CSI	QSA	PD	N	Mean CSI	QSA	PD	N	Mean CSI	QSA	PD
Health	13	0.353	*CORE*	0.88	6	0.383	*CORE*	0.83	7	0.345	*CORE*	0.93
Nutrition	42	0.910	*CORE*	0.81	22	0.845	*CORE*	0.84	20	1.014	*CORE*	0.78
Sensory aspects	27	0.303	*CORE*	0.33	11	0.238	*CORE*	0.50	16	0.349	*CORE*	0.22
Other foods	54	0.873	*CORE*	0.67	29	0.978	*CORE*	0.66	25	0.771	*CORE*	0.68
Preparation	24	0.289	*CORE*	0.38	14	0.342	*CORE*	0.36	10	0.246	*CORE*	0.40
Pulses	68	1.398	*CORE*	0.61	33	1.560	*CORE*	0.56	35	1.274	*CORE*	0.66
Convenience	13	0.177	*CORE*	0.50	9	0.234	*CORE*	0.39	4	0.158	*1st PERI*	0.75
Appropriateness	10	0.171	*CORE*	0.80	6	0.175	*1st PERI*	0.92	4	0.182	*CORE*	0.63
Legumes	13	0.254	*CORE*	0.62	5	0.200	*1st PERI*	0.40	8	0.309	*CORE*	0.75
Agriculture	1	0.006	*2nd PERI*	0.50	-	-	-	-	1	0.011	*2nd PERI*	0.50
Context	7	0.054	*2nd PERI*	0.50	3	0.086	*2nd PERI*	0.50	4	0.062	*1st PERI*	0.50
Digestion	4	0.042	*2nd PERI*	0.38	1	0.013	*2nd PERI*	**-0.50**	3	0.073	*2nd PERI*	0.67
Habits	4	0.073	*2nd PERI*	0.00	1	0.013	*2nd PERI*	**-0.50**	3	0.138	*2nd PERI*	0.17

Category	N	SI	QSA	PD	N	SI	QSA	PD	N	SI	QSA	PD
Purchasing	6	0.095	*2nd PERI*	0.00	1	0.011	*2nd PERI*	**-1.00**	5	0.176	*CORE*	0.20
Quality	5	0.065	*2nd PERI*	0.80	4	0.126	*2nd PERI*	1.00	1	0.007	*2nd PERI*	0.00
Tradition	5	0.071	*2nd PERI*	0.70	3	0.092	*2nd PERI*	0.83	2	0.052	*2nd PERI*	0.50
Variety	4	0.053	*2nd PERI*	0.75	2	0.058	*2nd PERI*	0.75	2	0.048	*2nd PERI*	0.75
Median	**10**	0.170	-	-	**5.5**	0.188	-	-	**4**	0.176	-	-

N: Frequency; SI: Mean of relevance using the Cognitive Salience Index; PD: Polarity degree index.

Table 6. Category distribution for Spain over the four zones of the structural approach (QSA): the central core (CORE), the first periphery (1st PERI), the second periphery (2nd PERI) and the contrast zone (CONTRA).

