



Fostering Mediterranean fish ensuring traceability and authenticity

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Contributors:	UNINA, ITENE, SLOW FOOD, CLAR, AUB		
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History of changes

Table 1. History of changes

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Table of contents

Abbreviations and Acronyms	5
Executive Summary	6
1. Introduction	7
2. Qualitative research	8
2.1. Focus group interviews in Tunisia	10
2.2. Focus group interviews in Italy.....	10
2.3. Focus group interviews in Lebanon.....	10
2.4. Focus group interviews in Spain.....	10
2.5. Focus group interview in Egypt	11
2.6. Main conclusions from FG.....	11
3. Economic analysis	11
3.1. Questionnaire results in Italy	13
3.1.1. Impact of the sociodemographic cues on consumer choice of attributes	15
3.1.2 Exploratory factor analysis and cluster analysis	16
3.2. Questionnaire results in Spain.....	19
3.2.1 Impact of the sociodemographic cues on consumer choice of attributes	22
3.2.2. Exploratory factor analysis and cluster analysis	22
4. Sensory evaluation	25
5. Conclusions	29
Annex 1	30
Annex 2	33
Annex 3	34
Annex 4	35
6. References	36

Index of Tables

Table 1: History of changes	2
Table 2: Abbreviation and Acronyms	5
Table 3: Variables applied in the Latent Class model.....	Errore. Il segnalibro non è definito.
Table 4: Italian sample description.....	12
Table 5: Description of Italian consumer clusters	17
Table 6: Sociodemographic description of the clusters	18
Table 7: Spanish sample description	19
Table 8: Description of Spanish consumer clusters.....	23
Table 9: Sociodemographic description of the clusters	24
Table 10: Blind and informed smell evaluations of raw anchovies.....	26
Table 11: Blind and informed evaluations of cooked anchovies.....	26
Table 12: Price evaluations.....	27
Table 13: Blind and informed evaluations of raw tuna fish	27
Table 14: Blind and informed evaluations of cooked tuna fish.....	27

List of Figures

Figure 1: Word cloud for all transcripts combined.....	8
Figure 2: Bartlett’s test of sphericity	15
Figure 3: Eigenvalues of the new factors from the exploratory factor analysis	Errore. Il segnalibro non è definito.
Figure 4: Factor loadings from the exploratory factor analysis.....	16
Figure 5: Respondent’s classification based on the exploratory factor analysis scores	16
Figure 6: Respondent’s classification based on the exploratory factor analysis scores	21
Figure 7: Eigenvalues of the new factors from the exploratory factor analysis.....	22
Figure 8: Factor loadings from the exploratory factor analysis.....	22
Figure 9: Raw anchovy overall liking	25
Figure 10: Raw anchovy appearance.....	Errore. Il segnalibro non è definito.
Figure 11: Cooked anchovy appearance	26

Abbreviations and Acronyms

Table 2. Abbreviation and Acronyms

Abbreviation / Acronym	Description
BW	Best-worst scaling
FG	Focus Group interview
MSC	Marine Stewardship Council
PRIMA	Partnership for research and innovation in the Mediterranean area

Executive Summary

The definition of extrinsic and intrinsic attributes affecting consumer preferences towards fish consumption was performed through three different approaches:

- FG interviews which were carried out into the different countries involved in the project;
- Economic analysis by means of a questionnaire online administered to both Italian and Spanish consumers;
- Sensory evaluation with Italian consumers.

Differences in fish species appreciation between countries and according to consumers' geographical location were found. A higher fish intake for participants from seaside areas was correlated with product availability, better supply chain, dietary habits, and traditions, whereas the behaviour of people living in internal areas was more sensitive to sensory and physical attributes, price, certification, lack of trust and freshness.

The Italian population was classified into four groups, based on the relative importance of extrinsic and intrinsic attributes on their fish consumption:

- *Label sensitive*;
- *Price sensitive*;
- *Sensory sensitive*, and
- *Wildly caught sensitive* people.

The Spanish population instead was classified into:

- *Catch area sensitive*;
- *Sensory sensitive*;
- *Price and freshness sensitive* and
- *Species sensitive* people.

The sensory evaluation performed with Italian consumers on red tuna and anchovies was useful to assess the effect of MSC label information on hedonic evaluation of fish.

In particular, the information on certification label improved the liking of both raw and cooked fish by consumers.

1. Introduction

The definition of extrinsic and intrinsic attributes affecting consumer preferences was performed through three different but complementary experimental approaches.

The first one consisted of qualitative research; this approach was carried out by focus group interview.

UNINA team developed the protocol to conduct FG interviews which were carried out into the different countries involved in the project. Two focus group interviews were conducted into the different countries, each one with about ten respondents, to gather information about different perception, habits, and purchase decision for fish products.

The second approach consisted of an economic analysis. This approach was carried out exploiting the previous FG results. In particular, they were used by UNINA team to draft a questionnaire to gather information based on a large portion of the population from each European country involved in the project. The questionnaire was translated by ITENE team in Spanish language.

A big survey with about 1,000 consumers in each country (Italy and Spain) was conducted. The questionnaire, online administered to consumers, was used to measure the effect of psycho-attitudinal variables, risk perception trust and information in consumer decision process and, in general, on consumer behavior related to fish consumption.

Finally, sensory evaluation with consumers was conducted as third step in order to both evaluate the effect of intrinsic attributes on consumer acceptability and asses the effect of certification label on hedonic responses by consumers. This approach involved 54 people in sensory evaluation of two fish species (anchovies and red tuna) in three experimental contexts: blind, expected, and informed sessions.

2. Qualitative research

This activity, led by UNINA and performed in collaboration with ITENE, CLAR, AUB, and SLOW FOOD involved the collection of qualitative data through focus group interviews. Each country involved within the project (Italy, Spain, Egypt, Lebanon, and Tunisia) conducted two focus groups, one for the seaside and another one for the inland population, to gather different opinions regarding the perceptions of fish cues and their impact on the consumer's decision-making process.

To support the SUREFISH project, a comprehensive literature review was undertaken of previous publications that addresses consumer preferences and behaviour related to fish. Four general themes were identified to better structure the literature review: consumer intentions, attitudes, and preferences for fish consumption; price and willingness to pay (WTP) for fishing; fish certification and labelling; and fish traceability, value chain, and blockchain.

Based on a deep literature review and the objectives of this research, semi-structured open questions were gathered in a manual (see annex 1) and tested in Tunisia in August 2020. Questions were broadly grouped into 5 themes: fish preferences, trends and concerns about fish consumption, intrinsic cues that guide consumer's decision choice, extrinsic cues that guide consumer's decision choice and the correlation between all factors related to fish. Then, the focus group guide was calibrated and validated, followed by additional 8 sessions conducted across 5 countries.

Through a series of focus groups, this task aims to explore the impact of fish intrinsic and extrinsic cues' impact on consumer's perception and preferences within the Mediterranean basin. Specifically, the following questions will be addressed:

- What are the factors that define consumer's preferences, intentions, and purchase behaviour for fish in the Mediterranean region?
- Is there and how do consumers preferences and decision choice change from one country to another, and within the same country?

