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

Gervaise Debuquec†, Josiane Cornet‡, Isabelle Adam‡, Mireille Cardinal‡*,

†Audencia-Nantes, School of Management, PRES-LUNAM, LESMA (Laboratoire de recherche en Stratégie et Marchés des produits Agroalimentaires), 8 route de la Jonelière, BP 31222, F-44312 Nantes 03, France
‡Ifremer, Laboratoire Science et Technologie de la Biomasse Marine, F-44311 Nantes 03, France

*Corresponding author: Mireille Cardinal, email address: Mireille.Cardinal@ifremer.fr

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
of oysters, generally among the youngest, consider that this product is too costly and difficult
to open, and the specific characteristics of oysters (live, raw and viscous) play a part in
developing a certain aversion to this product. This difference in behaviour between young and
senior purchasers may lead to a deficit in the recruitment of “new” consumers, and perhaps
ultimately leading to critical questions regarding the future of oyster consumption. How can
the continuity of oyster consumption be guaranteed down through the generations? This
question highlights the importance of promoting the product with young people, but perhaps
also of diversifying the range of oyster-based products. This search for new markets could
also be an opportunity for processors to extend their range of seafood products.

However, to find the best ways to develop and to avoid possible failure in the market, it is
necessary to take into account as early as possible the psychological barriers related to oyster
consumption and to analyse the potential for processed oyster-based products through
consumer perception. Understanding consumer reactions to new products is especially
interesting in the case of oysters as they are known to cause extremely marked reactions.

Many non-consumers are disgusted by oysters because of their appearance and the
consumers’ unwillingness to consume something alive and viscous. In the literature, “disgust”
deals specifically with animal substances versus plant substances because of the moral
dimension linked with their ingestion by eaters, as shown by Rozin and Fallon (1987). In
other respects, Kolnai (1998) has identified these two physical characteristics, alive and
viscous, as the most common and strongest sources of disgust. French consumers naturally
ingest raw, live oysters thanks to French culture which allows them to “appropriate” these
particular sensory qualities by classifying them in the category of rare, luxury and healthy
food. The feelings of disgust are strongly reduced by the fact that when ingesting oysters a lot
of other, generally positive, symbols are ingested at the same time. Fischler (1990) showed
that food ingestion is not an ordinary action but one that always has a symbolic dimension.
Thus, when eating raw, live oysters, French consumers in general, and those traditionally seen as “oyster eaters” in particular, consider that they are "drinking the sea”, conjuring up iodine and all the images of naturality, purity, lightness and freshness associated with this shellfish. In short, the social representations associated with oysters by consumers identify a healthy and refined food (Debucquet and Merdji, 2004). On the contrary, part of the population retains a very strong aversion towards oysters and their physical properties, all the more so if they did not eat raw oysters often and at a young age in their food education.

Processed oysters could thus be a way of removing these fears. In that case, however, it is necessary to analyse expectations and the associated overall perception. Many studies have indeed shown how information or the visual appearance of food influences flavour recognition or overall liking and generates expectations (Mojet and Koster, 2005; Kole, 2009; Delwiche, 2004); a contrast between expected and actual sensory qualities can induce a strong negative affective response focusing on the unexpected sensory qualities (Yeomans et al., 2008). In the case of oyster, the context of the first tasting or first “experience” (Faurion, 1996) contribute strongly to previous social representations associated with this kind of food and could influence the expected sensory qualities.

In this context, could processing overcome the impact of representations and sensory barriers associated with oyster in non-consumers? Or would deep-seated reasons still prevent consumption for non-consumers? On the other hand, would a traditional consumer of fresh oysters be ready to accept a processed product with the risk of losing certain attributes, such as “natural” and “authenticity”? From a theoretical perspective, this problematic leads to analysis of the phenomenon of anchoring as described by Moscovici (1961), that is, how the perception of new products and their sensory qualities are determined by previous representations and the social value associated with this food, which is called by Jodelet
(1994), the “already in mind”. As this topic has received little attention in the literature on sensory and hedonic evaluation, this article will try to fill the gap.

The general objective of the paper was to analyse and understand the key drivers in oyster or based-oyster products consumption with a twofold research objective: evaluating the impact of processing and social representation on hedonic perception. To achieve these objectives, a complementary approach was applied. A qualitative approach through individual interviews and focus groups was carried out to catch the conscious and unconscious elements in the consumer perception. Then consumer tests were performed on five oyster-based products in two situations of consumption in order to reach a large range of population in term of ages and professional activities (students and active workers in canteens and families with children and teenagers at home). Products were collected from three seafood companies, partners in the project. The range of products making it possible to illustrate the influence of the degree of processing was composed of a frozen, cooked oyster in a half-shell (C) and four sterilized products presented either in cans for soup (S) hot preparations for toast (T) or in glass jar for oyster butter (B) and potted oyster (P). Oyster was entire in the case of C product, mixed in T, B and P products and some pieces of oyster were present in S product. Table 1 gives the main ingredients and characteristics of each product. A preliminary study with a trained panel showed a wide range of sensory characteristics (Cardinal & Debucquet, 2010) : in appearance, from smooth, light and homogeneous (P, B) to a more complex product with small pieces and dark colour (T and S); in texture, from a liquid (S) to a paste with different degrees of fat perception (B, P, C); in odour with specific marine notes such as seaweed (T) to vegetable (S) or garlic (B, P) or onion and wine for C; in flavour, from marine notes such as seaweed (T, S) to butter and garlic, especially for B and P. The final objective was to identify if in the range of processed products presented, some of them were mainly adapted to a specific target of consumers.
Study 1: Qualitative study - Individual interviews and focus-groups -

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
red with an odourless dye was described as a red wine in olfactory terms. Analysis showed that the odours of a wine are, for the most part, represented by objects that have the colour of the wine. In our experiment, subjects were offered two samples of the five oyster-based products. The first was a blind test (subjects were told that it was seafood products); for the second, the same five products were offered but they were presented as novel products prepared with oysters. This comparative test was not strictly a sensory test but a projective exercise (Donoghue, 2000) to stimulate verbalization. The aim of this part of the focus-group was in fact to evaluate the influence of previous representations associated with oysters on product perception, especially taste descriptors, and, at the same time, to compare perceptions and assessment of oyster consumers in comparison with non-consumers.