Category	Global ES				High level of education ES				Low level of education ES			
	N	Mean CSI	QSA	PD	N	Mean CSI	QSA	PD	N	Mean CSI	QSA	PD
Nutrition	49	1.001	*CORE*	0.71	22	1.016	*CORE*	0.73	27	1.001	*CORE*	0.70
Pulses	42	0.677	*CORE*	0.64	23	0.842	*CORE*	0.70	19	0.490	*CORE*	0.58
Sensory aspects	27	0.331	*CORE*	0.02	13	0.290	*CORE*	0.00	14	0.400	*CORE*	0.04
Appropriateness	16	0.327	*CORE*	0.72	8	0.359	*CORE*	0.63	8	0.504	*CORE*	0.81
Context	17	0.347	*CORE*	0.44	10	0.279	*CORE*	0.35	7	0.516	*CORE*	0.57
Health	35	0.587	*CORE*	0.96	17	0.541	*CORE*	1.00	18	0.646	*CORE*	0.92
Preparation	29	0.477	*CORE*	0.38	18	0.539	*CORE*	0.33	11	0.492	*CORE*	0.45
Agriculture	17	0.274	*CORE*	0.74	3	0.100	*2nd PERI*	0.83	14	0.447	*CORE*	0.71
Other foods	12	0.280	*CORE*	0.54	6	0.267	*CONTRA*	0.58	6	0.300	*CORE*	0.50
Digestion	12	0.152	*1st PERI*	0.13	7	0.262	*CORE*	**-0.14**	5	0.238	*2nd PERI*	0.50
Convenience	10	0.150	*2nd PERI*	0.55	7	0.221	*1st PERI*	0.43	3	0.297	*2nd PERI*	0.83
Habits	6	0.082	*2nd PERI*	0.00	3	0.124	*2nd PERI*	0.00	3	0.075	*2nd PERI*	0.00
Legumes	4	0.067	*2nd PERI*	0.63	3	0.114	*2nd PERI*	0.67	1	0.011	*2nd PERI*	0.50
Purchasing	6	0.075	*2nd PERI*	0.25	1	0.100	*2nd PERI*	0.00	5	0.100	*2nd PERI*	0.30
Quality	7	0.149	*2nd PERI*	0.93	2	0.075	*2nd PERI*	1.00	5	0.233	*2nd PERI*	0.90
Tradition	3	0.050	*2nd PERI*	1.00	2	0.048	*2nd PERI*	1.00	1	0.028	*2nd PERI*	1.00
Variety	8	0.083	*2nd PERI*	0.63	5	0.118	*2nd PERI*	0.50	3	0.053	*2nd PERI*	0.83
Median	**12**	0.270	-	-	**7**	0.260	-	-	**6**	0.300	-	-

N: Frequency; SI: Mean of relevance using the Cognitive Salience Index; PD: Polarity degree index.

3.2.2. Correspondence analysis for categories

Correspondence analysis was used to visualize the associations between citation frequency for each category and the two levels of education in each country (Figure 2). The first axis represents 71% of the total inertia, with 19% for the second axis. The first axis characterizes countries and the second axis differentiates between education levels, particularly in Spain. French participants with a higher level of education used the category *convenience* more often. In Spain, participants with a lower level of education used words related to *agriculture, purchasing*, and *quality* more often than highly educated participants, who more frequently used words related to *variety*, *context*, *digestion*, and *preparation*.

Please insert here Figure 2

12

364   *3.3. Demographic questionnaire*

365   The analysis of variance in relation to country and level of education showed only a significant
366   interaction for household composition (F = 4.098, p = 0.045). The mean number of people per household
367   was higher for French participants with a higher level of education, while in Spain it was higher for
368   participants with a lower level of education. While for the taste of childhood and cultural tradition no
369   interaction was found, yet there was significant effect of country. The multiple paired-comparison Tukey
370   test (p <0.05) showed that Spanish participants gave a higher score than French participants to pulses
371   belonging to the taste of their childhood (F = 4.097, p = 0.045) and their cultural tradition (F =15.836,
372   p = 0.000).

373   Table 7 shows the Chi-squared result for country and education level. No significant differences in age,
374   gender, or education were observed (p >0.05) between countries.

375   **Table 7.** Significance for the qualitative variables evaluated in the questionnaire, in relation to
376   country, and level of education.

Variables	Chi2 results for country p values	Chi2 results for level of education p values
Country	N/A	1.000
Age	0.807	0.077
Gender	1.000	0.444
Education	1.000	N/A

377   (Chi-square cell-per-cell analysis; p-value <0.05). N/A: not applicable

378   **Discussion**

379   The first aim of this study was to compare consumers' social representations of pulses, taking into
380   consideration their country of residence and their level of education. The results highlighted similarities
381   between participants, but also differences that can be explained by their country, level of education, or
382   other reasons. The second aim was to improve social representation assessment through a free word
383   association task across different social groups. We identified some strengths and limitations that will be
384   discussed in relation to methodological aspects.
385
386   *4.1. Similarities between countries*

387   We identified some words and word categories located in the central core that are common to both
388   countries, unrelated to level of education. The category *pulses*, identified in the central core of the
389   category analysis for participants from both countries, contains words that are also in the central core of
390   the word analysis (*beans*, *chickpeas*, and *lentils).* As previously shown (Melendrez-Ruiz et al., 2020),
391   consumers tend to cite exemplars to confirm the meaning of the inductor word (*pulses*). These results
392   demonstrate that participants had quite clear knowledge of what pulses are. The exemplar names they
393   used correspond to the three most commonly consumed pulses in both countries. In France (Solagro &
394   RAC, 2016), the most common pulses are lentils (710 g/person/year), followed by beans (610

g/person/year), while chickpeas lag far behind (76 g/person/year). In 2018 (MAPA, 2019), the most commonly consumed pulses in Spain were chickpeas (1.29 kg/person), followed by lentils (1 kg/person), and beans (<1kg/person). The fact that no other example of pulses was cited, whether in France or in Spain, shows that consumers' representations of pulses are limited in comparison with the varieties of pulses available. Specific efforts should be made to promote other pulses, such as dried peas, for example.