Nine focus group interviews were held in 5 Mediterranean countries: Italy and Spain representing the northern basin of the Mediterranean basin and Tunisia, Lebanon and Egypt representing the southern part. Particularly, two focus groups took place in each country, the first one with people living near the seaside and the second one with people living in internal areas except in Egypt where only one focus group with inland population took place.

The focus groups were conducted via web, due to the pandemic situation. A participatory approach was adopted for the conduction of the focus group in order to be able to capture people's opinions and point of view without any influence from the moderator. More specifically, the intervention of the moderator was limited to structure the conversation, explain some doubts regarding the objective of the discussion or better understand each of the participant's statements while keeping in mind the elaborated focus group format. Also, the moderator needs to use simple and understandable language that all participants can apprehend easily. Generally, the strategy used for finding focus group participants was to use social network and word of mouth.

The selection of participants relied on partners using their national institution's network and upon specific criteria to ensure the uniformity of the groups across countries. Mainly, participants had to be over 18 years old, partially, or totally responsible for the shopping, and the groups had to be formed by participants originating from the same geographical area, either near the sea or in inland areas.

The sample consists of 85 participants: 53% male and 47% female; 41% are originally from internal areas while 59% live near the seaside. 15% of participants were between 18 and 30 years old, followed by individuals between 41 and 50 (2%), 13% between 31 and 40 years old, 1% between 51 and 60 and only 1% over 60 years old. 67% of the participants did not answer the age question.

The participants from 5 Mediterranean countries were used both as one sample and according to the geographical location of each session to able to explore the differences in fish perception among consumers.

All nine focus group discussions were audio-taped, video registered and carefully transcribed. The full transcripts of the discussions in English were used as input for the content analysis, which was performed with the qualitative research software tool Wordstat. Content analysis is a qualitative research tool to study the content of communication. This systematic and descriptive method is used to analyse words or phrases within a wider range of spoken or written communication. Initially, the focus groups transcripts were analysed throughout word and phrases count using Wordstat 2.0. Then, the focus group transcripts were analysed using grounded theory and inductive or deductive methods with an emphasis on emergent themes (Charmaz, 2011). Coding was performed based on the Model of the Quality Perception Process chosen to structure the findings of this research (Oude Ophuis & Van Trijp, 1995). The “classic approach” otherwise known as the “scissor-and-sort” technique, was used to cut up the printed transcripts, group similar quotes, and then assign the quotes to codes (Braun & Clarke, 2006; Felice D. Billups, 2003). Once the codes were established, they were put together into memos and the memos were subsumed into themes. The consistency, coherence, and distinctiveness of the themes were double-checked by the researchers. Also, word and phrases counts were performed to extract the most relevant terms describing the main findings from the focus groups.

Generally, fish species consumers preferences were quite different among countries as fish species came up as an important factor. Species such as sardines, salmon sea bream, and red mullet were consumed by all participants due to their easy availability in local markets. A particular preference for stronger tasting fish was noticed in the inland areas of Tunisia and Italy compared to seaside areas where more neutral tasting fish such as salmon, grouper, red mullet were preferred.

In terms of intrinsic cues: taste, absence of spines, smell and general appearance guided the participants’ choice as most of them leaned towards fish with a neutral taste, without spines and bones (or easily removable) and a pleasant general appearance that they linked with the brightness of the skin and eyes, the firmness of the flesh and with bloody gills. The nutritional aspect also came up as an important component when consuming fish as all participants agreed on it being a better source of protein than other types of meat. Convenience and easiness of preparation also are important as people leaned away from fresh fish due to its time-consuming cleaning process and limited recipes options (figure 1).

Regarding the extrinsic ones: origin, catch area and production method were noticed to be the important cues, As the majority had a strong preference for local fish compared to the imported alternatives. Wildly caught versus the farmed one and fresh-non processed products versus transformed or ready to eat alternatives such as fillets, nuggets, and fish fingers.

Trust issues whether in fishmongers or quality control institutions impacted participants’ perception of the product. In fact, participants who believed that regulations and norms are well respected in their country (case of Italy) had more trust compared to Tunisia and Lebanon where people did not have faith in the given guarantees regarding the quality of the product.



Figure 1. Word cloud for all transcripts combined (source: personal elaboration, 2021)

2.1. Focus group interviews in Tunisia

Regarding Tunisian participants, fish intake was quite different between the in land and seaside participants, as people living near the sea consumed more fish (with some people eating daily) compared to the others not only due to a higher availability and appreciation of the nutritional benefits of the product, but also due to their dietary habits since a young age. In fact, people living near the seaside stated a preference for fish with neutral taste, that is fresh, seasonal, and wildly caught compared to people living in internal areas where stronger and oiler fish meats (sardines, mackerel and seas bass) were preferred. Price and freshness were noticed to be the key determinant elements of consumer's purchase, participants linked the price with freshness (an expensive fish is fresher and of a better quality than the cheap one) and defined freshness based on the sensory and physical attributes of the product. Trust issues also emerged in the inland session, as all participants did not trust fishmongers and unfamiliar brands. In addition, factors linked to the consumer, age, marital status, and past experiences defined consumers' behaviour as people with young age did not have enough knowledge to distinguish fresh fish and older people had a higher appreciation for the product for its health benefits. Finally, people who were married and with larger households leaned toward cheaper fish such as sardines and farmed fish to satisfy their families' needs.

2.2. Focus group interviews in Italy

Regarding Italy, consumers leaned more toward fish with a neutral taste, especially on the seaside (for example sea bream). However, the extrinsic cues are mainly guiding consumer's choice in Italy. More precisely, origin, catch area, production method and freshness defined consumer's purchase intention. Italians generally preferred fresh wild caught fish compared to farmed, frozen and transformed products such as fillets, fish fingers. Still, all respondents agreed on frozen fish as an essential part of their fish intake not due to its convenience of use since it is already cleaned and ready to cook, but also for its easier availability.

2.3. Focus group interviews in Lebanon

In the case of Lebanon, unlike Tunisia and Italy, consumers' choice was mainly dependent on the health risks associated with fish consumption, The pollution and the information in mass media about food security scandals in the country created a lack of trust for locally caught fish, all participants living either near the seaside and internal areas leaned toward imported certified fish. Price was the second major barrier to fish consumption whether in land or near the sea, participants stated that their fish consumption was affected not only by the pandemic situation and the inflation of prices but to fish perceived as a luxury product that is more expensive than other meats. No differences in species preferences emerged between the inland and seaside participants as all leaned toward big fish such as salmon, grouper, and swordfish, without spines and bones and easy to prepare. However, it was noted that the seaside participants preferred stronger and oiler fish species such as sardines and mackerel, but they considered their level of consumption as low due to market unavailability. Dietary habits and traditions were found to define consumers' behaviour. The area of provenance, their parents' choice and past experiences shaped the participants' current behaviour.