Data analysis

An analysis of themes, sub-themes and lexical universes was carried out with data collected during the focus-groups and individual interviews, and, more particularly, the comments of subjects at both stages of the comparative test.

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

The lexical analysis of the comments collected during the comparative test showed huge discrepancies both between the first test (blind test) and the second test (the subjects were informed that the products were oyster-based products) and between oyster consumers and non-consumers. The results showed that taste perception is not only dependent on the first sensory experience but also on the pre-existing representations associated with oysters. Taste perception and, more particularly, taste descriptors effectively changed considerably between the first and second tests:
we observed that taste initially perceived as "insipid"(10), mainly among the non-oyster consumers (NC) and mostly recruited from young subjects became in the second test "strong"(7), "too strong"(5), "bitter"(3), "acid"(3), that what was called "an indefinable taste"(9) became "strange"(7), "doubtful taste"(4), "a bad aftertaste"(4), and finally that a texture initially perceived as "soft"(3), "thick"(8) or "heavy"(7) became "jelly-like"(9), and "viscous"(11). All in all, the lexical registers used after being told of the presence of oysters in the recipes showed that simply mentioning oyster revived the main sources of disgust produced by the consumption of raw oyster, that is: viscosity, stickiness and alive;

on the other hand, the change in lexical register for taste, perceived first as "good"(9) or "pleasant"(11) and becoming "not fine or exquisite enough"(5), "not high-class enough"(6) is mainly observed among the consumers (C). Moreover "Taste of the sea"(11) became for them "good taste but not strong enough because we don’t recognize the taste of oyster enough"(8) or sometimes "not natural enough"(7), "chemical"(3), and lastly a "delicious and creamy texture"(8) became "like boiled and over-cooked oysters"(6). All in all, these quotations highlight that all the dimensions confer oysters, in the mind of French oyster eaters, with the status of a refined, exceptional and natural dish.

Beyond these differences, the products were less appreciated during the second test by both oyster consumers and non-consumers as proved by highly negative comments and bigger amount of leftovers. The subjects were expecting to find oyster-based products "less fatty", "less pasty" and, in some opinions, "the fatty texture suggests that it was fatty oysters or oysters with soft roe". These last quotations confirm that oysters are perceived by most people as a diet and healthy food. In others words, in their mind, fat is not compatible with the representations associated with oyster, that is, hints of the sea, coast, iodine, and mineral salts.

\[1\] 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.
A second part of the focus-groups was dedicated to identifying the boundaries of acceptability as regards recipes and ingredients. As presented in the methodology part, a creativity exercise was implemented during the focus-groups in order to understand what kind of recipes would be accepted or rejected by consumers, according to the nature of the ingredients (meat, fish, fruits, vegetables, dairy products, etc.) and the level of processing of oysters.

• Concerning ingredients, the results demonstrated that the association between oysters and meat was rejected by almost everybody. This is an illustration of the impact of cultural habits on acceptability and more particularly of French habits. As oysters are commonly eaten in a raw, live form, the association with meat appears definitively dissonant because of the mixture of “substances”, especially “land substances” and lives “sea substances”: “They are two different species, from land and sea. So, no! [...] And moreover, meat is a living substance, as are oysters… That is definitely incompatible!”.

The case of red meat provoked the greatest disgust, because of the blood: “Red meat is not fully dead, it is still a little bit alive. Look at the blood!”\(^2\). The risk arising from this quotation is clearly a symbolic risk and, very logically, white meat (such as pork or chicken) or “reified” meat like ham were better accepted in the recipe with oyster-based products. Lastly, vegetables, as more neutral ingredients, or fish, as ingredients from the same universe, did not raise any problems.

• Concerning the level of processing of oysters and therefore the texture of oyster-based products, the participants in the focus-groups stressed the need to clearly identify each ingredient with regard to the issues of mixing “substances”. Consumers and non oyster consumers turned down products that were overly processed, of the paste- or blended-type, as they played a part in excessively denaturing the oysters and were perceived as industrial and suspicious products. While the ideal recipe for the oyster consumers was the cooked oyster in

