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

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14 **Abstract:**

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

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

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

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

90 which they exist (Lo Monaco & Bonetto, 2019). Exploring and understanding social representations
91 will require cognitive and projective approaches. **The first objective of the present study was to**
92 **compare the social representations of pulses for French and Spanish consumers with different**
93 **levels of education, through a free word association task.**

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

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

119 **Material and methods**

120 *2.1 Participants in France and in Spain*

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

130 Sixty participants were recruited in France and another sixty in Spain, for a total of 120 participants.
 131 The inclusion criteria for participants in both countries were to be resident in that city, aged between
 132 25 and 65 years old, with no specific food diet (e.g. vegetarian or vegan), and without being in a
 133 situation of great economic precarity. Thus, only people living in a household where at least one
 134 person worked or received a pension, allowance, or annuity were eligible for inclusion. In Dijon, the
 135 recruitment process took place at a social center for youth and culture (*Maison des Jeunes et de la*
 136 *Culture*) over a three-week period, in 2019. This Social Center proposes cultural and physical
 137 activities for adults and children. In Girona, there was no comparable single center proposing similar
 138 activities. Thus, the study was carried out in 2019 at five different locations around the city (two
 139 cultural centers, two sports centers, and a language center), to reproduce similar recruitment conditions
 140 in both Spain and France.

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

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

Age range / gender	France			Spain		
	Level of education			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

150
 151 *2.2 Procedure*

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

155 *The study was carried out first in Dijon and then in Girona.* The same protocol was used in both cities.
 156 One of the principal researchers was present in each country to carry out data collection, translation, and
 157 to ensure that the same protocol was followed. This last point was also made possible by writing an

158 interviewer guide containing all the instructions to be given to participants. On the day of the study, the
159 interviewer asked those present at each location about their willingness to participate in the study.
160 Participants who accepted were asked to read and fill out a consent form. The study was conducted
161 individually (one interviewer and one participant at a time) and lasted around 10 minutes. The test
162 consisted of the free word association task and a short questionnaire.

163 (i) Free word association task: A pretest was carried out with the inductor word “car”, to ensure that
164 participants understood the task. The task was then repeated with the inductor word “pulses” (*légumes*
165 *secs* in French and *llegums* in Catalan). Participants were asked to say aloud five words, expressions, or
166 adjectives that came spontaneously to their mind when prompted with the inductor word “pulses”. Once
167 participants had cited five words, they were asked to rank each of their words according to perceived
168 relative importance, from 1 to 5 (1 for the word that participants considered the least important and 5 for
169 the most important). Participants then had to rate the valence of each word, by giving a score from -2 to
170 +2: very negative (-2), negative (-1), neutral (0), positive (+1), very positive (+2).

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

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

179 2.3 Analyses

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

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

206 We performed analyses complementary to the classical structural approach. First, ranks of importance
 207 were transformed into a parametric measure. The Cognitive Saliency Index (CSI), proposed by Sutrop
 208 (2001), was calculated for the analysis of word categories. This index uses frequency and average
 209 position, without taking into account the length of the word list. For the analysis of raw data, since words
 210 cited less than three times were eliminated, the modified participants' lists did not contain the same
 211 number of words, so the Saliency Index (SI) (defined by Smith and Borgatti (1997)) was preferred. SI
 212 allowed us to take into account the length of each participant's modified word list when calculating the
 213 frequency of citation and the rank order. We multiplied SI (or CSI when appropriate) by the importance
 214 that each participant had given to each word. We therefore obtained a relevance value, from 0 to 1, for
 215 each of the words cited by each participant. From these results, we could calculate the average relevance
 216 for words and word categories. This relevance measure took into account not only the importance of the
 217 word or category, but also the order in which it was mentioned, and the length of the list (only for words
 218 where the SI index was computed). Separate SI or CSI indexes were constructed for the analysis of
 219 words, and categories of words.

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

229 2.3.2 *Polarity degree index*

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

234
$$\text{Polarity Degree index (PD)} = \frac{\sum S}{O \times M}$$

235 where S = score given to each word or category by all subjects, O = occurrence (frequency) of the
236 specific word or of the total number of words within a category, M = maximum value of the scoring
237 scale (to ensure that the index can only range from -1 to +1). This index range can be interpreted
238 similarly to the one used by De Rosa, who used the scores obtained on a scale going from -1 to +1. In
239 our case, considering M value increased the precision of PD. Separate polarity degree indexes were
240 constructed for the analysis of words, and categories of words.

241 To distinguish between neutral and positive or negative scores, Rosa proposed a neutral zone from -0.04
242 to +0.04. We decided to apply a more stringent rule, and to extend the neutral zone from -0.1 to +0.1. PD
243 values between +0.1 and +1 were considered to indicate a general positive attitude towards the word or
244 word category. Similarly, PD values between -0.1 and -1 were considered to indicate a general negative
245 attitude towards the word or word category.