2.4. Focus group interviews in Spain

Regarding Spain, the preference for fish species by participants was quite homogeneous. All Spanish consumers leaned toward salmon (smoked or fresh), tuna (fresh or canned), cod (fresh or frozen), sea bass (fresh or frozen), gilt-head bream (fresh), swordfish (fresh), sole, pompano, withing. Besides, they often eat other types of canned fish: such as anchovy, sardines, or mackerel. Physical and sensorial attributes, mainly the overall appearance, colour, brightness of eyes and skin, bloody gills, smooth texture and lack of fish bones were the main cues used by these participants to make their decision. Convenience, mainly the preparation time, was correlated with the physical attributes of fish. Bigger fish with no bones and spines was considered easier to prepare and more adapted to various recipes compared to small size fish. Country of origin is considered also as a major factor that impacts consumer decision. However, the lack of information, the absence of traceability or trust issues makes it hard for consumers to satisfy their requisitions in terms of information about their purchase. Price

was mainly a key factor for people living in inland areas, a tight budget and large families are a barrier to include more fish in daily diet as it is perceived as a luxury product. Packaging represents a barrier to fish buyers as Spanish consumers agree on minimizing waste as much as possible for convenience reasons but also for less pollution and more eco-friendly attitude.

2.5. Focus group interview in Egypt

At last, for Egypt, a particular preference for tilapia was noticed. Egyptians leaned towards fish with a neutral taste, low fat, high nutritional value (omega 3 and phosphorus), without spines and easy to prepare due to the increasing number of women in labour force. Fresh fish was the most preferred in terms of production method. However, Egyptian participants still consumed salted or smoked fish such as red mullet. Additionally, consumers were concerned about the quality and safety of fish, and they linked freshness with a longer shelf life and the origin of the products. Price also was considered as a major factor for fish freshness as most participants considered expensive fish to have better physical and sensorial attributes than the cheaper option. Also, price was considered a barrier to include more fish in their diets as it is seen as a luxury good that is inaccessible daily. Fish consumption also differs according to the participants living area as people living near the seaside consumed it at least 3 times per week, while those living in big cities consumed it once a week on average. In contrast, those living near the desert did not consume fish at all, as it is not considered a part of their diet.

2.6. Main conclusions from FG

Overall, the majority of participants had no clear understanding of the differences between the terms sea food, finfish and shellfish and tended to consider all seafood products as fish, one exception was noticed in the seaside session in Tunisia where people knew the differences between finfish and shellfish but tended to englobe all under sea food for easier communication. Then, differences in fish species appreciation between countries and according to consumers' geographical location were noted as people living near the seaside preferred fish with neutral taste, a lot of meat, without a smell compared to those living in internal areas. A higher fish intake for participants from coastal areas was correlated with product availability, better supply chain, dietary habits, and traditions. Moreover, the behaviour of people living in internal areas was more sensitive to sensory and physical attributes, price, certification, lack of trust and freshness compared to those living near the seaside where origin, catch area, production method and healthiness were the main drivers of fish intake. Besides, knowledge, age, marital status, and number of individuals in a household contributed to a change in consumer's perception of fish.

This work has few limitations; mainly the sample population does not allow us to project our findings across the general population so a future quantitative approach-based study could be conducted to validate our results.

3. Economic analysis

Based on the results of the focus group above, the latter were used to draft a survey aiming to gather information based on a large portion of the population from each country involved in the project. UNINA team constructed a questionnaire guide (see annex 2), that was translated and sent to the other research partners. The purpose of the survey is to reach 1000 fish consumers, either involved or not in the purchase process, to determine consumer preferences regarding the extrinsic/intrinsic fish characteristics and their impact on the consumer's decision-making process. A representative sample of the relevant population was collected considering socio-demographic patterns to ensure an accurate representation of the population of interest (see table 3).

Table 3. Variables applied in the Latent Class model

Variables	Type	Coding
Area of living	Categorical	1–4 (1 = Seaside area, 2 = Near the seaside, 3 = Inland area, 4 = Mounting area)
Gender	Dummy	(1 = Female, 2 = Male)
Age range	Categorical	1–4 (1 = 18-29, 2 = 30-44, 3 = 45-54, 4 = 55-70)
Number of household members	Continuous	1–10
Children	Dummy	(1 = No, 2 = Yes)
Number of children per household	Continuous	0–6
Education	Categorical	1–5 (1 = Secondary school diploma, 2 = High School Diploma, 3 = Bachelor's Degree, 4 = Master, 5 = PhD)
Profession	Categorical	1–6 (1 = Freelancer, 2 = Employee, 3 = Worker, 4 = None, 5 = Student, 6 = Others)
Income	Categorical	1–6 (1 = Bellow 20.000, 2 = 20.000–40.000, 3 = 40.000–60.000, 4 = 60.000–100.000, 5 = Above 100.000, 6 = I prefer not to respond)

The survey focused on:

- The overall fish consumption.
- The most and the least preferred fish features (Best-Worst analysis).
- The purchase behaviour.
- The importance of traceability and sustainability.
- The importance of quality label.
- The new trends of fish consumption (sushi consumption).
- the psycho-attitudinal characteristics of the interviewee (Trust, Food Neophobia, Food Choice, descriptive and dynamic rules, meat attach).
- general information of the participant.

Particularly, the best-worst (BW) scaling method was used to reveal the importance of cues that were found relevant in the qualitative research. The current BW scaling experiment had a balanced incomplete block design (13,4,4,1), i.e., 13 items (Appendix 2) divided into 13 choice sets with four items each, and every attribute appearing 4 times in the choice sets. Balanced refers to each item occurring the same number of times. All 13 items were fish-related attributes. Respondents were asked to choose between the fish attributes depending upon what they considered to be most (and least) important in their choice of fish. Then, the number of times each attribute was indicated as best (B), most important, and worst (W), least important, were used to calculate the BW score by subtracting the number of times the attribute was selected.

Overall, two databases were collected for Spain and Italy. For Italy, 1003 questionnaires have been collected while 1000 were collected in Spain.

A general description of the collected data was performed using descriptive statistics methods. Then, we analyzed the 13 attributes based on the sociodemographic cues to see whether they define

consumer fish preferences. After that, we used a Latent Class Clustering Model, or Latent Class Analysis (LCA). Clustering the sample using this method allows for further analysis of the underlying heterogeneity in attribute importance among respondents and reveals patterns that can be used by industries and policy makers.

3.1. Questionnaire results in Italy

For Italy (table 4), the survey has been filled by 50.4% females and 49.6% males. The 29.7% were between 55 and 77 years old, followed by the 28.4% between 30 and 40 years old, the 24% between 45 and 54 and the 17.8% between 18 and 29 years old. The 53% of the respondents are holders of high school diploma, the 29.7% are bachelor's degrees holders, the 10.6% for secondary school diploma holders and consecutively, the 3.2% and 3.5% are masters and PhD holders. The 39.9% of the respondents is made by employees, the 19.7% by unemployed, the 11.3% by freelancers, the 7.6% by students, while the 9.9% has a different profession from the one mentioned above. For the living area, the 51.4% of the respondents live in internal areas, the 21.4% and the 21.1% live, respectively, in seaside cities or near the seaside while only the 6% lives in mounting areas. The 78.2% of the respondents does not have kids, the remaining 21.8% has mainly 1 kid under 12 years old within the household. Regarding food orientation, the 82.9% is made by omnivores, the 6.2% by pescatarians, the 5.5% by flexitarians, the 2.1% by vegetarians, the 0.7% by vegans, while the 2,7% has a particular diet related to personal food allergies and personal preferences.