---

\(^2\) 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).
221 a half-shell, because it maintained a symbolic proximity to raw oysters ("Great! They remain
222 in their shell! They look fresh even if they have been frozen!"), on the contrary, non-
223 consumers looked for intermediary products, neither too mixed and without big pieces of
224 oyster to keep a symbolic distance from the sources of disgust.
225 • Regarding sanitary risk, it is interesting to note that during the focus-groups and after
226 presenting the processed oysters, none of the non-consumers spontaneously tackled this issue.
227 Surprisingly, the processing of oysters removed all the fears and anxiety about sanitary risk
228 because the "oyster is dead", that is, in the subjects' minds, in biological and symbolical
229 terms. On the contrary, more people among the raw oyster consumers were suspicious of
230 processed oysters because the process was always perceived as a "denaturation" of the oyster,
231 necessarily using additives and preservatives.
232 In conclusion, the results of the qualitative study revealed huge differences in the mechanisms
233 of perception of oyster-based products between consumers and non-consumers. Our data
234 suggest the importance of previous representations associated with raw oyster on processed
235 oyster perception in terms of taste, recipe acceptability and risk perception.
236
237 **Study 2: Quantitative study - Consumer test in real consumption situations** -
238
239 **In staff canteens**
240
241 **Method**
242 Consumer panel
243 The French multinational corporation Sodexo, one of the largest food service companies in
244 the world was a partner in the project and offered the opportunity to test products in different
245 staff restaurants. The context of restaurant was particularly interesting because oysters are, in
246 France, almost always consumed in the setting of a social and shared meal. The companies
were chosen according to their location and their field of activity in order to reach consumers with different profiles. Three cities that differ from one another in terms of distance from the sea were selected: Nantes, Tours and Lyon. Ifremer, a Marine Research Institute with a consumer population involved in marine questions and the Ecole des Mines, a school of Engineering mainly composed of young consumers, were the two companies chosen in Nantes to test products in their Sodexo restaurants. In Tours, the company selected was Sanofi, from the pharmaceutics sector, and finally Areva, a company working in the nuclear field, in Lyon made it possible to test people in the research department. The four self-service restaurants were different in terms of their mean numbers of daily customers and finally the number of participants in the consumer test was respectively for each restaurant, 155, 177, 87 and 62. The whole panel’s characteristics included the four canteens are presented in Table 2. The amount of oyster eater in this population reached 76%.

Procedure

Tests were performed between December 2009 and April 2010. Products were prepared in each self-service restaurant according to industrial recommendations and were presented at the entry of the restaurant on a plate prepared for each customer. To lighten the test for consumers, the five products were presented on two successive days with a presentation of three products the first day (P, S, T) and two products (B, C), the second day. Products were presented simultaneously on the same plate and consumers tasted the products according to a balanced order in the questionnaire. As the tests lasted for two days, all consumers did not taste necessarily all the products. Each person was informed that the products were oyster-based products and was invited to test them during their lunch. Customers were free to take them or not. After acceptance, the same questionnaire was distributed in each restaurant to collect their opinion. They were invited to give a few negative and/or positive words after tasting each product and to rate their overall liking with a score from 0 to 10: dislike
extremely (0), like extremely (10) and to express their perception of naturality, not at all (0),
quite natural (10). Personal information such as age, gender, educational level and consumer
(C) or non-consumer (NC) of raw oyster was asked for at the end of the session. In the paper,
NC refers to non-consumers of raw oyster, the traditional way of eating oysters in France.

Data analysis

Consumer data results were expressed as a mean ± standard deviation (SD). In consumer test,
estimation of the effect of each variable (social and demographic characteristics, traditional
oyster consumer) on overall liking was performed by analysis of variance on all consumer
scores with products and each of these variables as independent factors. The main effects and
interaction between factors were tested. The analysis of qualitative data (negative and/or
positive words associated to each product after tasting) was only performed on questionnaires
from the home tests where description was more detailed and richer than in restaurants.

Results: Overall liking and hedonic perception in staff canteens

The scores for overall liking and “naturality” attributed by consumers to each product are
presented in Table 3. The general mean for overall liking scores for all consumers highlights a
significant difference between the products. The cooked oyster in a half-shell obtained the
highest score (6.9 ± 1.9) followed by soup (6.2 ± 2.4), potted oyster (6.1 ± 2.1), hot toast (5.9
± 2.2) and finally oyster butter (5.7 ± 2.0), but no significant difference appeared between the
last three products. Food habits related to raw oyster consumption had a significant effect
(p=0.03) on overall liking as traditional raw oyster consumers gave higher scores to products
compared to those of non-consumers. No interaction appears between the variables “usual
oyster eater” and products which means a same general trend in overall liking for C and NC.
Analysis of variance performed over all the consumer data of liking with products and gender
as independent factors did not show any significant difference between scores attributed by women or men (p=0.43). Educational level and age did not lead to a significant difference either, (p=0.11 and p=0.79, respectively).

At home

Method

Consumer panel

145 consumers from 68 households on the Tastenet panel took part in the study. The Tastenet panel was composed of volunteers for consumer tests at home on fish and fish products selected by the French Research Institute Ifremer through the company’s staff (friends, family, neighbours). The answers of all family members older than 11 years were taken into account. The majority of these families lived in an urban area (Nantes). The main characteristics of this at home consumer panel are presented in Table 2.

Procedure

Consumer tests were performed between March and April 2010. Families were provided with the five oyster-based products (here, in their packaging) and a questionnaire for each product and each family member. There was a total freedom to choose the order of consumption of the 5 products as well as the time and the situation of consumption but it was recommended that the products be tested one by one on different days depending on the choice of the family and that the product be prepared according to the directions for use on the packaging. The consumption was organised with the family members previously identified in this home. The same questionnaire as at the self-service restaurants was presented.
The same kind of analysis was applied on overall liking data obtained in staff canteens and at home. Qualitative information obtained from the open questions, especially the negative and/or positive words associated with each product that respondents were asked to provide after tasting, was analysed using textual analysis software called ALCESTE\(^3\) version 2010. This software makes it possible to treat corpora of discourses and to separate statements into classes, using a downwards-hierarchical classification on the basis of co-occurrence of words (Reinert 2002). The classification of the respondents’ terms established by ALCESTE was based on the idea that the words used by each respondent were chosen according to his or her particular mental space that constitutes the person’s framework of reference (Reinert 1993). When data comes from a panel of respondents, it helps to analyse social representations, each class of word used often unconsciously by respondents then resulting from an anchoring process (Debucquet, 2011), in accordance with the theory of representations developed by the French school of social psychology (Moscovici 1961; Jodelet 1994; Moliner 2001) which shows how representations are embedded in a social and cultural context. This analysis was performed on questionnaires from the home tests where description was more detailed and richer. Moreover, Chi-square tests were carried out by ALCESTE software to identify significant associations (p<0.05) of each class of words with oyster-based products, sociodemographic profiles, and oyster consumers (C) or non-consumers (NC).