246 2.3.3 Questionnaire

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

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

254 Results

255 3.1. Analysis of words

256 3.1.1. Structural approach and polarity degree index

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

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

269 Five words were used in both countries, by participants at both levels of education (high and low):
270 *beans*, *chickpeas*, *good*, *health*, and *lentils*. Other words were specific to a country, at both levels of

271 education: *legumes* and *rice* were in the central core for all French participants; *food*, *healthy*, *needed*,
 272 and *protein* appeared in the central core for all Spanish participants.

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

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

300

301 **Table 2.** Word distribution for France over the four [Quadrants of the Structural Approach \(QSA\)](#): the
 302 central core (CORE), the first periphery (1st PERI), the second periphery (2nd PERI), and the contrast
 303 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
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	-	-

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

305 **Table 3.** Word distribution for Spain over the four [Quadrants of the Structural Approach \(QSA\)](#): the
306 core (CORE), the first periphery (1st PERI), the second periphery (2nd PERI) and the contrast zone
307 (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
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	-	-

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

309 3.1.2. Correspondence analysis (CA) for words

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

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

321 *Please insert here Figure 1*

322

323

324 3.2. Analysis of word categories

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

327 **Table 4.** Word categories after triangulation, with examples of words for each category, and total
328 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, <i>cocido</i> , 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

329

330 3.2.1. Structural approach and Polarity degree index

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

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

345 **Table 5.** Category distribution for France over the four **Quadrants of the Structural Approach (QSA)**:
346 the central core (CORE), the first periphery (1st PERI), the second periphery (2nd PERI) and the
347 contrast zone (CONTRA).
348

Category	Global FR				High level of education FR				Low level of education FR			
	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
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	-	-

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

350 **Table 6.** Category distribution for Spain over the four [Quadrants of the Structural Approach \(QSA\)](#):
351 the central core (CORE), the first periphery (1st PERI), the second periphery (2nd PERI) and the
352 contrast zone (CONTRA).
353

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	-	-

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

355
356 *3.2.2. Correspondence analysis for categories*

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

363 educated participants, who more frequently used words related to *variety*, *context*, *digestion*, and
364 *preparation*.

365 *Please insert here Figure 2*

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3.3. Demographic questionnaire

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

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

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

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

384 *N/A: not applicable*

385 Discussion

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

392
393

4.1. Similarities between countries

394 We identified some words and word categories located in the central core that are common to both
395 countries, unrelated to level of education. The category *pulses*, identified in the central core of the

396 category analysis for participants from both countries, contains words that are also in the central core
397 of the word analysis (*beans, chickpeas, and lentils*). As previously shown (Melendrez-Ruiz et al.,
398 2020), consumers tend to cite exemplars to confirm the meaning of the inductor word (*pulses*). These
399 results demonstrate that participants had quite clear knowledge of what pulses are. The exemplar
400 names they used correspond to the three most commonly consumed pulses in both countries. In France
401 (Solagro & RAC, 2016), the most common pulses are lentils (710 g/person/year), followed by beans
402 (610 g/person/year), while chickpeas lag far behind (76 g/person/year). In 2018 (MAPA, 2019), the
403 most commonly consumed pulses in Spain were chickpeas (1.29 kg/person), followed by lentils (1
404 kg/person), and beans (<1kg/person). The fact that no other example of pulses was cited, whether in
405 France or in Spain, shows that consumers' representations of pulses are limited in comparison with the
406 varieties of pulses available. Specific efforts should be made to promote other pulses, such as dried
407 peas, for example.

408 The *sensory* dimension was also frequent and relevant for both countries. This dimension goes beyond
409 taste and also includes physical characteristics such as color (green and brown), and texture, which are
410 important when referring to pulses. The evocation of a sensory attribute by a person does not
411 necessarily mean that this person consumes the studied food, but may indicate that liking for this
412 specific attribute is an important factor in determining appreciation of that particular food (Shepherd,
413 2001, p.117). The sensory dimension could therefore be a decisive factor in pulse consumption. A
414 study in Canada identified 'not liking their taste' as a key reason for not eating pulses (IPSOS, 2010).
415 This reason could also apply to the Spanish participants to our study, with a negative attitude toward
416 the word *tasteless*.

417 The category *preparation* is another dimension in the central core common to both countries. This
418 category contains items related to practical knowledge of pulses. In both countries, participants
419 spontaneously evoked familiar cooking methods, and named a variety of dishes made with pulses. In
420 France, the most typical dishes containing pulses are *cassoulet* (white beans with sausage), and *petit*
421 *salé aux lentilles* (lentils with pork), which are considered traditional in French gastronomy (Rio,
422 2017). In Spanish gastronomy, pulses are used in popular recipes such as *fabada* or *empedrados* (made
423 with white beans), *mongetes con butifarra* (beans with sausage), lentils with chorizo, and chickpeas,
424 served puréed, stewed, or as a main dish (Medina, 2005).

