Perception of oyster-based products by French consumers. The effect of processing and role of social representations

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Abstract:

The search for new markets in the seafood sector, associated with the question of the continuity of raw oyster consumption over generations can be an opportunity for processors to extend their ranges with oyster-based products. The twofold aim of this study was to evaluate the impact of processing and social representation on perception of oyster-based products by French consumers and to identify the best means of development in order to avoid possible failure in the market. Five products with different degrees of processing (cooked oysters in a half-shell, hot preparation for toast, potted oyster, oyster butter and oyster-based soup) were presented within focus groups and consumer tests, at home and in canteens with the staff of several companies in order to reach consumers with different ages and professional activities. The results showed that social representation had a strong impact and that behaviours were contrasted according to the initial profile of the consumer (traditional raw oyster consumers or non-consumers) and their age distribution (younger and older people). The degree of processing has to be adapted to each segment. It is suggested to develop early exposure to influence the food choices and preferences of the youngest consumers on a long-term basis.

Highlights

► Orientations for the development of oyster-based products on the French market. ► Social representation has a strong impact on perception of oyster-based products. ► Eating or not raw oyster modifies consumer behaviour. ► Two different markets according to consumers' expectations and age distribution. ► The degree of processing has to be adapted to each segment.

Keywords : Oyster ; Processing ; Consumer perception ; Disgust ; Social representation

1. Introduction

Of the European countries that produce oysters, France is the leader with around 113,000 tons (France Agrimer, 2010) and ranks fourth at the world level after China, Japan and Korea. France has the characteristic to sell nearly all its production on the national market. Oysters (*Crassostrea gigas*) are a traditional product mainly consumed in their live form, and in spite of the producers' efforts to extend the period of consumption, they still remain a seasonal product for the French market, with a peak of consumption between Christmas and New Year's Day (Girard & Mariojouls, 2003). Therefore, in French food culture, oysters belong to the category of rare and luxury foods. A recent survey on household consumption (Panel Kantar Worldpanel) conducted in 2009 for France Agrimer (2010) showed that only 21% of households bought oysters at least once a year even though two thirds of the French population consume the product. This study also confirms a certain stability in consumption, as well as the importance of "cultural", "economic" and "demographic" factors in consumers' behaviour, as already observed by Girard and Mariojouls (2003). The consumer profile for fresh oysters is essentially a person over the age of 50, in an upper income bracket, living in the West of France and generally in a household of two people. On the contrary, non-consumers

51 of oysters, generally among the youngest, consider that this product is too costly and difficult

52 to open, and the specific characteristics of oysters (live, raw and viscous) play a part in

53 developing a certain aversion to this product. This difference in behaviour between young and

54 senior purchasers may lead to a deficit in the recruitment of "new" consumers, and perhaps

55 ultimately leading to critical questions regarding the future of oyster consumption. How can

56 the continuity of oyster consumption be guaranteed down through the generations? This

57 question highlights the importance of promoting the product with young people, but perhaps

58 also of diversifying the range of oyster-based products. This search for new markets could

59 also be an opportunity for processors to extend their range of seafood products.

60 However, to find the best ways to develop and to avoid possible failure in the market, it is

61 necessary to take into account as early as possible the psychological barriers related to oyster

62 consumption and to analyse the potential for processed oyster-based products through

63 consumer perception. Understanding consumer reactions to new products is especially

64 interesting in the case of oysters as they are known to cause extremely marked reactions.

65 Many non-consumers are disgusted by oysters because of their appearance and the

66 consumers' unwillingness to consume something alive and viscous. In the literature, "disgust"

67 deals specifically with animal substances *versus* plant substances because of the moral

68 dimension linked with their ingestion by eaters, as shown by Rozin and Fallon (1987). In

69 other respects, Kolnai (1998) has identified these two physical characteristics, alive and

70 viscous, as the most common and strongest sources of disgust. French consumers naturally

71 ingest raw, live oysters thanks to French culture which allows them to "appropriate" these

72 particular sensory qualities by classifying them in the category of rare, luxury and healthy

73 food. The feelings of disgust are strongly reduced by the fact that when ingesting oysters a lot

74 of other, generally positive, symbols are ingested at the same time. Fischler (1990) showed

75 that food ingestion is not an ordinary action but one that always has a symbolic dimension.

76 Thus, when eating raw, live oysters, French consumers in general, and those traditionally seen

77 as "oyster eaters" in particular, consider that they are "drinking the sea", conjuring up iodine

78 and all the images of naturality, purity, lightness and freshness associated with this shellfish.

79 In short, the social representations associated with oysters by consumers identify a healthy

80 and refined food (Debucquet and Merdji, 2004). On the contrary, part of the population

81 retains a very strong aversion towards oysters and their physical properties, all the more so if

82 they did not eat raw oysters often and at a young age in their food education.

83 Processed oysters could thus be a way of removing these fears. In that case, however, it is

84 necessary to analyse expectations and the associated overall perception. Many studies have

85 indeed shown how information or the visual appearance of food influences flavour

86 recognition or overall liking and generates expectations (Mojet and Koster, 2005; Kole, 2009;

87 Delwiche, 2004); a contrast between expected and actual sensory qualities can induce a strong

88 negative affective response focusing on the unexpected sensory qualities (Yeomans *et al*.,

89 2008). In the case of oyster, the context of the first tasting or first "experience" (Faurion,

90 1996) contribute strongly to previous social representations associated with this kind of food

91 and could influence the expected sensory qualities.

92 In this context, could processing overcome the impact of representations and sensory barriers

93 associated with oyster in non-consumers? Or would deep-seated reasons still prevent

94 consumption for non-consumers? On the other hand, would a traditional consumer of fresh

95 oysters be ready to accept a processed product with the risk of losing certain attributes, such

96 as "natural" and "authenticity"? From a theoretical perspective, this problematic leads to

97 analysis of the phenomenon of anchoring as described by Moscovici (1961), that is, how the

98 perception of new products and their sensory qualities are determined by previous

99 representations and the social value associated with this food, which is called by Jodelet

100   (1994), the "already in mind". As this topic has received little attention in the literature on

101   sensory and hedonic evaluation, this article will try to fill the gap.