Results : Overall liking and hedonic perception at home

Even if our research is not focused on the consumption context effect, previous studies have shown differences in overall liking between at home test and other situations, it is the reason why results from at home are presented separately. The results of the consumer tests

\(^3\) Analyse des Lexèmes Co-occurents dans les Enoncés Simples d’un Texte (Analysis of co-occurent lexemes in simple wordings of a text)
performed at home showed the same order in overall liking as those obtained in staff canteens but the scores attributed were generally lower, except for cooked oyster (Table 4). The highest scores were attributed to cooked oyster and soup with a mean score of 6.9 (± 2.0) and 5.6 (± 2.6) respectively. No significant difference appeared between the other three products. A higher perception of naturality was also associated with the preferred products. In this test, even though oyster consumers, also called “oyster eaters”, had better rated soup and potted oyster, the difference in overall liking between “oyster eater” and non-oyster consumer was not significant (p=0.29). As observed in the restaurants, gender and educational level did not affect the overall liking scores. On the other hand, age had a significant effect $F_{4,4} = 4.5$, p=0.001 and the youngest consumers generally attributed lower scores, especially to the soup, hot toast and cooked oyster compared to the upper age class. It is also interesting to note the frequency of refusal for each product (Table 4). Cooked oyster, hot toast and soup were the products with the highest frequencies of non-consumption, respectively, 17.1 %, 14.5% and 13.0% of the whole panel compared to 4.8% and 4.1% respectively for potted oyster and butter. Generally this refusal came from the youngest fraction of the population tested, in this case, the children in the families and also from the non consumers of raw oyster (Table 4). Once the consumption barrier had been removed and the product tested, consumers provided their hedonic evaluation through a score for overall liking as well as the main descriptors describing the positive and/or negative characteristics for each product. The results from the ALCESTE data processing made up of positive and negative words collected through the open questions in the questionnaire gave some explanations to the perception and overall liking of each product. From the positive evocations provided by the subjects, 2655 specific words were analysed and 74% of the statements classified into 3 classes (Table 5). The largest class (Class 1 – 55.0 % of classified statements) focused on the taste of oyster as socially perceived in France: a refined and exquisite taste, combined with the image of a festive, rare
and luxury food. The second (Class 2 – 37.0%) deals with the texture and appearance of the products in relation to convenience issues (ease of preparation, easy to spread). The last, and smallest (Class 3 – 8.0%), expresses the need to compare these unknown products with more familiar fish products, such as fish soup and potted fish. Table 5 gives the significant associations (p<0.05) between these classes and variables as products, socio-demographic profiles and consumer type (C or NC). The butter was associated with class 1, the soup with class 3 and the cooked oyster in a half-shell with class 2. Moreover, older people, men, “raw oyster eaters” (C), and those introduced to oysters early (before the age of ten) were significantly associated with class 1, young people, women, students, and those introduced to oysters rather late (after the age of 20) with class 2, and lastly, people of intermediary age introduced late to oysters with class 3. These results highlight the opposition between younger and older generations regarding food issues (convenience and innovation as regards recipe and way of consumption (aperitif, short meal with friends) versus search for taste and authenticity) and specifically the influence of oyster consumption (“non-oyster eaters” versus “traditional oyster eaters”).

From the negative evocations provided by subjects, a larger corpus of 3099 specific words was analysed and 61 % of the statements were classified into 4 classes (Table 6). The largest class (Class 1 – 37.0% of the statements classified) contains a lexicon highlighting doubt, fear, and anxiety towards the products as if exposure to oyster-based products would reactivate all the fears associated with raw oyster consumption. Class 2 (29.0 %) focuses on the dissonance resulting from the fatty and pasty characteristic of certain products, perceived as sticky and sickly (“too much cream and butter”). In consumers’ minds, oysters are a light, healthy product with small quantities of fat. Class 3 (25.0 %) deals with the taste of the oyster itself, oyster consumers conflicting with non-oyster consumers. The former were deeply concerned about the tastelessness and weak oyster taste of the products whereas the latter
often judged the taste of oyster to be “too strong”. Lastly, the smallest class (Class 4 – 9.0%) focuses on the disgust induced by the presence of big pieces of oyster in the processed products. Concerning the significant associations, the soup and hot toast were associated with class 1, the butter and potted oyster with class 2, the cooked oyster in a half-shell with class 3, and the potted oyster with class 4. These results are consistent with the sensory characteristics previously described by a trained panel (data not shown). Moreover, cooked oyster consumers, born inland and introduced very late to oyster consumption (after the age of 36) were significantly associated with class 1, the “raw oyster eaters” (C) from coastal areas and older people with class 2, young people and students with class 3 and lastly the non-oyster consumers (NC), neither raw nor cooked, with class 4. Once again, these results highlight the impact of previous representations on hedonic evaluation and overall liking, which translated into two opposite lexicons referring to two segments of population, “oyster eaters” and non-consumers.

**DISCUSSION**

We proposed in this paper to inquire on the key drivers in oyster or based-oyster products consumption and more specifically to focus on the impact of processing and social representation on hedonic perception. Theoretical and methodological issues will be discussed with regards to main results of the different studies.