The *sensory* dimension was also frequent and relevant for both countries. This dimension goes beyond taste and also includes physical characteristics such as color (green and brown), and texture, which are important when referring to pulses. The evocation of a sensory attribute by a person does not necessarily mean that this person consumes that food, but may indicate that liking for this specific attribute is an important factor in determining appreciation of that particular food (Shepherd, 2001, p.117). The sensory dimension could therefore be a decisive factor in pulse consumption. A study in Canada identified 'not liking their taste' as a key reason for not eating pulses (IPSOS, 2010). This reason could also apply to the Spanish participants to our study, with a negative attitude toward the word *tasteless*.

The category *preparation* is another dimension in the central core common to both countries. This category contains items related to practical knowledge of pulses. In both countries, participants spontaneously evoked familiar cooking methods, and named a variety of dishes made with pulses. In France, the most typical dishes containing pulses are *cassoulet* (white beans with sausage), and *petit salé aux lentilles* (lentils with pork), which are considered traditional in French gastronomy (Rio, 2017). In Spanish gastronomy, pulses are used in popular recipes such as *fabada* or *empedrados* (made with white beans), *mongetes con butifarra* (beans with sausage), lentils with chorizo, and chickpeas, served puréed, stewed, or as a main dish (Medina, 2005).

The category and the word *health* were also in the central core for both countries. This finding highlights a common social representation of pulses as healthy food, shared by both cultures. This is also shown by the category *nutrition,* located in the central core for both countries. This result probably reflects the fact that consumers know the benefits of pulses for human health, as previously shown for French consumers (Melendrez-Ruiz et al., 2019). Nevertheless, the frequent use of words related to nutrition by participants from both countries has to be considered with caution, because the components of the category *nutrition* were not the same for the two sets of participants. In the word analysis, we found only one word related to nutrition in the central core for Spain (*protein),* while French participants used many words related to nutrition *(vitamins, proteins, eating, nutrients,* and *balance*), but none of these words was located in the central core for the two French subgroups. This result means that Spanish consumers consider protein richness as the main nutritional benefit of pulses, while French consumers may simply know that pulses have interesting nutritional properties in general. The better knowledge of protein content identified among Spanish consumers may be due to the position occupied by pulses in the Spanish food pyramid, at the same level as white meats (Aranceta Bartrina, 2016).

4.2. Differences between countries

Some specific word categories were located in the central core of the social representation for one country only. In France, this was the case for the category *other foods.* Among the words in the category *other foods, rice*, and *legumes* are located in the central core in the word analysis. It is possible that the naming of starches by French participants could reveal knowledge about the importance of combining

436   pulses and cereals to satisfy requirements in amino acids. Yet a previous study demonstrated that French
437   consumers used pulses more often as a substitute for starches than in combination with them
438   (Melendrez-Ruiz et al., 2019), showing that they are probably not aware of the principles of amino acid
439   complementarity. Thus, the association of *other foods* with pulses in the present study more probably
440   reflects confusion between pulses, legumes, and starches. This interpretation is supported by the fact
441   that pulses were positioned in the same category as starches in the French food pyramid for many years
442   (PNNS, 2015).

443   For Spanish participants, the specific word categories that were located in the central core are
444   *appropriateness* and *context*. Within *appropriateness*, we found through the word analysis that *good*
445   and *needed* were particularly frequent and relevant. The frequent use of these words reveals that Spanish
446   participants consider pulses as a suitable food, adapted to many food choice situations (Mela, 2001).
447   The *context* dimension can refer not only to the physical location where products are consumed or
448   bought, but also to social setting, culture, and the availability of food. This dimension defines the food
449   products that are appropriate to be consumed or not in a given situation (Schifferstein et al., 2001). The
450   fact that both groups of Spanish participants placed *context* in the central core, unlike the French
451   participants, reveals that Spanish consumers consider pulses a usual food in many consumption
452   situations. These findings are consistent with the answers to the questionnaire, which indicate that
453   Spanish participants considered pulses as being part of their childhood tastes and cultural tradition
454   significantly more than French participants did. It seems clear that culture influences not only the social
455   representation but also the perceived position of pulses as belonging to Spanish food habits. This could
456   either explain or result from their higher consumption in comparison with France.