102   The general objective of the paper was to analyse and understand the key drivers in oyster or

103   based-oyster products consumption with a twofold research objective: evaluating the impact

104   of processing and social representation on hedonic perception. To achieve these objectives, a

105   complementary approach was applied. A qualitative approach through individual interviews

106   and focus groups was carried out to catch the conscious and unconscious elements in the

107   consumer perception. Then consumer tests were performed on five oyster-based products in

108   two situations of consumption in order to reach a large range of population in term of ages

109   and professional activities (students and active workers in canteens and families with children

110   and teenagers at home). Products were collected from three seafood companies, partners in

111   the project. The range of products making it possible to illustrate the influence of the degree

112   of processing was composed of a frozen, cooked oyster in a half-shell (C) and four sterilized

113   products presented either in cans for soup (S) hot preparations for toast (T) or in glass jar for

114   oyster butter (B) and potted oyster (P). Oyster was entire in the case of C product, mixed in T,

115   B and P products and some pieces of oyster were present in S product. Table 1 gives the main

116   ingredients and characteristics of each product. A preliminary study with a trained panel

117   showed a wide range of sensory characteristics (Cardinal & Debucquet, 2010) : in appearance,

118   from smooth, light and homogeneous (P, B) to a more complex product with small pieces and

119   dark colour (T and S); in texture, from a liquid (S) to a paste with different degrees of fat

120   perception (B, P, C); in odour with specific marine notes such as seaweed (T) to vegetable (S)

121   or garlic (B, P) or onion and wine for C; in flavour, from marine notes such as seaweed (T, S)

122   to butter and garlic, especially for B and P. The final objective was to identify if in the range

123   of processed products presented, some of them were mainly adapted to a specific target of

124   consumers.

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Study 1: Qualitative study - Individual interviews and focus-groups -

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Method

After a first, exploratory stage with in-depth and individual interviews (10 people), four

focus-groups of 8 people each (in total 32 people) were made up. During focus-groups, the

five products were presented and tasted by the subjects but several projective exercises and

open questions were introduced in order to induce spontaneous evocations and collect

references to the unconscious, as suggested by Moliner (2001) as a means of accessing social

representations. Each focus-group lasted on average 2 h 30. This qualitative stage aimed (1) at

identifying the main factors involved in the consumption or non-consumption of oyster-based

products, especially those related to previous social representations associated with oysters

and to the recipe itself (the perceived compatibility of the ingredients with oysters, the impact

of the degree of oyster processing on acceptability) and (2) to set up hypotheses to be tested in

the questionnaire (study 2). Subjects were recruited in the Pays de Loire area and the sample

was an equal distribution of age classes, gender, educational level and oyster consumers (C)

versus non-consumers (NC). For the recruitment, consumers were informed that the session

was a discussion on seafood products with a taste session (no information was delivered on

the kind of the products) and therefore they were invited to tell what products they generally

consumed and what products they never consumed. They did not know that the session

focused on oyster.

In addition, a comparative test on taste perception was implemented during the focus-groups,

inspired by the psychophysical experiment by Morrot *et al*. (2001) on odour perception.

These authors investigated the interaction between the vision of colours and odour perception

through lexical analysis of experts' wine tasting comments. A white wine artificially coloured

150 red with an odourless dye was described as a red wine in olfactory terms. Analysis showed

151 that the odours of a wine are, for the most part, represented by objects that have the colour of

152 the wine. In our experiment, subjects were offered two samples of the five oyster-based

153 products. The first was a blind test (subjects were told that it was seafood products); for the

154 second, the same five products were offered but they were presented as novel products

155 prepared with oysters. This comparative test was not strictly a sensory test but a projective

156 exercise (Donoghue, 2000) to stimulate verbalization. The aim of this part of the focus-group

157 was in fact to evaluate the influence of previous representations associated with oysters on

158 product perception, especially taste descriptors, and, at the same time, to compare perceptions

159 and assessment of oyster consumers in comparison with non-consumers.

160

161   Data analysis

162 An analysis of themes, sub-themes and lexical universes was carried out with data collected

163 during the focus-groups and individual interviews, and, more particularly, the comments of

164 subjects at both stages of the comparative test.

165

166   Results : Impact of oyster representations on hedonic perception of processed products

167 The lexical analysis of the comments collected during the comparative test showed huge

168 discrepancies both between the first test (blind test) and the second test (the subjects were

169 informed that the products were oyster-based products) and between oyster consumers and

170 non-consumers. The results showed that taste perception is not only dependent on the first

171 sensory experience but also on the pre-existing representations associated with oysters. Taste

172 perception and, more particularly, taste descriptors effectively changed considerably between

173 the first and second tests:

174   •   we observed that taste initially perceived as *"insipid"(10)[1]*, mainly among the non-

175   oyster consumers (NC) and mostly recruited from young subjects **became** in the second test

176   *"strong"(7), " too strong"(5), "bitter"(3), "acid"(3),* that what was called *"an indefinable*

177   *taste"(9)* **became** *"strange"(7), "doubtful taste"(4), "a bad aftertaste"(4),* and lastly that a

178   texture initially perceived as *"soft"(3), "thick"(8)* or *"heavy"(7)* **became** *"jelly-like"(9),* and

179   *"viscous"(11).* All in all, the lexical registers used after being told of the presence of oysters

180   in the recipes showed that simply mentioning oyster revived the main sources of disgust

181   produced by the consumption of raw oyster, that is: viscosity, stickiness and alive;

182   •   on the other hand, the change in lexical register for taste, perceived first as *"good"* (9)

183   or *"pleasant"(11)* and becoming *"not fine or exquisite enough"(5), "not high-class*

184   *enough"(6)* is mainly observed among the consumers (C). Moreover *"Taste of the sea"(11)*

185   **became** for them *"good taste but not strong enough because we don't recognize the taste of*

186   *oyster enough"(8)* or sometimes *"not natural enough"(7), "chemical"(3)*, and lastly a

187   *"delicious and creamy texture"(8)* **became** *"like boiled and over-cooked oysters"(6).* All in

188   all, these quotations highlight that all the dimensions confer oysters, in the mind of French

189   oyster eaters, with the status of a refined, exceptional and natural dish.

190

191   Beyond these differences, the products were less appreciated during the second test by both

192   oyster consumers and non-consumers as proved by highly negative comments and bigger

193   amount of leftovers. The subjects were expecting to find oyster-based products *"less fatty"*,

194   *"less pasty"* and, in some opinions, *"the fatty texture suggests that it was fatty oysters or*

195   *oysters with soft roe".* These last quotations confirm that oysters are perceived by most

196   people as a diet and healthy food. In others words, in their mind, fat is not compatible with the

197   representations associated with oyster, that is, hints of the sea, coast, iodine, and mineral salts.