**Theoretical issues**

To review the expected results briefly: it was anticipated that processing oysters would decrease disgust among non consumer of raw oysters (NC) and that, at the same time, social representations associated with raw oyster consumption would influence hedonic perception of oyster-based products both among consumers (C) and non consumer (NC). Analysis of
data from opened questions (study 2) revealed major differences between consumer (C) and non consumer (NC) as expected. Indeed, significant associations (p<0.05) between lexical classes, products, socio-demographic profiles and consumer type have been found. Consumer (C), older people and those introduced to oyster early were associated with both a class (positive associations) focused on refined and exquisite taste of some products and also a class (negative associations) focused on the tasteless and weak oyster taste of others products. On the other hand, non consumer (NC), young people and people introduced late to oyster were associated both with a class (positive associations) focused on convenience issues but also with a class (negative associations) focused on anxiety, fear and doubt, oyster-based products consumption reviving unconsciously the main sources of disgust (live, viscous and sticky properties) associated with raw oyster consumption. The comparative test (blind test vs test with information) (Study 1) performed during focus-groups confirmed these results when comparing statements of consumers and of non consumers. Our results match previous research on how the congruence or not of expected and actual flavour has an influence on hedonic evaluation (Yeomans et al., 2008). Expanding on what Faurion (1996) wrote, “flavour is not an intrinsic property of a stimulus but the meeting of a food and an eater”, our research contributes to better understanding of how previous representations predetermined hedonic evaluation. This issue of expected versus actual flavor seemed to be crucial but covered different meanings according to the kind of consumers (C) versus (NC), in accordance with the theory of social representations and especially the anchoring process (Moscovici, 1961). Finally, our results match and enrich those of Desmet and Schifferstein (2008), who described the impact of positive and negative emotions on food experience, taste perception being namely influence by sensory attributes, experienced consequences, anticipated consequences and personal or cultural meanings; here the impact of social
representations associated with oyster consumption, and more broadly speaking, the status of this kind of food in culture have been highlighted.

If we consider now the overall liking of the processed products measured in restaurant and in home (study 2), results showed the same order in the overall liking ranking, with significant differences between cooked oyster (C) and soup (S), the two preferred products and potted oyster (P), hot toast (T) and oyster butter (B), the three less preferred ones. The ranking of products according to the criteria of “naturality perceived” is in the same order and identical in both situations again and is congruent with the opposition observed in previous sensory characterization. This result highlights the importance of the recipe and the nature of ingredient on the perception; the more the recipe is natural the more the image of the product appears congruent with the positive images associated with seafood and sea more widely, as presented before and confirmed with the creativity exercise during focus-groups (study 1).

In accordance with these results, data collected through open questions in the questionnaire (study 2) arose also the fat issue and mainly the incompatibility of fat with oyster. This result gave an other illustration of the importance of social representations associated with oyster, their status in French food culture, their health value, and their source (images of the sea). As mentioned in introduction, oyster is perceived as a luxury and refined food, partly because of its healthy properties, real but also assumed because of the positive imaginary associated with seafood.

Regarding the relationship between consumer profile and overall liking, results of both tests (at home and restaurant test) did not show any effect of gender and educational level. Contrary to raw oyster consumption which can participate, according to the expression of Bourdieu (1979) in a mechanism of “distinction”, oyster-based products seem to have lost their prestigious status because of the industrial process in itself and exactly like for triploid oysters (Debucquet & Merdji, 2004). However some contradicting results have been observed.
concerning the influence of others variables on overall liking and especially the type of consumer (C) vs (NC) and age. In restaurant test, food habits related to raw oyster consumption had a significant effect (p=0.03) on overall liking (scores of consumer (C) higher than scores of non-consumer (NC)) while no significant effect has to be noticed regarding home test. This difference could be attributed to a smaller panel size in home test compared to restaurant test. Conversely, age had a significant effect \( (F_{4.4}=4.5, p=0.001) \) on overall liking (scores of youngest consumers lower than oldest ones) while no significant effect has been noticed in restaurant test. The higher rate of under 25 years-old consumers, 27.6% at home vs 14.6% in staff restaurants, could explain this difference. Results from focus-group and opened questions in study 2 are consistent with the study of Girard & Mariojouls (2003) namely the relation between the type of consumer and age; oyster eaters being more frequent among people over the age of 50 while non consumer were more often recruited among the youngest.

This question arises more widely the issue of first exposure and first tasting and their impact on further sensory experiences as analyzed mainly with children (Loewen and Pliner, 1999). Individuals’ memories of flavour from childhood are typically for foods that are remembered as very palatable or very unpalatable (Barker, 1983). During individual interviews and focus-groups, most of the non-consumers who felt a strong disgust for raw, live oysters were exposed rather late (in average, after 18 years old) to this kind of food unlike the consumers who were used to eating it from a young age, sometimes in the first years of their live even. Thus, it appears that the earlier the subjects were exposed to raw, live oysters, the less they considered them unpalatable and the more willing they were to taste these new oyster-based products.

Finally, these results bring up the question of the role of both first tasting and social representations, especially for non consumers having to face with a previous disgust for the
animal itself. Martins and Pliner (2005) have shown in the case of food from animal origin the
impact of beliefs on hedonic perception, as well as the impact of the assumed negative
consequences of eating such foods on acceptation or rejection. The frequency of refusal for
each product in home test (study 2) gave interesting information: cooked oyster (C), hot toast
(T) and soup (S) are products with the highest frequencies of non-consumption, respectively
17.1 %, 14.5% and 13.0% compared to 4.8% and 4.1% for potted oyster and butter.
Moreover, this refusal came from the youngest fraction of the population tested, children in
the families and also from non-consumer (C). These results seem to be relevant: disgust and
refusal is more associated with products close to the original form of animal (cooked oyster in
half-shell) or containing small pieces of oyster (hot toast and soup). These results highlight
here again the impact of processing, as a way to “reify” more or less strongly oyster, on the
acceptability of the oyster-based products.