457   Differences between countries were also observed regarding the formats in which consumers habitually
458   buy pulses. Spanish participants declared that they buy pulses in glass jars (cooked) or in bulk. In Spain,
459   pulses in bulk can be either raw or cooked, which is different from the situation in France, where pulses
460   sold in bulk are always raw. French participants preferred to buy pulses in a cardboard box (raw), a
461   transparent plastic bag (raw), or in cans (cooked). It thus seems that Spanish consumers favored the
462   purchase of cooked pulses, while French consumers mostly favored buying raw pulses. This is in line
463   with consumption data: in Spain, in 2018, there was an increase in the purchase of cooked pulses that
464   reached the same level as raw pulses, i.e. 73 000 kg (MAPA, 2019). This result could explain the fact
465   that French participants expressed a negative attitude towards *long cooking*, an expression that was not
466   cited in Spain. The long cooking of pulses has already been identified as a barrier to pulse consumption
467   in France in previous studies (Lecerf, 2016; Magrini, 2016; Melendrez-Ruiz et al., 2019; Rio, 2017).

468

469   *4.3. Differences by level of education within countries*

470   Some differences were identified in the central core of specific word categories and words, in relation
471   to the level of education of participants in each country.

472   In both countries, words related to *convenience* were more frequent and relevant for participants with a
473   higher level of education than for those with a lower level of education. This category contains words
474   expressing convenience (*easy to prepare, practical,* and *non-perishable*) and inconvenience (*long
475   cooking*). Among these words, *long cooking* was the only one that was cited more than three times, and

only by French participants with a higher level of education. These results reveal that the convenience of pulses is perceived differently according to the level of education, but it is difficult to conclude, from our results, which participants find pulses more convenient than others. In addition, when calculating the polarity index, we took into account the positive and negative values of each word for each category, with the result that the *convenience* category was not identified as negative, nor as extremely positive.

French participants with a lower level of education considered items related to *purchasing* more frequent and relevant than other participants, and they also considered the words in the category *purchasing* as being particularly negative. This category mostly contains words related to price. It has often been shown, in the literature, that education level and financial resources are linked. In our study, we did not collect information about the economic situation of participants, but we can reasonably suppose from our results that the price of pulses is considered high by participants with a lower level of education because they may have limited financial resources. Pulses in France are affordable but comparatively more expensive than pasta, rice, or potatoes (price per kilo for retailer own brands: green lentils = 2.64 €, spaghetti = 0.87 €, basmati rice = 1.62 € and potatoes = 1 €, at Carrefour Drive, France in February 2020). A previous study showed that the perception of prices by French consumers corresponds to this reality: participants considered pulses more expensive than starches but less expensive than meat (Melendrez-Ruiz et al., 2019). The fact that participants with a lower level of education considered the price of pulses as negative in the present study may confirm that, in France, people compare pulses to starchy foods and not to meat, and therefore use pulses as they would use starches, as a source of carbohydrates and not as a source of proteins.

In Spain, participants with a higher level of education cited words in the category *digestion* a little more frequently than other participants. In the word analysis, this dimension is not very salient, the only word of this category cited more than three times was *flatulence*, cited in Spain with a comparably low frequency by both groups, and not cited more than three times in France. The same relative absence of digestive considerations was found in other studies. For example, digestive considerations were not considered a key factor in deciding whether or not to eat pulses (IPSOS, 2010). Nevertheless, in our results, the relatively low importance of words of this category has to be counterbalanced by the very negative salience attributed to the category and the words it contains. This result seems to indicate that although only a few participants feel concerned about disorders consecutive to the ingestion of pulses, for those who did mention *digestion*, it was considered as a major drawback.