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[1] For the two groups (NC and C) constituted of 16 persons (2 focus-groups of 8 persons each), the number in bracket represents the number of citations of each term.

198   A second part of the focus-groups was dedicated to identifying the boundaries of acceptability

199   as regards recipes and ingredients. As presented in the methodology part, a creativity exercise

200   was implemented during the focus-groups in order to understand what kind of recipes would

201   be accepted or rejected by consumers, according to the nature of the ingredients (meat, fish,

202   fruits, vegetables, dairy products, etc.) and the level of processing of oysters.

203   •   Concerning ingredients, the results demonstrated that the association between oysters

204   and meat was rejected by almost everybody. This is an illustration of the impact of cultural

205   habits on acceptability and more particularly of French habits. As oysters are commonly eaten

206   in a raw, live form, the association with meat appears definitively dissonant because of the

207   mixture of "substances", especially "land substances" and lives "sea substances": *They are*

208   *two different species, from land and sea. So, no! […]. And moreover, meat is a living*

209   *substance, as are oysters... That is definitely incompatible!"*. The case of red meat provoked

210   the greatest disgust, because of the blood: *Red meat is not fully dead, it is still a little bit*

211   *alive. Look at the blood!"*[2]. The risk arising from this quotation is clearly a symbolic risk and,

212   very logically, white meat (such as pork or chicken) or "reified" meat like ham were better

213   accepted in the recipe with oyster-based products. Lastly, vegetables, as more neutral

214   ingredients, or fish, as ingredients from the same universe, did not raise any problems.

215   •   Concerning the level of processing of oysters and therefore the texture of oyster-based

216   products, the participants in the focus-groups stressed the need to clearly identify each

217   ingredient with regard to the issues of mixing "substances". Consumers and non oyster

218   consumers turned down products that were overly processed, of the paste- or blended-type, as

219   they played a part in excessively denaturing the oysters and were perceived as industrial and

220   suspicious products. While the ideal recipe for the oyster consumers was the cooked oyster in

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[2] Historians have analysed the importance of the beliefs associated with red meat and blood, especially during the pre-scientific period (Darnon, 1999). A recent research project dedicated to the perception of food germs has shown that blood in red meat is still nowadays perceived as risky because of the survival of the belief in "spontaneous generation" among lay persons (Debucquet, Merdji, Fischler, 2007).

a half-shell, because it maintained a symbolic proximity to raw oysters (*"Great! They remain in their shell! They look fresh even if they have been frozen!"*), on the contrary, non-consumers looked for intermediary products, neither too mixed and without big pieces of oyster to keep a symbolic distance from the sources of disgust.

• Regarding sanitary risk, it is interesting to note that during the focus-groups and after presenting the processed oysters, none of the non-consumers spontaneously tackled this issue. Surprisingly, the processing of oysters removed all the fears and anxiety about sanitary risk because the "*oyster is dead*", that is, in the subjects' minds, in biological and symbolical terms. On the contrary, more people among the raw oyster consumers were suspicious of processed oysters because the process was always perceived as a "denaturation" of the oyster, necessarily using additives and preservatives.

In conclusion, the results of the qualitative study revealed huge differences in the mechanisms of perception of oyster-based products between consumers and non-consumers. Our data suggest the importance of previous representations associated with raw oyster on processed oyster perception in terms of taste, recipe acceptability and risk perception.

Study 2: Quantitative study - Consumer test in real consumption situations -

In staff canteens

Method

Consumer panel

The French multinational corporation Sodexo, one of the largest food service companies in the world was a partner in the project and offered the opportunity to test products in different staff restaurants. The context of restaurant was particularly interesting because oysters are, in France, almost always consumed in the setting of a social and shared meal. The companies

247   were chosen according to their location and their field of activity in order to reach consumers

248   with different profiles. Three cities that differ from one another in terms of distance from the

249   sea were selected: Nantes, Tours and Lyon. Ifremer, a Marine Research Institute with a

250   consumer population involved in marine questions and the Ecole des Mines , a school of

251   Engineering mainly composed of young consumers, were the two companies chosen in

252   Nantes to test products in their Sodexo restaurants. In Tours, the company selected was

253   Sanofi, from the pharmaceutics sector, and finally Areva, a company working in the nuclear

254   field, in Lyon made it possible to test people in the research department. The four self-service

255   restaurants were different in terms of their mean numbers of daily customers and finally the

256   number of participants in the consumer test was respectively for each restaurant, 155, 177, 87

257   and 62. The whole panel's characteristics included the four canteens are presented in Table 2.

258   The amount of oyster eater in this population reached 76%.

259

260   Procedure

261   Tests were performed between December 2009 and April 2010. Products were prepared in

262   each self-service restaurant according to industrial recommendations and were presented at

263   the entry of the restaurant on a plate prepared for each customer. To lighten the test for

264   consumers, the five products were presented on two successive days with a presentation of

265   three products the first day (P, S, T) and two products (B, C), the second day. Products were

266   presented simultaneously on the same plate and consumers tasted the products according to a

267   balanced order in the questionnaire. As the tests lasted for two days, all consumers did not

268   taste necessarily all the products. Each person was informed that the products were oyster-

269   based products and was invited to test them during their lunch. Customers were free to take

270   them or not. After acceptance, the same questionnaire was distributed in each restaurant to

271   collect their opinion. They were invited to give a few negative and/or positive words after

272   tasting each product and to rate their overall liking with a score from 0 to 10: dislike

273   extremely (0), like extremely (10) and to express their perception of naturality, not at all (0),

274   quite natural (10). Personal information such as age, gender, educational level and consumer

275   (C) or non-consumer (NC) of raw oyster was asked for at the end of the session. In the paper,

276   NC refers to non-consumers of raw oyster, the traditional way of eating oysters in France.

277

278   Data analysis

279   Consumer data results were expressed as a mean ± standard deviation (SD). In consumer test,

280   estimation of the effect of each variable (social and demographic characteristics, traditional

281   oyster consumer) on overall liking was performed by analysis of variance on all consumer

282   scores with products and each of these variables as independent factors. The main effects and

283   interaction between factors were tested. The analysis of qualitative data (negative and/or

284   positive words associated to each product after tasting) was only performed on questionnaires

285   from the home tests where description was more detailed and richer than in restaurants.