Methodological issues

This complementary approach, including a preliminary sensory analysis with a trained panel,
individual interviews and focus groups, and consumer tests made it possible to triangulate the
results. Qualitative results from individual and group interviews matched closely those of
consumer tests, particularly the open questions included in the questionnaire and scores of the
overall liking for the five oyster-based products. On the other hand, the preliminary sensory
approach made it possible to bridge some product characteristics, through descriptors, and
overall consumer liking, with the latter strongly dependent on the consumption or not of raw
oysters. For instance, a strong odour/taste of garlic or seaweed can be valued by non-
consumers and symmetrically rejected by consumers: for the former, it was an original and
new odour/taste that did not recall that of oyster, whilst for the latter, it was a “tasteless”
product because they did not recognize the “genuine taste of oyster”.

21
One last methodological consideration could be the impact of the tests’ context on the overall liking. Initially, we choose two contexts for the tests, home test and staff canteens test, to reach various profiles of consumers in terms of age, gender and professional activities, active workers, students, teenagers living still in their family, etc. Even though the effect of the context was not a main objective of our research, we can note that the ranking of the overall liking of the 5 products was the same in both cases but the scores attributed at home were generally lower than those given in staff restaurants. Most of the studies where Standardised Situation Tests (SST) and Home Use test have been compared reported higher liking scores in SST than in HUT scores (Boutrolle, Arranz, Rogeaux, & Delarue, 2005; Kozlowska et al., 2003; Murphy, Clark, & Berglund, 1958). However, in a few cases, the reverse has been observed (Daillant-Spinnler & Issanchou, 1995; Hellemann, Mela, Aaron, & Eleri Evans, 1993). For example for high fat version of a cream cheese, consumers were more severe at home than in laboratory. Authors argued “that assessors overestimated the products in the laboratory because during home consumption consumers refer to a broader range of products (i.e. other brands)” and also “the possibility that assessors like to please the experimenter when they rate the products in the laboratory”. In our case, the lower scores in home tests could be explained by the status of the oyster-based products themselves and the strong involvement attached to raw oyster consumption in France. As mentioned in the introduction, just as well for consumer and non consumer, raw oyster is a luxury and “high- symbolic value” food strongly associated to family consumption for specifics events. Moreover, as in home tests the families were given the products with their packaging (for 4 products) they became probably more aware of the fact that oyster-based products were processed food, all the more so since the ingredient list was on packaging. Furthermore, it is likely that the family environment developed higher involvement for its members and may therefore have led to more critical analysis (Boutrolle, 2007; Stroebele and De Castro, 2004; de Graaf, 2005).
Conversely, the social interaction in staff canteens and the limited portion sizes presented to the consumers may explain a generally better evaluation (King, 2004, Boutrolle, 2007).

CONCLUSION

In conclusion, this study showed the impact of social representation, strengthened by the specific initial product characteristics and the positive or negative effects of the first exposure and tasting of raw oyster on perception and its repercussion on expectations or fears related to processed oyster-based products. For instance, contrasted behaviours may appear depending on the initial profile of the consumer, traditional raw oyster consumer or non-consumer. The results allowed us to identify two different market orientations, the first adapted to traditional raw oyster consumers, rather old, with a range of products as close as possible to the natural product, where the oyster taste is clearly recognised; the second aimed at non-consumers of raw oysters, rather young, and proposing products with adapted characteristics, for example an attenuated odour or taste of oyster and a texture with few or even no oyster pieces. For non-raw, live oyster consumers, the more the oyster was processed (such as butter and potted oyster), the less the sources of disgust identified by Rozin and Fallon (1987) and Kolnai (1998) were effective. In their minds, the process played a part in reifying the oyster substance and reducing the aversion. This segmentation also covers expectations of consumers in terms of age distribution, and confirms the opposition between younger and older people. Processing could make possible generational transfer in oyster consumption if these expectations are fulfilled. Nevertheless, the first consumption or the willingness to consume an oyster or an oyster-based product remains a hurdle in the case of non-consumers. As suggested before, the positive effect of early and frequent exposure, for instance in canteens or university cafeterias, should be exploited in order to have a long-term influence
on food choice and the preferences of the younger consumers. However, one of the main
limits of our research is the lack of information on real uses and context of consumption. Are
these products still adapted to festive and refined consumption according to the French
traditional habit or doomed to a more ordinary consumption? The question could be answered
through further research.

Acknowledgements

This study, carried out with the support of the Pôle Agronomique Ouest and Valorial, was
funded by the Brittany and Pays de la Loire regions. The products used in the study were
processed by three industrial partners: Cuisine Gourmande, La Belle Iloise and Youinou.
Thanks to Sodexo and especially the staff in the four restaurants in Lyon, Nantes and Tours
for their efficient organization in the consumer tests.
REFERENCES


Footnotes

1 Analyse des Lexèmes Co-occurrents dans les Enoncés Simples d’un Texte (Analysis of co-occurrent lexemes in simple wordings of a text)

2 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.

3 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).