Table 4. Italian sample description

Variable	Code	Number of individuals	Percentage
Gender			
<i>Female</i>	1	506	50.4
<i>Male</i>	2	497	49.6
Age class			
<i>18-29</i>	1	179	17.8
<i>30-44</i>	2	285	28.4
<i>45-54</i>	3	241	24.0
<i>55-70</i>	4	298	29.7
Educational level			
<i>Secondary school diploma</i>	1	106	10.6
<i>High school diploma</i>	2	532	53.0
<i>Bachelor's degree</i>	3	298	29.7
<i>Master</i>	4	32	3.2
<i>PhD</i>	5	35	3.5
Job			
<i>Freelancer</i>	1	113	11.3
<i>Employee</i>	2	400	39.9
<i>Worker</i>	3	117	11.7
<i>None</i>	4	198	19.7

<i>Student</i>	5	76	7.6
<i>Others</i>	6	99	9.9
Revenue level			
<20.000€	1	271	27.0
20.000-40.000 €	2	408	40.7
40.000-60.000 €	3	126	12.6
60.000-100.000 €	4	41	4.1
>100.000 €	5	12	1.2
<i>Prefer to not respond</i>	6	145	14.5
Area of living			
<i>Seaside city</i>	1	215	21.4
<i>Near the seaside</i>	2	212	21.1
<i>Internal area</i>	3	516	51.4
<i>Mounting area</i>	4	60	6.0
Number of members per household			
1		83	8.3
2		266	26.5
3		288	28.7
4		305	30.4
5		53	5.3
6		6	0.6
7		1	0.1
8		1	0.1
Kids			
<i>No</i>	1	784	78.2
<i>Yes</i>	2	219	21.8
Number of kids per household			
0		8	0.8
1		145	14.5
2		62	6.2
3		2	0.2
4		1	0.1
6		1	0.1
<i>(Empty)</i>		784	78.2
Food orientation			
<i>Vegetarian</i>	1	21	2.1

<i>Vegan</i>	2	7	0.7
<i>Omnivore</i>	3	831	82.9
<i>Flexitarian</i>	4	55	5.5
<i>Pescatarian</i>	5	62	6.2
<i>Others</i>	6	27	2.7
<i>Total</i>		1003	100.0

The survey results have shown that Italian consumers like fish as food, with an average overall liking score of 8 (on a Likert scale of 1-9). 806 really like fish, 162 consumers partially prefer fish, and 35 do not like fish. Most of the respondents eat fish once a week or twice a week, only a few (almost 80 people) consume it less than once a month. The most common bought species are tuna, followed by salmon, cod, sea bream, anchovies, sea bass, mackerel, grouper, and tilapia. Mediterranean origin of the fish is preferred (average point of 6 on a Likert scale of 1-7). Participants usually buy fresh fish from supermarkets or fishmongers, as well as canned or frozen alternatives. During the purchase process, Italians take into consideration the advice of their trusted seller (average point of 5 on a Likert scale of 1-7), but a lot of them personally evaluate fish freshness considering the brightness of the eyes, the smell, the skin color, while only few of them consider the redness of the gills and the seasonality. Most of the interviewees consider traceability as an important cue for fish products (average point of 6 on a Likert scale of 1-7). Instead, the best known and most purchased quality certification label is MSC (Marine Stewardship Council).

Regarding new fish trends, almost half of consumers eat sushi once a month, most of them started to eat it in the last 5 years, this may be due to the popularity of ethnic food especially among new generations.

3.1.1. Impact of the sociodemographic cues on consumer choice of attributes

Regarding the sociodemographic cues, fish labelling, fish species and the smell are respectively significant at the levels of 0.01, 0.05 and 0.001 for gender. Females care more than males regarding fish labelling and smell, while males pay more attention to fish species when making their decision. People who are older had more interest in freshness the production method (fresh, frozen, unfrozen), taste and cleanliness as the t-test for different age groups was found significant when comparing the oldest (55-70) and youngest group (18-29). The area of living was found to be significant for price, type of production, seasonality, catch area and taste. People who live in seaside or near the seaside areas are less sensitive to price, type of production, farmed fish, and taste than those living in internal or mountain areas. Regarding jobs: workers were found to be less sensitive than employees to fish labelling. Others who did not specify their jobs were found to be more sensitive to fish species compared to freelancers. In contrast, others were found to be more sensitive to freshness compared to the freelancers and employees. Concerning farmed fish, others were less sensitive compared to freelancers, workers, and students. For the cleanliness, others were less sensitive than freelancers, employees, workers, and students. Education was found to be significant for fish labelling, fish species, freshness, and smell. The more educated are more sensitive to fish labelling, fish species, smell, and freshness. Income also was found to be relevant in defining the importance of fish cues as with higher incomes we found more caring about whether fish was farmed or not, about the seasonality, and less price sensitiveness. The number of family members negatively affects fish species, freshness and the type of production, and families become less sensitive to cleaned products. The presence of children impacts the catch area and freshness attribute as people with kids give more attention to these two attributes than other households without kids.

3.1.2 Exploratory factor analysis and cluster analysis

Throughout the exploratory factor analysis, we analysed which of the attributes do contribute the most in explaining the consumer behaviour. A Bartlett's test of sphericity (figure 2) was performed, the p-value of 0.000 indicates significance.

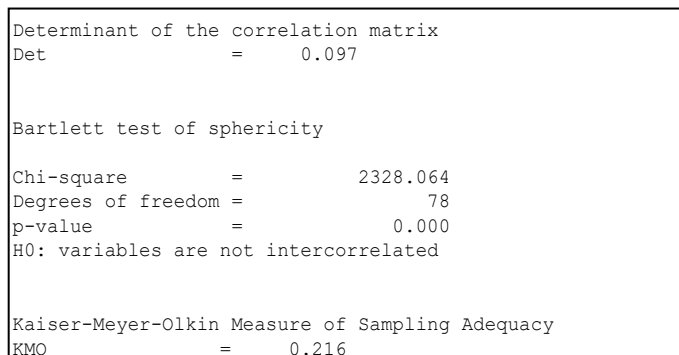


Figure 2. Bartlett's test of sphericity

The exploratory factor analysis revealed that the 3 first new factor loadings are able to explain the 72.88% of the variance (figure 3). The first factor is mainly dependent on the smell (0.5868) and wild caught attribute (-0.6483). The second factor depends on the type of production (-0.7451) and the sustainability characteristics of fish (0.3232). Lastly, the third factor depends on fish labelling (-0.6664) and the freshness of the product (0.5022) (figure 4).