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

440 4.2. *Differences between countries*

441 Some specific word categories were located in the central core of the social representation for one
442 country only. In France, this was the case for the category *other foods*. Among the words in the
443 category *other foods*, *rice*, and *legumes* are located in the central core in the word analysis. It is
444 possible that the naming of starches by French participants could reveal knowledge about the
445 importance of combining pulses and cereals to satisfy requirements in amino acids. Yet a previous
446 study demonstrated that French consumers used pulses more often as a substitute for starches than in
447 combination with them (Melendrez-Ruiz et al., 2019), showing that they are probably not aware of the
448 principles of amino acid complementarity. Thus, the association of *other foods* with pulses in the
449 present study more probably reflects confusion between pulses, legumes, and starches. This
450 interpretation is supported by the fact that pulses were positioned in the same category as starches in
451 the French food pyramid for many years, until 2018 (PNNS, 2015).

452 For Spanish participants, the specific word categories that were located in the central core are
453 *appropriateness* and *context*. Within *appropriateness*, we found through the word analysis that *good*
454 and *needed* were particularly frequent and relevant. The frequent use of these words reveals that
455 Spanish participants consider pulses as a suitable food, adapted to many food choice situations (Mela,
456 2001). The *context* dimension can refer not only to the physical location where products are consumed
457 or bought, but also to social setting, culture, and the availability of food. This dimension defines the
458 food products that are appropriate to be consumed or not in a given situation (Schifferstein et al.,
459 2001). The fact that both groups of Spanish participants placed *context* in the central core, unlike the
460 French participants, reveals that Spanish consumers consider pulses a usual food in many consumption
461 situations. These findings are consistent with the answers to the questionnaire, which indicate that
462 Spanish participants considered pulses as being part of their childhood tastes and cultural tradition
463 significantly more than French participants did. It seems clear that culture influences not only the
464 social representation but also the perceived position of pulses as belonging to Spanish food habits.
465 This could either explain or result from their higher consumption in comparison with France.

466

467 4.3. *Differences by level of education within countries*

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

470 In both countries, words related to *convenience* were more frequent and relevant for participants with a
471 higher level of education than for those with a lower level of education. This category contains words
472 expressing convenience (*easy to prepare*, *practical*, and *non-perishable*) and inconvenience (*long*
473 *cooking*). Among these words, *long cooking* was the only one that was cited more than three times,
474 and only by French participants with a higher level of education. These results reveal that the
475 convenience of pulses is perceived differently according to the level of education, but it is difficult to
476 conclude, from our results, which participants find pulses more convenient than others. In addition,
477 when calculating the polarity index, we took into account the positive and negative values of each
478 word for each category, with the result that the *convenience* category was not identified as negative,
479 nor as extremely positive.

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

495 In Spain, participants with a higher level of education cited words in the category *digestion* a little
496 more frequently than other participants. In the word analysis, this dimension is not very salient, the
497 only word of this category cited more than three times was *flatulence*, cited in Spain with a
498 comparably low frequency by both groups, and not cited more than three times in France. The same
499 relative absence of digestive considerations was found in other studies. For example, digestive
500 considerations were not considered a key factor in deciding whether or not to eat pulses (IPSOS,
501 2010). Nevertheless, in our results, the relatively low importance of words of this category has to be
502 counterbalanced by the very negative salience attributed to the category and the words it contains. This
503 result seems to indicate that although only a few participants feel concerned about disorders
504 consecutive to the ingestion of pulses, for those who did mention *digestion*, it was considered as a
505 major drawback.

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

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

514 4.4. Methodological aspects: strengths and limitations

515 We particularly focused our analysis of results on the central core of the social representation, which
516 represents its more frequent and important elements. The central core is recognized to be simple,
517 concrete, and coherent; it reveals a system of values that bears the culture and the social norms of
518 participants (Abric, 2011). By contrast, with many studies that considered only frequency and rank of
519 importance, we chose to focus also on order of citation, using two indexes: Salience and Cognitive
520 Salience. This analysis allowed us to improve understanding of consumers' social representations of

521 pulses across different social groups. For example, it seems that there could be a learning process in
522 relation to pulses. Most French consumers are located in the first phase of this learning process, which
523 they show by citing exemplar words for pulses, names of other foods, and pulse characteristics. Most
524 Spanish consumers are more advanced in the learning process, citing words related to *health*,
525 *nutrition*, and *convenience*. It seems that consumers first need to identify the product, and then to
526 acquire more precise knowledge about what pulses are for and how to use them. We also proposed an
527 adapted calculation of the cut-off points for frequency and relevance, which took into account the
528 median, and not the average value. With this calculation, we took into account the nature of our
529 values, allowing us to perform a more satisfactory analysis. We also proposed the polarity degree
530 index, an adaptation of the polarity index, in order to obtain more precise information regarding
531 consumer attitudes toward a word or category (positive or negative).