Table 1. Oyster-based product characteristics: form, ingredients, presentation and preparation

<table>
<thead>
<tr>
<th>Oyster based products</th>
<th>Main ingredients and (% of oyster in recipe) when recipe available</th>
<th>Presentation and product preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Soup</td>
<td>Oyster (15), vegetables, spices</td>
<td>Metallic can; warm in a pan</td>
</tr>
<tr>
<td>P Potted oyster</td>
<td>Oyster (30), cream, onion, white sauce, butter, garlic</td>
<td>Glass jar, cool before spreading</td>
</tr>
<tr>
<td>B Oyster butter</td>
<td>Oyster (43), cream, butter, white sauce, onion, garlic</td>
<td>Glass jar, cool before spreading</td>
</tr>
<tr>
<td>T Hot toast</td>
<td>Oyster (17.5), seaweed, carrot, onion</td>
<td>Metallic can; spread on bread and toast 5 min in an oven</td>
</tr>
<tr>
<td>C Frozen oyster</td>
<td>whole oyster with sauce in a half-shell</td>
<td>Cook 10 min in an oven</td>
</tr>
</tbody>
</table>
**Table 2. Characteristics of the staff restaurant consumer panel and at-home consumer panel**

<table>
<thead>
<tr>
<th></th>
<th>At-home panel</th>
<th>Staff restaurant panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (%)</td>
<td>56.2 / 43.8</td>
<td>41.1 / 58.9</td>
</tr>
<tr>
<td>Age (years) (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 25</td>
<td>27.6</td>
<td>14.6</td>
</tr>
<tr>
<td>26-35</td>
<td>9.7</td>
<td>24.0</td>
</tr>
<tr>
<td>36-45</td>
<td>21.4</td>
<td>24.1</td>
</tr>
<tr>
<td>46-55</td>
<td>26.2</td>
<td>20.1</td>
</tr>
<tr>
<td>+55</td>
<td>15.2</td>
<td>17.2</td>
</tr>
<tr>
<td>Educational level¹ (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>29.7</td>
<td>7.6</td>
</tr>
<tr>
<td>Middle</td>
<td>31.9</td>
<td>33.1</td>
</tr>
<tr>
<td>High</td>
<td>27.5</td>
<td>59.3</td>
</tr>
<tr>
<td>Oyster eater (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes / No</td>
<td>74.5 / 25.5</td>
<td>76.0 / 24.0</td>
</tr>
<tr>
<td>Respondents (Total)</td>
<td>145</td>
<td>481</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Factors</th>
<th>F and p values</th>
<th>Factor level</th>
<th>P</th>
<th>B</th>
<th>T</th>
<th>S</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer</td>
<td>F&lt;sub&gt;4,4&lt;/sub&gt;=4.66</td>
<td>&lt;sup&gt;C&lt;/sup&gt;</td>
<td>6.0 (2.0)</td>
<td>5.7 (2.0)</td>
<td>6.1 (2.1)</td>
<td>6.3 (2.3)</td>
<td>7.0 (1.8)</td>
</tr>
<tr>
<td>Type</td>
<td>p=0.03</td>
<td>NC&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.2 (2.4)</td>
<td>5.7 (2.4)</td>
<td>5.2 (2.4)</td>
<td>5.7 (2.5)</td>
<td>6.7 (2.2)</td>
</tr>
<tr>
<td>Age</td>
<td>F&lt;sub&gt;4,4&lt;/sub&gt;=4.42</td>
<td>&lt;sup&gt;p&lt;/sup&gt;</td>
<td>&lt;25</td>
<td>6.4 (2.1)</td>
<td>6.6 (2.1)</td>
<td>5.0 (2.4)</td>
<td>5.5 (2.4)</td>
</tr>
<tr>
<td></td>
<td>p=0.79</td>
<td>26-35</td>
<td>5.8 (2.0)</td>
<td>6.0 (2.0)</td>
<td>5.8 (2.2)</td>
<td>6.1 (2.2)</td>
<td>7.0 (2.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36-45</td>
<td>5.9 (2.2)</td>
<td>5.8 (2.1)</td>
<td>6.2 (2.5)</td>
<td>6.5 (2.6)</td>
<td>7.0 (1.9)</td>
</tr>
<tr>
<td>Overall liking</td>
<td></td>
<td>46-55</td>
<td>6.0 (2.3)</td>
<td>5.0 (1.8)</td>
<td>6.4 (1.9)</td>
<td>6.2 (2.6)</td>
<td>6.6 (1.9)</td>
</tr>
<tr>
<td>Gender</td>
<td>F&lt;sub&gt;4,2&lt;/sub&gt;=0.62</td>
<td>Male</td>
<td>5.9 (2.0)</td>
<td>5.7 (1.9)</td>
<td>5.7 (2.2)</td>
<td>6.3 (2.2)</td>
<td>6.9 (1.8)</td>
</tr>
<tr>
<td></td>
<td>p=0.43</td>
<td>Female</td>
<td>6.2 (2.3)</td>
<td>5.6 (2.2)</td>
<td>6.2 (2.2)</td>
<td>6.1 (2.4)</td>
<td>7.0 (1.8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>6.5 (2.2)</td>
<td>6.1 (2.5)</td>
<td>7.5 (1.7)</td>
<td>6.3 (2.4)</td>
<td>6.9 (2.8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>6.1 (2.2)</td>
<td>5.8 (1.8)</td>
<td>5.8 (2.4)</td>
<td>5.8 (2.2)</td>
<td>7.1 (1.8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td>5.8 (2.1)</td>
<td>5.5 (2.1)</td>
<td>5.8 (2.1)</td>
<td>6.6 (2.3)</td>
<td>6.9 (1.7)</td>
</tr>
<tr>
<td>Overall liking</td>
<td></td>
<td>Product</td>
<td>General mean</td>
<td>6.1 (2.1)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.7 (2.0)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.9 (2.2)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.2 (2.4)&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Perception of</td>
<td>F&lt;sub&gt;4,1006&lt;/sub&gt;=13.4</td>
<td>General mean</td>
<td>5.6 (2.5)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.1 (2.3)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.85 (2.3)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.4 (2.3)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>6.7 (3.8)&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>“naturality”</td>
<td>p=0.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Factor</th>
<th>F and p values</th>
<th>Factor level</th>
<th>P</th>
<th>B</th>
<th>Products</th>
<th>T</th>
<th>S</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Type</td>
<td>F_{4,1}=1.1, p=0.29</td>
<td>C</td>
<td>5.0 (2.3)</td>
<td>4.7 (2.5)</td>
<td>5.0 (2.7)</td>
<td>6.8 (2.6)</td>
<td>6.9 (2.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC</td>
<td>4.4 (2.2)</td>
<td>5.1 (2.4)</td>
<td>5.1 (2.4)</td>
<td>5.0 (2.5)</td>
<td>6.7 (1.9)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>F_{4,4}=4.5, p=0.001</td>
<td>&lt; 25 &lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.8 (2.3)</td>
<td>4.8 (2.5)</td>
<td>5.0 (2.5)</td>
<td>4.3 (2.7)</td>
<td>6.1 (2.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>26-35 &lt;sup&gt;b,c&lt;/sup&gt;</td>
<td>5.1 (2.4)</td>
<td>4.2 (1.9)</td>
<td>5.2 (2.0)</td>
<td>6.3 (1.8)</td>
<td>7.7 (1.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>36-45 &lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>4.7 (2.1)</td>
<td>4.8 (2.3)</td>
<td>4.9 (2.5)</td>
<td>5.8 (2.6)</td>
<td>7.0 (1.8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>46-55 &lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>4.8 (2.7)</td>
<td>4.5 (2.8)</td>
<td>4.5 (2.8)</td>
<td>5.9 (2.7)</td>
<td>6.6 (2.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+55 &lt;sup&gt;c&lt;/sup&gt;</td>
<td>5.1 (1.9)</td>
<td>4.8 (2.6)</td>
<td>6.0 (3.0)</td>
<td>6.5 (2.3)</td>
<td>7.7 (1.5)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>F_{4,1}=0.4, p=0.52</td>
<td>Male</td>
<td>4.7 (2.3)</td>
<td>5.1 (2.5)</td>
<td>5.3 (2.7)</td>
<td>5.8 (2.7)</td>
<td>6.7 (2.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>4.9 (2.3)</td>
<td>4.7 (2.4)</td>
<td>4.8 (2.6)</td>
<td>5.5 (2.6)</td>
<td>7.0 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Educational Level</td>
<td>F_{4,2}=1.3, p=0.27</td>
<td>Low</td>
<td>5.2 (2.1)</td>
<td>5.1 (2.4)</td>
<td>4.6 (2.4)</td>
<td>4.8 (2.9)</td>
<td>6.4 (1.7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium</td>
<td>4.8 (2.4)</td>
<td>5.0 (2.6)</td>
<td>5.2 (2.8)</td>
<td>6.0 (2.4)</td>
<td>7.1 (2.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td>4.6 (2.4)</td>
<td>4.5 (2.4)</td>
<td>5.1 (2.6)</td>
<td>5.9 (2.5)</td>
<td>7.0 (2.1)</td>
<td></td>
</tr>
<tr>
<td>Products</td>
<td>F_{4,643}=16.1, p=0.000</td>
<td>General mean</td>
<td>4.9 (2.3) &lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.8 (2.5) &lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.0 (2.6) &lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.6 (2.6) &lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.9 (2.0) &lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Perception of “naturality”