Finally, Spanish participants with a lower level of education used considerably more frequently than other participant's words related to *agriculture*. The words they used more often are *garden*, *nature*, and *soil*, indicating that these participants specifically associate pulses with naturalness, traditional crops and cultivation at household level. This can be linked to personal characteristics, such as having grown up in the countryside, having a vegetable garden, or working in agriculture.

A cluster analysis was carried out in order to reveal any other difference (results not showed) but this analysis only confirmed the predominant role of country and level of education over any other characteristics.

4.4. Methodological aspects: strengths and limitations

We particularly focused our analysis of results on the central core of the social representation, which represents its more frequent and important elements. The central core is recognized to be simple, concrete, and coherent; it reveals a system of values that bears the culture and the social norms of participants (Abric, 2011). By contrast, with many studies that considered only frequency and rank of importance, we chose to focus also on order of citation, using two indexes: Salience and Cognitive Salience. This analysis allowed us to improve understanding of consumers' social representations of pulses a across different social groups. For example, it seems that there could be a learning process in relation to pulses. Most French consumers are located in the first phase of this learning process, which they show by citing exemplar words for pulses, names of other foods, and pulse characteristics. Most Spanish consumers are in the second part of the learning process, citing words related to *health*, *nutrition*, and *convenience*. It seems that consumers first need to identify the product, and then to acquire more precise knowledge about what pulses are for and how to use them. We also proposed an adapted calculation of the cut-off points for frequency and relevance, which took into account the median, and not the average value. With this calculation, we took into account the nature of our values, allowing us to perform a more satisfactory analysis. We also proposed the polarity degree index, an adaptation of the polarity index, in order to obtain more precise information regarding consumer attitudes toward a word or category (positive or negative).

By analyzing both words (raw data) and word categories (dimensions), greater insight into the social representation of subgroups of consumers became available. Both methods brought to light differences between participants in France and in Spain. Surprisingly, divergent results were obtained for the comparison of participants with different levels of education within a country. In France, the word analysis showed marked differences between participants by level of education. Highly educated French participants cited words such as *white beans* and *apricots*, while those with a lower level of education cited words such as *potatoes, spinach,* and *green beans*. These differences were not perceptible in the category analysis, where these words were grouped into the category *other foods*, revealing no difference between participants with higher or lower levels of education. Another example is the word *long cooking* for highly educated participants, which could be an important factor for this group of consumers, but was not revealed by the category analysis. By contrast, for Spanish participants, differences between education levels were perceptible in the category analysis. For example, Spanish participants with a lower level of education mentioned words in the category *agriculture* more frequently. In the word analysis, these differences were not revealed because each of these words was used at a frequency below three. This difference between the analysis by words and by categories of words is an artefact of the dropping of words. It was not possible to do the analysis by words without dropping the words with a frequencies lower than 3. Indeed, keeping all the words induces a considerable background noise, (more than 300 words were evoked). This raises all the interest of the double analysis, by words and by categories.

The main limit in our study was that, after sorting participants by level of education for each country, the number of participants in each subgroup was relatively low. Participants were recruited in two relatively small cities, and it would be interesting to extend such a study to different places in each country, to confirm that these results reveal specificities of countries and not merely of specific regions. Some of our results should therefore be confirmed by further studies.

Conclusion

This study adapted and improved the assessment of the social representations of a food product across different social groups, which could constitute an interesting opportunity for future research. Our results highlighted similarities and differences among the words and categories used in each country and at both levels of education. Some categories were found in each subgroup, such as *health, pulses, nutrition, preparation*, and *sensory aspects*, while other categories were specific to one country. French participants mostly used words related to *food products*, while Spanish participants used concepts related to *appropriateness* and *context* more frequently. In addition, we found that Spanish consumers considered pulses as part of their culture and childhood more frequently than French consumers. This could explain the higher consumption of pulses in Spain compared to France. In this sense, culture not only influences the content of the social representation about pulses but also influences the perception of consumers about pulses as belonging or not to their food habits and culture. Finally, some strategies could be proposed in each country to encourage and increase pulse consumption. In France, for example, it would be helpful to increase not only knowledge about nutrition and health with regard to pulses, but also know-how regarding buying, cooking, and combining pulses. In Spain, it could be interesting to promote pulses as a product that is considered culturally important for consumers (by popularizing this message throughout the population). For both countries, strategies should aim at increasing the presence of pulses from childhood onward: exposing children to pulses from an early age could increase their long-term appreciation of these products.

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