286

287   Results : Overall liking and hedonic perception in staff canteens

288   The scores for overall liking and "naturality" attributed by consumers to each product are

289   presented in Table 3. The general mean for overall liking scores for all consumers highlights a

290   significant difference between the products. The cooked oyster in a half-shell obtained the

291   highest score (6.9 ± 1.9) followed by soup (6.2 ± 2.4), potted oyster (6.1 ± 2.1), hot toast (5.9

292   ± 2.2) and finally oyster butter (5.7 ± 2.0), but no significant difference appeared between the

293   last three products. Food habits related to raw oyster consumption had a significant effect

294   (p=0.03) on overall liking as traditional raw oyster consumers gave higher scores to products

295   compared to those of non-consumers. No interaction appears between the variables "usual

296   oyster eater" and products which means a same general trend in overall liking for C and NC.

297   Analysis of variance performed over all the consumer data of liking with products and gender

298   as independent factors did not show any significant difference between scores attributed by

299   women or men (p=0.43). Educational level and age did not lead to a significant difference

300   either, (p=0.11and p=0.79, respectively).

301

302   *At home*

303   Method

304   Consumer panel

305   145 consumers from 68 households on the Tastenet panel took part in the study. The Tastenet

306   panel was composed of volunteers for consumer tests at home on fish and fish products

307   selected by the French Research Institute Ifremer through the company's staff (friends,

308   family, neighbours). The answers of all family members older than 11 years were taken into

309   account. The majority of theses families lived in an urban area (Nantes). The main

310   characteristics of this at home consumer panel are presented in Table 2.

311

312   Procedure

313   Consumer tests were performed between March and April 2010. Families were provided with

314   the five oyster-based products (here, in their packaging) and a questionnaire for each product

315   and each family member. There was a total freedom to choose the order of consumption of

316   the 5 products as well as the time and the situation of consumption but it was recommended

317   that the products be tested one by one on different days depending on the choice of the family

318   and that the product be prepared according to the directions for use on the packaging. The

319   consumption was organised with the family members previously identified in this home. The

320   same questionnaire as at the self-service restaurants was presented.

321

322   Data analysis

323   The same kind of analysis was applied on overall liking data obtained in staff canteens and at

324   home. Qualitative information obtained from the open questions, especially the negative

325   and/or positive words associated with each product that respondents were asked to provide

326   after tasting, was analysed using textual analysis software called ALCESTE[3] version 2010.

327   This software makes it possible to treat corpora of discourses and to separate statements into

328   classes, using a downwards-hierarchical classification on the basis of co-occurrence of words

329   (Reinert 2002). The classification of the respondents' terms established by ALCESTE was

330   based on the idea that the words used by each respondent were chosen according to his or her

331   particular mental space that constitutes the person's framework of reference (Reinert 1993).

332   When data comes from a panel of respondents, it helps to analyse social representations, each

333   class of word used often unconsciously by respondents then resulting from an anchoring

334   process (Debucquet, 2011), in accordance with the theory of representations developed by the

335   French school of social psychology (Moscovici 1961; Jodelet 1994; Moliner 2001) which

336   shows how representations are embedded in a social and cultural context. This analysis was

337   performed on questionnaires from the home tests where description was more detailed and

338   richer. Moreover, Chi-square tests were carried out by ALCESTE software to identify

339   significant associations ($p<0.05$) of each class of words with oyster-based products,

340   sociodemographic profiles, and oyster consumers (C) or non-consumers (NC).

341

342   Results : Overall liking and hedonic perception at home

343   Even if our research is not focused on the consumption context effect, previous studies have

344   shown differences in overall liking between at home test and other situations, it is the reason

345   why results from at home are presented separately. The results of the consumer tests

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[3] Analyse des Lexèmes Co-occurrents dans les Enoncés Simples d'un Texte (Analysis of co-occurent lexemes in simple wordings of a text)

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346   performed at home showed the same order in overall liking as those obtained in staff canteens

347   but the scores attributed were generally lower, except for cooked oyster (Table 4). The highest

348   scores were attributed to cooked oyster and soup with a mean score of 6.9 ($\pm$ 2.0) and 5.6 ($\pm$

349   2.6) respectively. No significant difference appeared between the other three products. A

350   higher perception of naturality was also associated with the preferred products. In this test,

351   even though oyster consumers, also called "oyster eaters", had better rated soup and potted

352   oyster, the difference in overall liking between "oyster eater" and non-oyster consumer was

353   not significant (p=0.29). As observed in the restaurants, gender and educational level did not

354   affect the overall liking scores. On the other hand, age had a significant effect $F_{4,4} = 4.5$,

355   p=0.001 and the youngest consumers generally attributed lower scores, especially to the soup,

356   hot toast and cooked oyster compared to the upper age class. It is also interesting to note the

357   frequency of refusal for each product (Table 4). Cooked oyster, hot toast and soup were the

358   products with the highest frequencies of non-consumption, respectively, 17.1 %, 14.5% and

359   13.0% of the whole panel compared to 4.8% and 4.1% respectively for potted oyster and

360   butter. Generally this refusal came from the youngest fraction of the population tested, in this

361   case, the children in the families and also from the non consumers of raw oyster (Table 4).

362   Once the consumption barrier had been removed and the product tested, consumers provided

363   their hedonic evaluation through a score for overall liking as well as the main descriptors

364   describing the positive and/or negative characteristics for each product. The results from the

365   ALCESTE data processing made up of positive and negative words collected through the

366   open questions in the questionnaire gave some explanations to the perception and overall

367   liking of each product. From the positive evocations provided by the subjects, 2655 specific

368   words were analysed and 74% of the statements classified into 3 classes (Table 5). The largest

369   class (Class 1 – 55.0 % of classified statements) focused on the taste of oyster as socially

370   perceived in France: a refined and exquisite taste, combined with the image of a festive, rare

15

371   and luxury food. The second (Class 2 – 37.0%) deals with the texture and appearance of the

372   products in relation to convenience issues (ease of preparation, easy to spread). The last, and

373   smallest (Class 3 – 8.0%), expresses the need to compare these unknown products with more

374   familiar fish products, such as fish soup and potted fish. Table 5 gives the significant

375   associations ($p<0.05$) between these classes and variables as products, socio-demographic

376   profiles and consumer type (C or NC). The butter was associated with class 1, the soup with

377   class 3 and the cooked oyster in a half-shell with class 2. Moreover, older people, men, "raw

378   oyster eaters" (C), and those introduced to oysters early (before the age of ten) were

379   significantly associated with class 1, young people, women, students, and those introduced to

380   oysters rather late (after the age of 20) with class 2, and lastly, people of intermediary age

381   introduced late to oysters with class 3. These results highlight the opposition between younger

382   and older generations regarding food issues (convenience and innovation as regards recipe

383   and way of consumption (aperitif, short meal with friends) *versus* search for taste and

384   authenticity) and specifically the influence of oyster consumption ("non-oyster eaters" *versus*

385   "traditional oyster eaters").