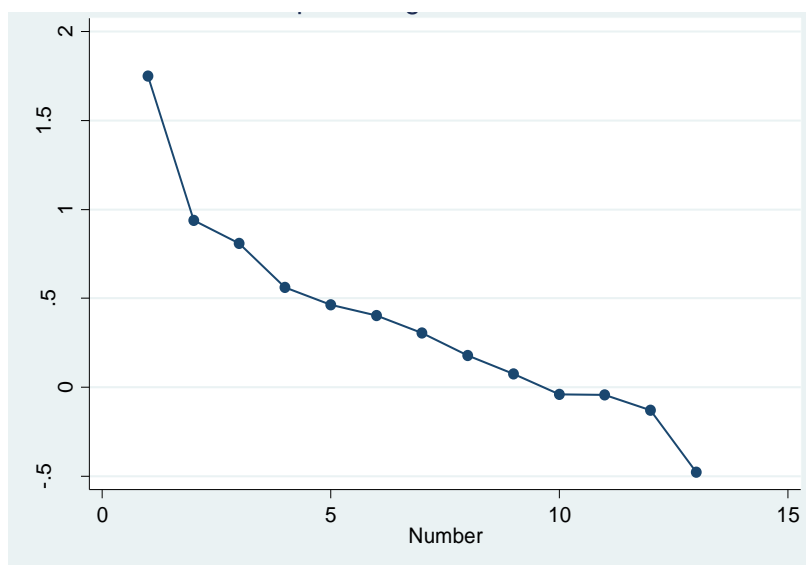


Figure 3. Eigenvalues of the new factors from the exploratory factor analysis

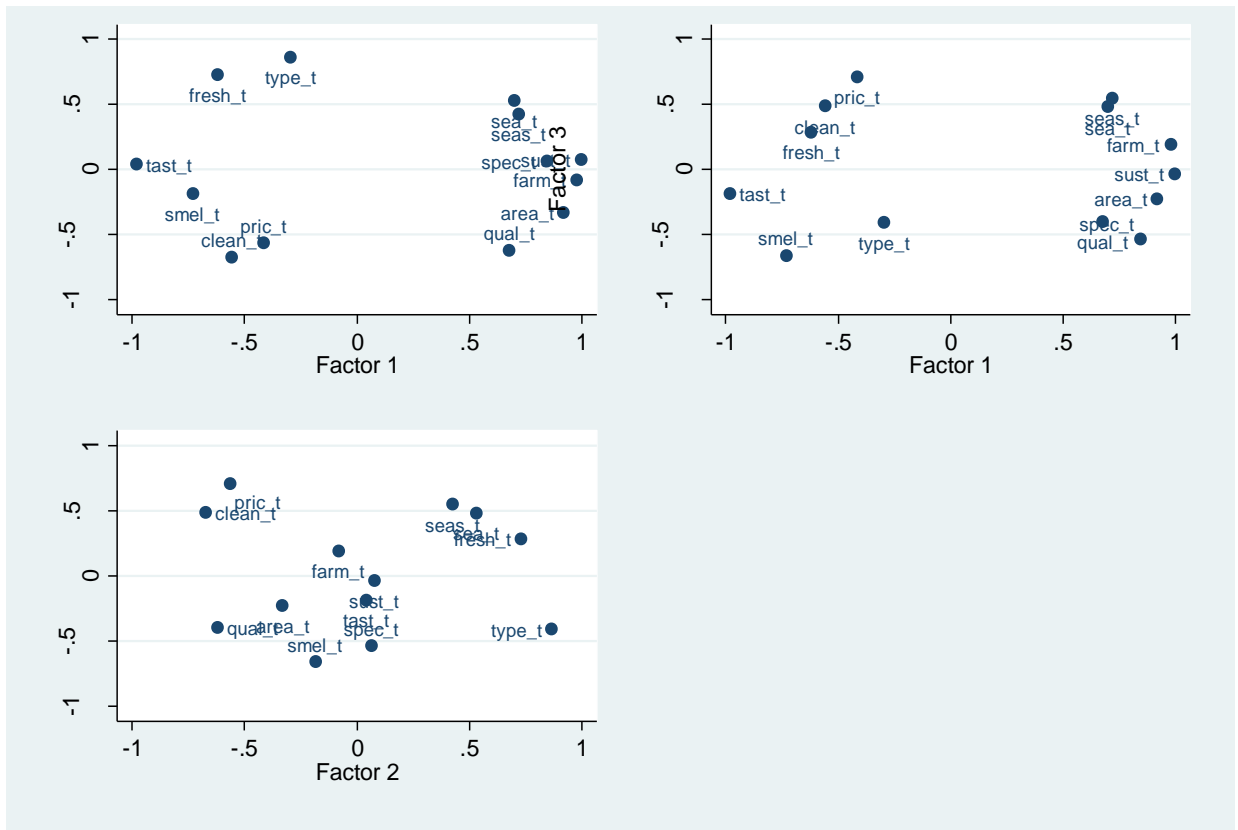


Figure 4. Factor loadings from the exploratory factor analysis

Then, the classification of the respondents was carried out using the table of factorial coordinates of the questionnaires. The classification tree makes it possible to separate our sample into homogeneous groups having the greatest possible difference of inter-class inertia and the minimum of intra-class inertia variation (Figure 5). The classification tree suggests cutting the tree into 4 groups and assigning everyone its class number.

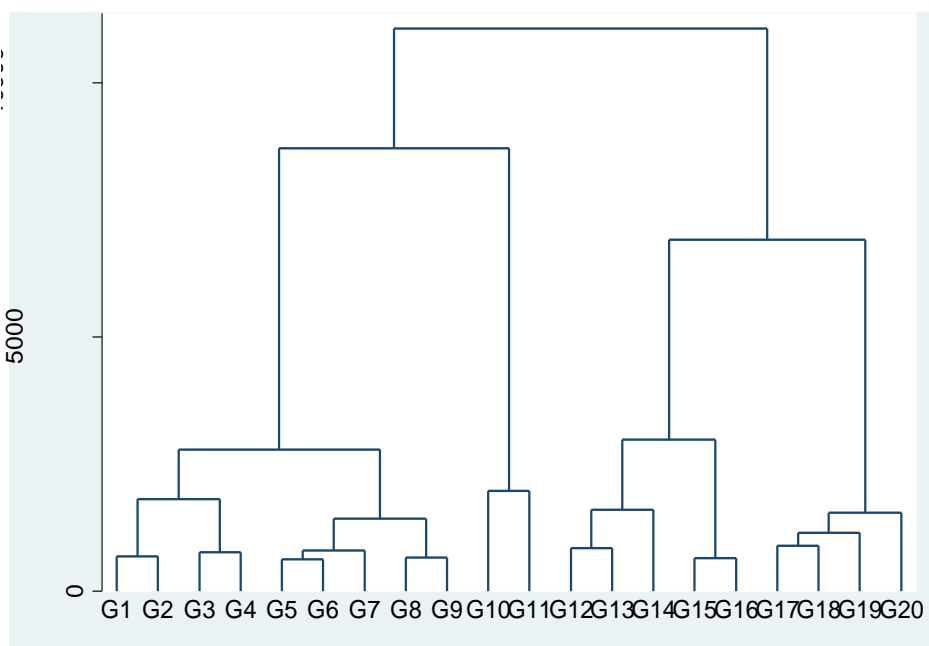


Figure 5. Respondent's classification based on the exploratory factor analysis scores

We, then, compared the means of each variable between each class to determine the characteristics of each group (Table 5). 3 out of the 4 classes cared about fish freshness while only the first one was less affected by this cue during their decision making. The first group, label sensitive (19.54% of the sample), valued fish labelling in first place (1.596939), followed by smell (2.122449), while they were less interested in cleanliness (-0.7295918) and whether fish is farmed or not (-1.045918). The consumers in this group were mainly with less kids compared to others. The second group, price sensitive (19.94% of the sample), were sensitive to price in the first place with a negative coefficient (-3.90378), followed by cleanliness (-1.917526), while they were more interested in mostly freshness (2.914089) and smell (1.525773). Price-sensitive consumers were primarily women, elderly people, and those with many children. The third group of consumers, sensory sensitive consumers (31.5% of the sample), were mostly affected by the smell (3.936709), and taste (1.585443), and were less affected by catch area (-1.955696) and fish species (-1.623418). this group was mainly made by male respondents. Lastly, the fourth group of consumers, the wild caught sensitive group (19.14% of the sample), was mostly affected by whether fish was wildy caught or not (1.78), and by the sustainability cues (1.245), and was less affected by the catch area (-1.355) and fish species (-1.56) during their decision making (table 6).