<table>
<thead>
<tr>
<th>Refusal to taste</th>
<th>Products</th>
<th>F and p values</th>
<th>General mean</th>
<th>F and p values</th>
<th>General mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole panel</td>
<td>F_{5,634}=9.8, p=0.000</td>
<td>5.1 (2.8) &lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.7 (2.7) &lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.1 (2.5) &lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.9 (2.3) &lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>C</td>
<td>%</td>
<td>4.8</td>
<td>4.1</td>
<td>14.5</td>
<td>13.0</td>
</tr>
<tr>
<td>%</td>
<td>4.6</td>
<td>0.9</td>
<td>12.0</td>
<td>11.1</td>
<td>13.9</td>
</tr>
<tr>
<td>NC</td>
<td>%</td>
<td>5.4</td>
<td>13.5</td>
<td>21.6</td>
<td>18.9</td>
</tr>
</tbody>
</table>

<sup>1</sup>F value for the tested factor and probability associated in the analysis of variance with products and factor used as independent variables

<sup>2</sup>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).

<table>
<thead>
<tr>
<th>Class description</th>
<th>% of classified statements</th>
<th>Lexical universe</th>
<th>Oyster-based product</th>
<th>Socio demographic profiles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The taste of oyster and sea: light, choice / exquisite, refined</td>
<td>55.0</td>
<td>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)</td>
<td>Oyster butter (15)</td>
<td>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)</td>
</tr>
<tr>
<td><strong>Class 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texture and appearance, convenience issues</td>
<td>37.0</td>
<td>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)</td>
<td>Cooked oyster in half-shell (19)</td>
<td>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)</td>
</tr>
<tr>
<td><strong>Class 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The analogy with fish-based products</td>
<td>8.0</td>
<td>Like (72), fish (170), soup (189) or potted (60)</td>
<td>Soup (40)</td>
<td>36-45 years old (17) High educational level (5) Introduced to oyster consumption over the age of 30 (3)</td>
</tr>
</tbody>
</table>

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).

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

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)