386   From the negative evocations provided by subjects, a larger corpus of 3099 specific words

387   was analysed and 61 % of the statements were classified into 4 classes (Table 6). The largest

388   class (Class 1 – 37.0% of the statements classified) contains a lexicon highlighting doubt,

389   fear, and anxiety towards the products as if exposure to oyster-based products would

390   reactivate all the fears associated with raw oyster consumption. Class 2 (29.0 %) focuses on

391   the dissonance resulting from the fatty and pasty characteristic of certain products, perceived

392   as sticky and sickly ("too much cream and butter"). In consumers' minds, oysters are a light,

393   healthy product with small quantities of fat. Class 3 (25.0 %) deals with the taste of the oyster

394   itself, oyster consumers conflicting with non-oyster consumers. The former were deeply

395   concerned about the tastelessness and weak oyster taste of the products whereas the latter

396 often judged the taste of oyster to be "too strong". Lastly, the smallest class (Class 4 – 9.0%)

397 focuses on the disgust induced by the presence of big pieces of oyster in the processed

398 products. Concerning the significant associations, the soup and hot toast were associated with

399 class 1, the butter and potted oyster with class 2, the cooked oyster in a half-shell with class 3,

400 and the potted oyster with class 4. These results are consistent with the sensory

401 characteristics previously described by a trained panel (data not shown). Moreover, cooked

402 oyster consumers, born inland and introduced very late to oyster consumption (after the age of

403 36) were significantly associated with class 1, the "raw oyster eaters" (C) from coastal areas

404 and older people with class 2, young people and students with class 3 and lastly the non-

405 oyster consumers (NC), neither raw nor cooked, with class 4. Once again, these results

406 highlight the impact of previous representations on hedonic evaluation and overall liking,

407 which translated into two opposite lexicons referring to two segments of population, "oyster

408 eaters" and non-consumers.

409

410 **DISCUSSION**

411 We proposed in this paper to inquire on the key drivers in oyster or based-oyster products

412 consumption and more specifically to focus on the impact of processing and social

413 representation on hedonic perception. Theoretical and methodological issues will be discussed

414 with regards to main results of the different studies.

415

416   ***Theoretical issues***

417 To review the expected results briefly: it was anticipated that processing oysters would

418 decrease disgust among non consumer of raw oysters (NC) and that, at the same time, social

419 representations associated with raw oyster consumption would influence hedonic perception

420 of oyster-based products both among consumers (C) and non consumer (NC). Analysis of

17

421   data from opened questions (study 2) revealed major differences between consumer (C) and

422   non consumer (NC) as expected. Indeed, significant associations ($p<0.05$) between lexical

423   classes, products, socio-demographic profiles and consumer type have been found. Consumer

424   (C), older people and those introduced to oyster early were associated with both a class

425   (positive associations) focused on refined and exquisite taste of some products and also a

426   class (negative associations) focused on the tasteless and weak oyster taste of others products.

427   On the other hand, non consumer (NC), young people and people introduced late to oyster

428   were associated both with a class (positive associations) focused on convenience issues but

429   also with a class (negative associations) focused on anxiety, fear and doubt, oyster-based

430   products consumption reviving unconsciously the main sources of disgust (live, viscous and

431   sticky properties) associated with raw oyster consumption. The comparative test (blind test *vs*

432   test with information) (Study 1) performed during focus-groups confirmed these results when

433   comparing statements of consumers and of non consumers. Our results match previous

434   research on how the congruence or not of expected and actual flavour has an influence on

435   hedonic evaluation (Yeomans *et al*., 2008). Expanding on what Faurion (1996) wrote,

436   "flavour is not an intrinsic property of a stimulus but the meeting of a food and an eater", our

437   research contributes to better understanding of how previous representations predetermined

438   hedonic evaluation. This issue of expected *versus* actual flavor seemed to be crucial but

439   covered different meanings according to the kind of consumers (C) versus (NC), in

440   accordance with the theory of social representations and especially the anchoring process

441   (Moscovici, 1961). Finally, our results match and enrich those of Desmet and Schifferstein

442   (2008), who described the impact of positive and negative emotions on food experience, taste

443   perception being namely influence by sensory attributes, experienced consequences,

444   anticipated consequences and personal or cultural meanings; here the impact of social

445 representations associated with oyster consumption, and more broadly speaking, the status of

446 this kind of food in culture have been highlighted.

447 If we consider now the overall liking of the processed products measured in restaurant and in

448 home (study 2), results showed the same order in the overall liking ranking, with significant

449 differences between cooked oyster (C) and soup (S), the two preferred products and potted

450 oyster (P), hot toast (T) and oyster butter (B), the three less preferred ones. The ranking of

451 products according to the criteria of "naturality perceived" is in the same order and identical

452 in both situations again and is congruent with the opposition observed in previous sensory

453 characterization. This result highlights the importance of the recipe and the nature of

454 ingredient on the perception; the more the recipe is natural the more the image of the product

455 appears congruent with the positive images associated with seafood and sea more widely, as

456 presented before and confirmed with the creativity exercise during focus-groups (study 1).

457 In accordance with these results, data collected through open questions in the questionnaire

458 (study 2) arose also the fat issue and mainly the incompatibility of fat with oyster. This result

459 gave an other illustration of the importance of social representations associated with oyster,

460 their status in French food culture, their health value, and their source (images of the sea). As

461 mentioned in introduction, oyster is perceived as a luxury and refined food, partly because of

462 its healthy properties, real but also assumed because of the positive imaginary associated with

463 seafood.

464 Regarding the relationship between consumer profile and overall liking, results of both tests

465 (at home and restaurant test) did not show any effect of gender and educational level.