Table 5. Description of Italian consumer clusters

Cluster	1	2	3	4
<i>Number of respondents per cluster</i>	196	200	316	291
<i>Name of the cluster</i>	Label sensitive group	Price sensitive group	Sensory sensitive group	Wildly caught sensitive group
<i>qual_t</i>	1.596939	1	0.4525316	0.725
<i>spec_t</i>	-0.5102041	-0.6872852	-1.623418	-1.56
<i>area_t</i>	-0.4693878	-0.9003436	-1.955696	-1.355
<i>fresh_t</i>	-0.7346939	2.914089	4	3.26
<i>pric_t</i>	0.2653061	-3.90378	1.316456	1.12
<i>type_t</i>	-0.3316327	0.7285223	0.4810127	0.135
<i>sust_t</i>	1.061224	1.371134	0.7183544	1.245
<i>sea_t</i>	-0.0663265	0.9793814	-0.4525316	1.78
<i>seas_t</i>	-0.4846939	-0.3024055	-0.6139241	-0.235
<i>farm_t</i>	-1.045918	-1.140893	-1.550633	-1.045
<i>clean_t</i>	-0.7295918	-1.917526	-0.7278481	-1.27
<i>tast_t</i>	0.7397959	0.862543	1.585443	0.895
<i>smel_t</i>	2.122449	1.525773	3.936709	-0.52

Table 6. Sociodemographic description of the clusters

Cluster	1	2	3	4
<i>Number of respondents per cluster</i>	196	200	316	291
<i>Name of the cluster</i>	Label sensitive group	Price sensitive group	Sensory sensitive group	Wildly catch sensitive group
<i>Gender</i>	0.494898	0.5189003	0.5506329	0.42
<i>Age range</i>	2.545918	2.725086	2.594937	2.76
<i>Geo</i>	2.454082	2.381443	2.477848	2.35
<i>Education</i>	2.464286	2.305842	2.341772	2.365
<i>Job</i>	2.877551	3.089347	3.006329	3.085
<i>Income</i>	2.637755	2.687285	2.468354	2.4
<i>Family</i>	2.97449	3.006873	3.018987	3.015
<i>Kids</i>	1.704082	1.776632	1.800633	1.835
<i>Diet</i>	3.255102	3.24055	3.151899	3.215

And finally, ANOVA tests were performed to verify the significance of the sociodemographic cues between the different consumers groups (Annex 3). Only the presence or absence of kids within the households (F-test=0.0199), was found to be significant amongst the different classes.

3.2. Questionnaire results in Spain

For Spain, the survey has been filled by 50.3% males and 49.7% females. The 35.0% were between 55 and 77 years old, followed by the 26.1% between 30 and 40 years old, the 15% are between 45 and 54 and the 23.9% are between 18 and 29 years old. The 39.4% of the respondents are holders of high school diploma, the 37.8% are bachelor's degrees holders, the 11% for secondary school diploma holders and consecutively, the 11.8% are masters and PhD holders. The 39.5% of the respondents is made by employees, the 20.7% by unemployed, the 8.4% by freelancers, the 9.7% by students, while the 10.8% has a different profession from the one mentioned above. For the living area, the 40.7% of the respondents live in internal areas, the 32.2% and the 22.7% live, respectively, in seaside cities or near the seaside while only the 4.4% lives in mountain areas. The 33% of the respondents does not have kids, the remaining 67% has mainly between 2 and 4 kids under 12 years old within the household. Regarding food orientation, the 54.2% is made by omnivores, the 3.6% by pescatarians, the 11% by flexitarians, the 2.8% by vegetarians, the 1% by vegans, while the 27.4% has a particular diet related to personal food allergies and personal preferences (table 7).

Table 7. Spanish sample description

Variable	Code	Number of individuals	Percentage
Gender			
<i>Female</i>	1	497	49.7
<i>Male</i>	2	503	50.3
Age class			
<i>18-29</i>	1	239	23.9
<i>30-44</i>	2	261	26.1
<i>45-54</i>	3	150	15.0
<i>55-70</i>	4	350	35.0
Educational level			
<i>Secondary school diploma</i>	1	110	11.0
<i>High School Diploma</i>	2	394	39.4
<i>Bachelor's Degree</i>	3	378	37.8
<i>Master or PHD</i>	4	118	11.8
Job			
<i>Freelancer</i>	1	84	8.4
<i>Employee</i>	2	395	39.5
<i>Worker</i>	3	107	10.7
<i>Unemployed</i>	4	209	20.9
<i>Student</i>	5	97	9.7
<i>Others</i>	6	108	10.8
Revenue level			
<i><20.000€</i>	1	311	31.1
<i>20.000-40.000 €</i>	2	413	41.3
<i>40.000-60.000 €</i>	3	135	13.5
<i>60.000-100.000 €</i>	4	52	5.2
<i>>100.000 €</i>	5	16	1.6
<i>Prefer not to respond</i>	6	73	7.3
Area of living			
<i>Seaside city</i>	1	322	32.2
<i>Near the seaside</i>	2	227	22.7
<i>Internal area</i>	3	407	40.7
<i>Mounting area</i>	4	44	4.4
Number of members per household			

0		1	0.1
1		80	8.0
2		269	26.9
3		290	29.0
4		269	26.9
5		61	6.1
6		19	1.9
7		6	0.6
8		2	0.2
9		3	0.3
Kids			
No	1	330	33.0
Yes	2	670	67.0
Total		1000	99.7
Number of kids per household			
1		213	21.3
2		97	9.7
3		15	1.5
4		3	0.3
5		1	0.1
9		1	0.1
(Empty)		670	67.0
Food orientation			
Vegetarian	1	28	2.8
Vegan	2	10	1.0
Omnivore	3	542	54.2
Flexitarian	4	110	11.0
Pescatarian	5	36	3.6
Others	6	274	27.4

The survey results have shown that Spanish consumers like fish as food, with an average overall liking score of 7 (on a Likert scale of 1-9), in particular, 751 really like fish, 198 consumers partially prefer fish, and 51 do not like fish. Most of the respondents eat fish once a week or twice a week, only 22 people consume it less than once per month. The most common bought species are tuna, salmon, cod, sea bass, anchovies, mackerel, sea bream, tilapia and grouper. Mediterranean origin of the fish is important (average point of 5 on a Likert scale of 1-7). Participants usually buy fresh or canned fish from supermarkets, during the purchasing process, they gladly evaluate the opinion of their trusted seller (average point of 6 on a Likert scale of 1-7), but most of the Spanish personally evaluate the fish freshness; they focus the attention on the smell, the skin color, the eyes, and the texture of the fish

species. Fish traceability is important for Spanish (average point of 5 on a Likert scale of 1-7). Whereas the most known and the most purchased quality certification label is MSC (Marine Stewardship Council).