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

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

556

557 **Conclusion**

558 This study adapted and improved the assessment of the social representations of a food product across
559 different social groups, which could constitute an interesting opportunity for future research. Our
560 results highlighted similarities and differences among the words and categories used in each country
561 and at both levels of education. Some categories were found in each subgroup, such as *health*, *pulses*,

562 *nutrition, preparation, and sensory aspects*, while other categories were specific to one country.
563 French participants mostly used words related to *food products*, while Spanish participants used
564 concepts related to *appropriateness* and *context* more frequently. In addition, we found that Spanish
565 consumers considered pulses as part of their culture and childhood more frequently than French
566 consumers. This could explain the higher consumption of pulses in Spain compared to France. In this
567 sense, culture not only influences the content of the social representation about pulses but also
568 influences the perception of consumers about pulses as belonging or not to their food habits and
569 culture. Finally, some strategies could be proposed in each country to encourage and increase pulse
570 consumption. In France, for example, it would be helpful to increase not only knowledge about
571 nutrition and health with regard to pulses, but also know-how regarding buying, cooking, and
572 combining pulses. In Spain, it could be interesting to promote pulses as a product that is considered
573 culturally important for consumers (by popularizing this message throughout the population). For both
574 countries, strategies should aim at increasing the presence of pulses from childhood onward: exposing
575 children to pulses from an early age could increase their long-term appreciation of these products.

576

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692

Figure 1

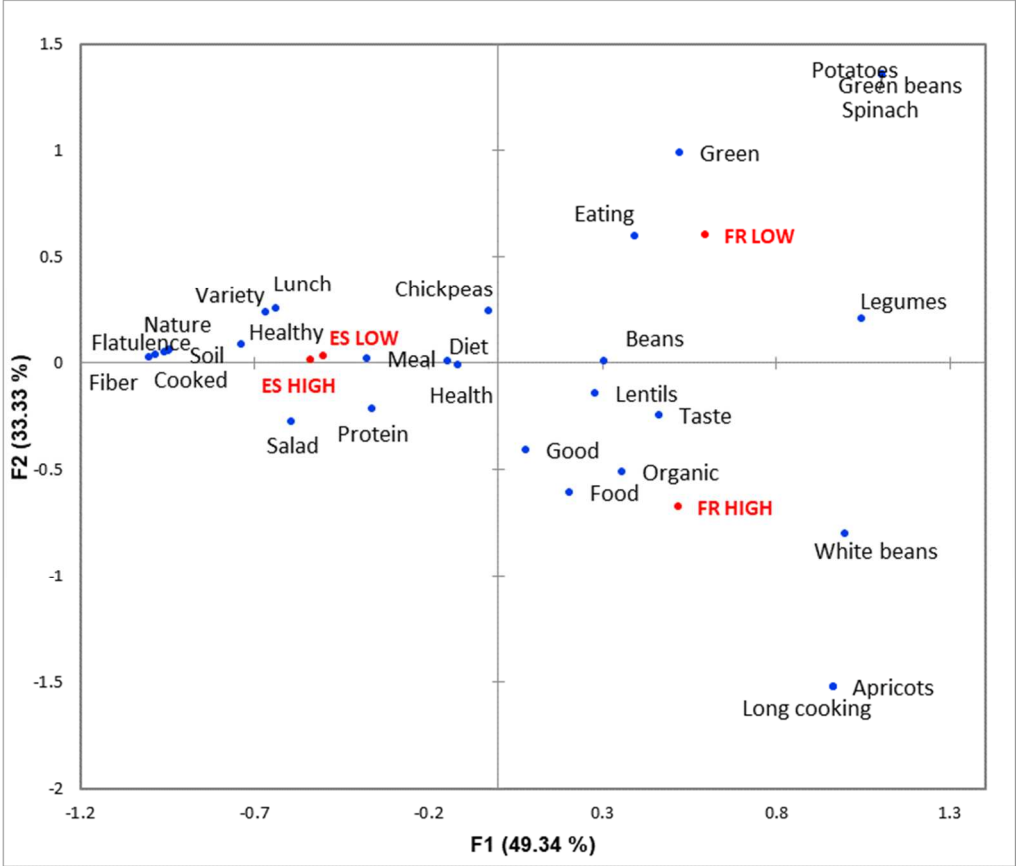


Figure 2