466 Contrary to raw oyster consumption which can participate, according to the expression of

467 Bourdieu (1979) in a mechanism of "distinction", oyster-based products seem to have lost

468 their prestigious status because of the industrial process in itself and exactly like for triploid

469 oysters (Debucquet & Merdji, 2004). However some contradicting results have been observed

470 concerning the influence of others variables on overall liking and especially the type of

471 consumer (C) vs (NC) and age. In restaurant test, food habits related to raw oyster

472 consumption had a significant effect (p=0.03) on overall liking (scores of consumer (C)

473 higher than scores of non-consumer (NC)) while no significant effect has to be noticed

474 regarding home test. This difference could be attributed to a smaller panel size in home test

475 compared to restaurant test. Conversely, age had a significant effect ($F_{4.4}=4.5$, p=0.001) on

476 overall liking (scores of youngest consumers lower than oldest ones) while no significant

477 effect has been noticed in restaurant test. The higher rate of under 25 years-old consumers,

478 27.6% at home vs 14.6% in staff restaurants, could explain this difference. Results from

479 focus-group and opened questions in study 2 are consistent with the study of Girard &

480 Mariojouls (2003) namely the relation between the type of consumer and age; oyster eaters

481 being more frequent among people over the age of 50 while non consumer were more often

482 recruited among the youngest.

483 This question arises more widely the issue of first exposure and first tasting and their impact

484 on further sensory experiences as analyzed mainly with children (Loewen and Pliner, 1999).

485 Individuals' memories of flavour from childhood are typically for foods that are remembered

486 as very palatable or very unpalatable (Barker, 1983). During individual interviews and focus-

487 groups, most of the non-consumers who felt a strong disgust for raw, live oysters were

488 exposed rather late (in average, after 18 years old) to this kind of food unlike the consumers

489 who were used to eating it from a young age, sometimes in the first years of their live even.

490 Thus, it appears that the earlier the subjects were exposed to raw, live oysters, the less they

491 considered them unpalatable and the more willing they were to taste these new oyster-based

492 products.

493 Finally, these results bring up the question of the role of both first tasting and social

494 representations, especially for non consumers having to face with a previous disgust for the

495   animal itself. Martins and Pliner (2005) have shown in the case of food from animal origin the

496   impact of beliefs on hedonic perception, as well as the impact of the assumed negative

497   consequences of eating such foods on acceptation or rejection. The frequency of refusal for

498   each product in home test (study 2) gave interesting information: cooked oyster (C), hot toast

499   (T) and soup (S) are products with the highest frequencies of non-consumption, respectively

500   17.1 %, 14.5% and 13.0% compared to 4.8% and 4.1% for potted oyster and butter.

501   Moreover, this refusal came from the youngest fraction of the population tested, children in

502   the families and also from non-consumer (C). These results seem to be relevant: disgust and

503   refusal is more associated with products close to the original form of animal (cooked oyster in

504   half-shell) or containing small pieces of oyster (hot toast and soup). These results highlight

505   here again the impact of processing, as a way to "reify" more or less strongly oyster, on the

506   acceptability of the oyster-based products.

507

508   *Methodological issues*

509   This complementary approach, including a preliminary sensory analysis with a trained panel,

510   individual interviews and focus groups, and consumer tests made it possible to triangulate the

511   results. Qualitative results from individual and group interviews matched closely those of

512   consumer tests, particularly the open questions included in the questionnaire and scores of the

513   overall liking for the five oyster-based products. On the other hand, the preliminary sensory

514   approach made it possible to bridge some product characteristics, through descriptors, and

515   overall consumer liking, with the latter strongly dependent on the consumption or not of raw

516   oysters. For instance, a strong odour/taste of garlic or seaweed can be valued by non-

517   consumers and symmetrically rejected by consumers: for the former, it was an original and

518   new odour/taste that did not recall that of oyster, whilst for the latter, it was a "tasteless"

519   product because they did not recognize the "genuine taste of oyster".

520   One last methodological consideration could be the impact of the tests 'context on the overall

521   liking. Initially, we choose two contexts for the tests, home test and staff canteens test, to

522   reach various profiles of consumers in terms of age, gender and professional activities, active

523   workers, students, teenagers living still in their family, etc. Even though the effect of the

524   context was not a main objective of our research, we can note that the ranking of the overall

525   liking of the 5 products was the same in both cases but the scores attributed at home were

526   generally lower than those given in staff restaurants. Most of the studies where Standardised

527   Situation Tests (SST) and Home Use test have been compared reported higher liking scores in

528   SST than in HUT scores (Boutrolle, Arranz, Rogeaux, & Delarue, 2005; Kozlowska et al.,

529   2003; Murphy, Clark, & Berglund, 1958). However, in a few cases, the reverse has been

530   observed (Daillant-Spinnler & Issanchou, 1995; Hellemann, Mela, Aaron, & Eleri Evans,

531   1993). For example for high fat version of a cream cheese, consumers were more severe at

532   home than in laboratory. Authors argued "that assessors overestimated the products in the

533   laboratory because during home consumption consumers refer to a broader range of products

534   (i.e. other brands)" and also "the possibility that assessors like to please the experimenter

535   when they rate the products in the laboratory". In our case, the lower scores in home tests

536   could be explained by the status of the oyster-based products themselves and the strong

537   involvement attached to raw oyster consumption in France. As mentioned in the introduction,

538   just as well for consumer and non consumer, raw oyster is a luxury and "high- symbolic

539   value" food strongly associated to family consumption for specifics events. Moreover, as in

540   home tests the families were given the products with their packaging (for 4 products) they

541   became probably more aware of the fact that oyster-based products were processed food, all

542   the more so since the ingredient list was on packaging. Furthermore, it is likely that the

543   family environment developed higher involvement for its members and may therefore have

544   led to more critical analysis (Boutrolle, 2007; Stroebele and De Castro, 2004; de Graaf, 2005).

545   Conversely, the social interaction in staff canteens and the limited portion sizes presented to

546   the consumers may explain a generally better evaluation (King, 2004, Boutrolle, 2007).