Regarding new fish trends, almost half of consumers eat sushi from one to three times per month. Like the Italian trend, a lot of Spanish, started to eat fish in the last five years.

3.2.1 Impact of the sociodemographic cues on consumer choice of attributes

Regarding the sociodemographic cues, farmed fish attribute and fish species are respectively significant at the levels of 0.05, and 0.01 for gender. Females care more than males regarding fish species, and whether fish is farmed or not when making their decision. People who are older had more interest in fish labelling and farmed attributes, and were less interested regarding freshness and seasonality, as the t-test for different age groups was found significant when comparing the oldest (55-70) and youngest group (18-29). The area of living was found to be significant for fish species, catch area, farmed, and cleanliness. People who live in seaside or near the seaside areas are more sensitive to fish species, and cleanliness, while they were less sensitive to catch area than those living in internal or mountain areas. Regarding jobs: fish labelling had a higher impact on freelancer's choice compared to students. Employees were found to be more sensitive to fish species compared to workers. In contrast, Unemployed were found to be more sensitive to the type of production compared to the freelancers. Others, who did not specify their jobs, gave less interest to the sustainability attribute compared to unemployed respondents. Concerning the seasonality, students, workers, and employees were more interested about fish seasonality compared to freelancers, unemployed and others.

Concerning farmed fish, others were more sensitive compared to freelancers, unemployed respondents, and students. For the cleanliness, others were more sensitive than students, employees, workers, and students. Education was found to be significant for farmed fish, and taste. The more educated are more sensitive to farmed fish, and taste attributes. Income also was found to be relevant in defining the importance of fish cues as with higher incomes we found more caring about the price, the seasonality, and less sensitive about the taste. The number of family members negatively affects fish labelling, seasonality and price, and families become less sensitive to the type of production. The presence of children impacts fish labelling, freshness, whether fish is farmed or not, cleanliness and taste attributes as people with kids give more attention to these two attributes than other households without kids.

3.2.2. Exploratory factor analysis and cluster analysis

Throughout the exploratory factor analysis, we analysed which of the attributes do contribute the most in explaining the consumer behaviour. A Bartlett's test of sphericity was performed, the p-value of 0.000 indicates significancy (figure 6).

Determinant of the correlation matrix		
Det	=	0.075
Bartlett test of sphericity		
Chi-square	=	2576.341
Degrees of freedom	=	78
p-value	=	0.000
H0: variables are not intercorrelated		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		
KMO	=	0.286

Figure 6. Respondent's classification based on the exploratory factor analysis scores

The exploratory factor analysis revealed that the 3 first new factor loadings can explain the 76.9% of the variance (figure 7). The first factor is mainly dependent on the type of production (-0.8124) and sustainability attribute (0.4078). The second factor depends on the price (0.7125) and the sustainability characteristics of fish (-0.5411). Lastly, the third factor depends on fish labelling (-0.7161) and the freshness of the product (0.4908) (figure 8).