547

548   **CONCLUSION**

549

550   In conclusion, this study showed the impact of social representation, strengthened by the

551   specific initial product characteristics and the positive or negative effects of the first exposure

552   and tasting of raw oyster on perception and its repercussion on expectations or fears related to

553   processed oyster-based products. For instance, contrasted behaviours may appear depending

554   on the initial profile of the consumer, traditional raw oyster consumer or non-consumer. The

555   results allowed us to identify two different market orientations, the first adapted to traditional

556   raw oyster consumers, rather old, with a range of products as close as possible to the natural

557   product, where the oyster taste is clearly recognised; the second aimed at non-consumers of

558   raw oysters, rather young, and proposing products with adapted characteristics, for example

559   an attenuated odour or taste of oyster and a texture with few or even no oyster pieces. For

560   non-raw, live oyster consumers, the more the oyster was processed (such as butter and potted

561   oyster), the less the sources of disgust identified by Rozin and Fallon (1987) and Kolnai

562   (1998) were effective. In their minds, the process played a part in reifying the oyster

563   substance and reducing the aversion. This segmentation also covers expectations of

564   consumers in terms of age distribution, and confirms the opposition between younger and

565   older people. Processing could make possible generational transfer in oyster consumption if

566   these expectations are fulfilled. Nevertheless, the first consumption or the willingness to

567   consume an oyster or an oyster-based product remains a hurdle in the case of non-consumers.

568   As suggested before, the positive effect of early and frequent exposure, for instance in

569   canteens or university cafeterias, should be exploited in order to have a long-term influence

570   on food choice and the preferences of the younger consumers. However, one of the main

571   limits of our research is the lack of information on real uses and context of consumption. Are

572   these products still adapted to festive and refined consumption according to the French

573   traditional habit or doomed to a more ordinary consumption? The question could be answered

574   through further research.

575

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661 **Footnotes**

662

663 [1]Analyse des Lexèmes Co-occurrents dans les Enoncés Simples d'un Texte (Analysis of co-occurent lexemes in

664 simple wordings of a text)

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666 [2]For the two groups (NC and C) constituted of 16 persons (2 focus-groups of 8 persons each), the number in

667 bracket represents the number of citations of each term.

668

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670 [3]Historians have analysed the importance of the beliefs associated with red meat and blood, especially during

671 the pre-scientific period (Darnon, 1999). A recent research project dedicated to the perception of food germs has

672 shown that blood in red meat is still nowadays perceived as risky because of the survival of the belief in

673 "spontaneous generation" among lay persons (Debucquet, Merdji, Fischler, 2007).

674
675 **Table 1.** Oyster- based product characteristics: form, ingredients, presentation and
676 preparation
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	Oyster based products	Main ingredients and (% of oyster in recipe) when recipe available	Presentation and product preparation
S	Soup	Oyster (15),vegetables, spices	Metallic can; warm in a pan
P	Potted oyster	Oyster (30), cream, onion, white sauce, butter, garlic	Glass jar, cool before spreading
B	Oyster butter	Oyster (43), cream, butter, white sauce, onion, garlic	Glass jar, cool before spreading
T	Hot toast	Oyster (17.5), seaweed, carrot, onion	Metallic can; spread on bread and toast 5 min in an oven
C	Frozen oyster	whole oyster with sauce in a half-shell	Cook 10 min in an oven

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682 **Table 2.** Characteristics of the staff restaurant consumer panel and at-home consumer panel
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	At-home panel	Staff restaurant panel
Gender (%)		
Female / Male	56.2 / 43.8	41.1 / 58.9
Age (years) (%)		
< 25	27.6	14.6
26-35	9.7	24.0
36-45	21.4	24.1
46-55	26.2	20.1
+55	15.2	17.2
Educational level[1] (%)		
Low	29.7	7.6
Middle	31.9	33.1
High	27.5	59.3
Oyster eater (%)		
Yes / No	74.5 / 25.5	76.0 / 24.0
Respondents (Total)	145	481

684 [1]Low educational level: elementary school; middle educational level: secondary school and middle degree
685 professional education; high educational level: secondary school and higher educational level, higher degree of
686 professional education, university or higher
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Table 3. Overall liking in staff restaurant test (mean and standard deviation) according to socio-demographic variables and perception of "naturality"

	Factors	F and p values[1]	Factor level[2]	Products				
				P	B	T	S	C
	Consumer Type	$F_{4,1}$=4.66 p=0.03	C[b]	6.0 (2.0)	5.7 (2.0)	6.1 (2.1)	6.3 (2.3)	7.0 (1.8)
			NC[a]	6.2 (2.4)	5.7 (2.4)	5.2 (2.4)	5.7 (2.5)	6.7 (2.2)
	Age	$F_{4,4}$=0.42 p=0.79	< 25	6.4 (2.1)	6.6 (2.1)	5.0 (2.4)	5.5 (2.4)	7.7 (1.4)
			26-35	5.8 (2.0)	6.0 (2.0)	5.8 (2.2)	6.1 (2.2)	7.0 (2.1)
Overall liking			36-45	5.9 (2.2)	5.8 (2.1)	6.2 (2.5)	6.5 (2.6)	7.0 (1.9)
			46-55	6.0 (2.3)	5.0 (1.8)	6.4 (1.9)	6.2 (2.6)	6.6 (1.9)
			+55	6.1 (2.1)	5.2 (2.2)	6.3 (2.0)	6.6 (2.1)	6.7 (1.6)
	Gender	$F_{4,1}$=0.62 p=0.43	Male	5.9 (2.0)	5.7 (1.9)	5.7 (2.2)	6.3 (2.2)	6.9 (1.8)
			Female	6.2 (2.3)	5.6 (2.2)	6.2 (2.2)	6.1 (2.4)	7.0 (1.8)
	Educational level	$F_{4,2}$=2.15 p=0.11	Low	6.5 (2.2)	6.1 (2.5)	7.5 (1.7)	6.3 (2.4)	6.9 (2.8)
			Medium	6.1 (2.2)	5.8 (1.8)	5.8 (2.4)	5.8 (2.2)	7.1 (1.8)
			High	5.8 (2.1)	5.5 (2.1)	5.8 (2.1)	6.6 (2.3)	6.9 (1.7)
Overall liking	Product	$F_{4,1073}$=10.7 p=0.000	General mean	6.1 (2.1)[ab]	5.7 (2.0)[a]	5.9 (2.2)[ab]	6.2 (2.4)[b]	6.9 (1.9)[c]
Perception of "naturality"		$F_{4,1006}$=13.4 p=0.000	General mean	5.6 (2.5)[b]	5.1 (2.3)[a]	5.85 (2.3)[b]	6.4 (2.3)[c]	6.7 (3.8)[c]

[1]F value for the tested factor and probability associated in the analysis of variance with products and factor used as independent variables

[2]Factor levels with different letters are significantly different at $p<0.05$

Table 4. Overall liking and perception of "naturality" in the at home test (mean and standard deviation)

	Factor	F and p values[1]	Factor level[2]	P	B	Products T	S	C
	Consumer Type	$F_{4,1}$=1.1 p=0.29	C	5.0 (2.3)	4.7 (2.5)	5.0 (2.7)	6.8 (2.6)	6.9 (2.1)
			NC	4.4 (2.2)	5.1 (2.4)	5.1 (2.4)	5.0 (2.5)	6.7 (1.9)
	Age	$F_{4,4}$=4.5 p=0.001	< 25 [a]	4.8 (2.3)	4.8 (2.5)	5.0 (2.5)	4.3 (2.7)	6.1 (2.0)
			26-35 [b c]	5.1 (2.4)	4.2 (1.9)	5.2 (2.0)	6.3 (1.8)	7.7 (1.6)
			36-45 [a b]	4.7 (2.1)	4.8 (2.3)	4.9 (2.5)	5.8 (2.6)	7.0 (1.8)
Overall liking			46-55 [a b]	4.8 (2.7)	4.5 (2.8)	4.5 (2.8)	5.9 (2.7)	6.6 (2.4)
			+55 [c]	5.1 (1.9)	4.8 (2.6)	6.0 (3.0)	6.5 (2.3)	7.7 (1.5)
	Gender	$F_{4,1}$=0.4 p=0.52	Male	4.7 (2.3)	5.1 (2.5)	5.3 (2.7)	5.8 (2.7)	6.7 (2.1)
			Female	4.9 (2.3)	4.7 (2.4)	4.8 (2.6)	5.5 (2.6)	7.0 (2.0)
	Educational level	$F_{4,2}$=1.3 p=0.27	Low	5.2 (2.1)	5.1 (2.4)	4.6 (2.4)	4.8 (2.9)	6.4 (1.7)
			Medium	4.8 (2.4)	5.0 (2.6)	5.2 (2.8)	6.0 (2.4)	7.1 (2.1)
			High	4.6 (2.4)	4.5 (2.4)	5.1 (2.6)	5.9 (2.5)	7.0 (2.1)
	Products	$F_{4,643}$=16.1 p=0.000	General mean	4.9 (2.3) [a]	4.8 (2.5) [a]	5.0 (2.6) [a]	5.6 (2.6) [b]	6.9 (2.0) [c]
Perception of "naturality"	Products	$F_{4,634}$=9.8 p=0.000	General mean	5.1 (2.8) [a]	4.7 (2.7) [a]	5.1 (2.5) [a]	5.9 (2.3) [b]	6.6 (2.4) [c]
	Refusal to taste		Whole panel %	4.8	4.1	14.5	13.0	17.1
			C %	4.6	0.9	12.0	11.1	13.9
			NC %	5.4	13.5	21.6	18.9	27.0

[1] F value for the tested factor and probability associated in the analysis of variance with products and factor used as independent variables

[2] Factor levels with different letters are significantly different at p<0.05

Tableau 5. Positive descriptors: lexical classes and significant associations with oyster-based products, socio-demographic profiles, and oyster consumers (C) or non-consumers (NC).

Class description	% of classified statements	Lexical universe	Oyster-based product	Socio demographic profiles
Class 1 *The taste of oyster and sea: light, choice / exquisite, refined*	55.0	Taste (25) of oyster (44), unctuous (21), fresh (17), light (14), sea (12) product (13), choice / exquisite (11), creamy (10), taste with right balance (9), sea product (7), iodine (5)	Oyster butter (15)	More than 55 years old (9) 46-55 years old (7) Man (4) Introduced to oyster consumption before age of 10 (3) Raw oyster eater (C) (3)
Class 2 *Texture and appearance, convenience issues*	37.0	Good (43) texture (32), small (23) pieces (23) of vegetables (28), smell (28) of vegetables (28), pleasant (20) presentation (26), pleasant (20) consistency (15), nice (19) color (18), well (17) seasoned (16), easy (9) to prepare (9), to spread (5)	Cooked oyster in half-shell (19)	Woman (8) 26-35 years old (5) Less than 25 years old (4) Introduced to oyster consumption between ages of 20 and 30 (4) Students (3)
Class 3 *The analogy with fish-based products*	8.0	Like (72), fish (170), soup (189) or potted (60)	Soup (40)	36-45 years old (17) High educational level (5) Introduced to oyster consumption over the age of 30 (3)

Ranking of words in lexical classes and socio demographic characteristics in decreasing order of chi-square values (chi-square value significant at $p < 0.05$)

Tableau 6. Negative descriptors: lexical classes and significant associations with oyster-based products, socio-demographic profiles, and oyster consumers (C) or non consumer (NC).

Class description	% of classified statements	Lexical universe	Oyster-based product	Socio demographic profiles
Class 1 *The bizarre and the suspect*	37.0	Unpleasant (27) smell (72), unappetizing (49) appearance (52) and colour (32), unpleasant (19) and strange (9) consistency (12), strong (17), bad (8), not digested (7), too dirty (5), repulsive (5)	Soup (22) Hot toast (11)	Born in land (10) C consumer (6) Introduced to oyster consumption between the ages of 36 and 45
Class 2 *The incompatibility with fat*	29.0	Fatty (73), sickly (31), sticky (28), cream (27), viscous (26), doughy (16), bitter (13)	Oyster butter (31) Potted oyster (7)	Born in seashore (4) NC consumer (3) More than 55 years old (3)
Class 3 *The taste of oyster: "tasteless or too strong"*	25.0	Taste (79) of raw (12) oyster (105), not enough (24) found again (23) or too strong (5), like scallop (21)	Cooked oyster in half-shell (33)	Less than 25 years old (7) Student (7) Low educational level (7)
Class 4 *The aversion to oyster pieces: disgust towards the animal itself*	9.0	Big (30) / too many (4) pieces (145) of oyster (13), unpleasant (50), not liking (42), not eating (12)	Potted oyster (4)	NC consumer (12) neither raw nor cooked Has never been introduced to oyster consumption (6)

Ranking of words in lexical classes and socio demographic characteristics in decreasing order of chi-square values (chi-square value significant at $p < 0.05$)