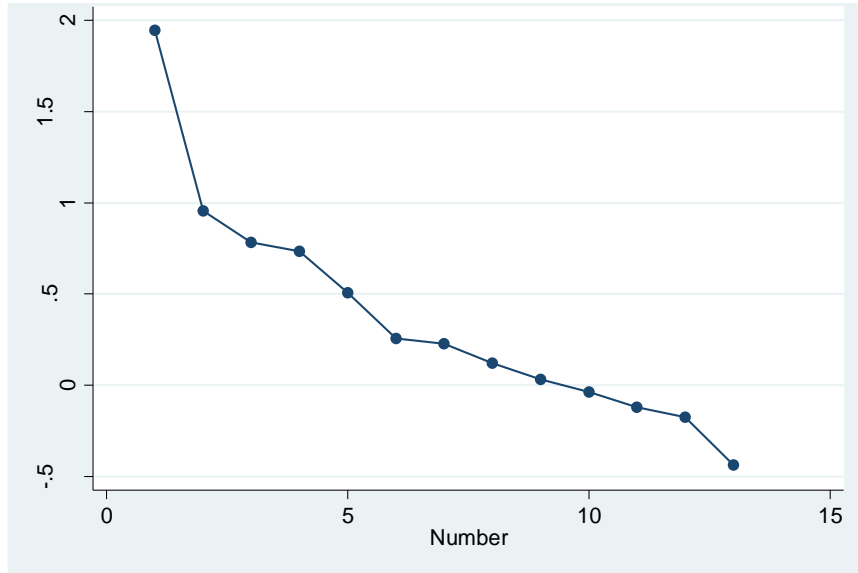


Figure 7. Eigenvalues of the new factors from the exploratory factor analysis

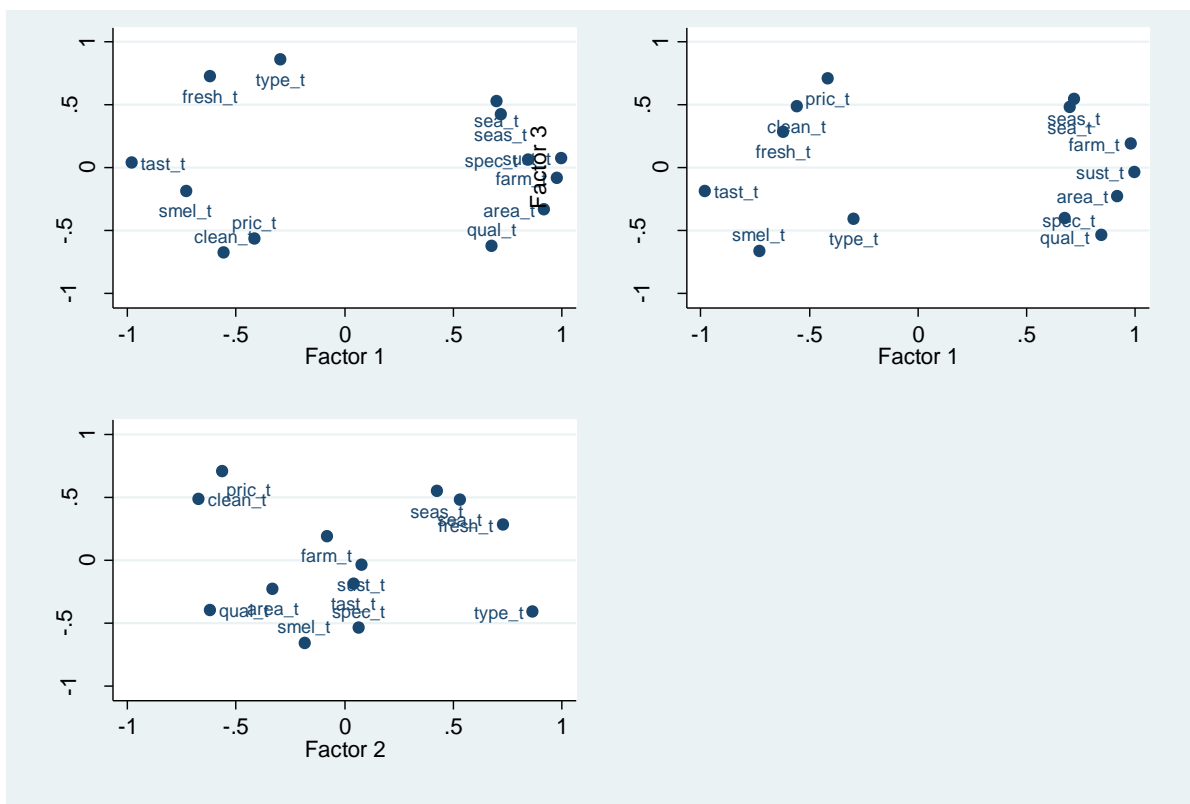


Figure 8. Factor loadings from the exploratory factor analysis

We, then, compared the means of each variable between each class to determine the characteristics of each group (table 8, table 9). Overall, the third and fourth clusters are sensitive to the freshness attribute, while the first and second groups are more sensitive to fish labelling. Particularly, the first group (23.4% of the sample), catch area sensitive consumers, valued price in the first place (1.8462), followed by the cleanliness (0.9744), while they are the least interested regarding the catch area (-0.9231). The consumers in this group are mostly omnivores. The second group of consumers, sensory sensitive consumers (12.1% of the sample), are mostly affected by the smell (3.936709), and taste (1.585443), and are less affected by catch area (-1.955696) and fish species (-1.623418). The consumers in this group are mainly males, younger respondents, and those with the least kids within their households. The third group of consumers, price, and freshness sensitive consumers (14.4% of the sample) are mostly affected by the price (4.0), and whether fish is farmed or not (1.1250) and are the least affected by the freshness characteristic (-4.0) amongst the four groups. The consumers in this group are mostly females, older respondents, with the highest income, and education levels, and mostly respondents with kids. Lastly, the fourth group of consumers, the species sensitive group (50.1% of the sample), are mostly affected by fish species (1.7764), and whether fish is farmed or not cues (0.9162) and are less affected by the price (-2.0998), smell (-2.4351) and taste (-1.4431) during their decision making. The consumers in this group are mostly those who live near the seaside, the lowest income respondents, and with small families.

Table 8. Description of Spanish consumer clusters

Clusters	1	2	3	4
<i>Name of the clusters</i>	Catch area sensitive group	Sensory sensitive group	Price and freshness sensitive group	Species sensitive group
<i>Number of respondents per cluster</i>	234	121	144	501
<i>Qual_t</i>	-1.1496	-2.2727	0.4444	0.5170
<i>Spec_t</i>	0.6667	1.2975	0.9097	1.7764
<i>Area_t</i>	-0.9231	-0.4380	-0.2847	-0.2415
<i>Fresh_t</i>	0.2051	0.0992	-4.0000	-3.3293
<i>Pric_t</i>	1.8462	1.8512	4.0000	-2.0998
<i>Type_t</i>	0.2650	-0.6860	-0.6736	0.0240
<i>Sust_t</i>	-0.7179	-0.2479	-0.5833	0.0958
<i>Sea_t</i>	-0.1197	0.9256	0.0903	0.4990
<i>Seas_t</i>	0.0085	0.5785	-0.3125	0.1297
<i>Farm_t</i>	0.5983	1.1074	1.1250	0.9162
<i>Clean_t</i>	0.9744	0.4545	0.5833	0.2016
<i>Tast_t</i>	-0.3932	-1.2727	-1.2222	-1.4431
<i>Smel_t</i>	0.5812	-3.9008	-1.9444	-2.4351

Table 9. Sociodemographic description of the clusters

Clusters	1	2	3	4
<i>Name of the clusters</i>	Catch area sensitive group	Sensory sensitive group	Price and freshness sensitive group	Species sensitive group
<i>Number of respondents per cluster</i>	234	121	144	501
<i>Gender</i>	1.470085	1.603306	1.465278	1.50499
<i>Age range</i>	2.611111	2.024793	2.819444	2.692615
<i>Geo</i>	2.213675	2.239669	2.166667	2.139721
<i>Education</i>	2.5	2.413223	2.548611	2.51497
<i>Job</i>	3.192308	3.066116	3.305556	3.133733
<i>Income</i>	2.213675	2.504132	2.548611	2.155689
<i>Family</i>	3.115385	3.280992	2.847222	3.057884
<i>Kids</i>	1.611111	1.595041	1.743056	1.694611
<i>Diet</i>	3.995726	3.942149	3.9375	3.91018

And finally, ANOVA tests were performed to verify the significance of the sociodemographic cues between the different consumers groups (Annex 4). Only age range (F-test=0.0232), and the presence or absence of kids within the households (F-test=0.0081), was found to be significant amongst the different classes.

4. Sensory evaluation

Based on the Italian questionnaire results, UNINA team has carried out a sensory evaluation with two fish species: red tuna and anchovies, both species caught from the Mediterranean Sea. The specific aim of the experiment was to assess the effect of MSC label information on consumer perception and liking for the fish. A total of 54 fish consumers (38 = female, average age: 37y.o.) have been involved in the sensory evaluation, performed in three different experimental conditions:

- **BLIND SESSION.** During a first session, consumers performed a blind test, during which they tested the fish samples without any information on them. Samples were served by using three-digit numerical codes.
- **EXPECTED SESSION.** Secondly, they were asked to only observe the MSC label and score the expected liking of fish samples, red tuna and anchovies, labelled with the MSC certification.
- **INFORMED SESSION.** Finally, one week later, the same consumers evaluated again the fish samples, as in the first step, but labelled with the MSC certification.

In both first and third sessions, consumers were first asked to score the overall liking, and the liking for smell, and appearance of the raw samples, on 9-point hedonic scales. Secondly, they were asked to indicate the expected price for the raw samples (€/kg) and finally they evaluated the cooked samples, scoring the overall liking, and the liking for smell, appearance, taste, and texture properties.

Fish for sensory analysis were bought from local fishmonger. Whole raw anchovies were placed in a plastic dish and served to consumers (more than one anchovy per dish, for simulating the purchase

moment). After the evaluation of raw samples, they were decapitated, gutted, floured and oven cooked, then placed in a dish for the next step of the test.

Tuna's samples were bought in slices. Each slice was cut in cubes of approximately 4x4x2cm and then placed in a plastic dish for the raw evaluation. After this first step, the cubes were oven cooked and served to the consumers for the next step of the test.

Both anchovies and tuna's cubes were cooked in dry air oven for 5 minutes at 270°C.

Figure 9 shows the comparison of the overall liking for raw anchovies scored in blind and informed sessions. There is a significant difference between the data ($p = 0.032$), in particular the overall liking for raw anchovies was higher in informed condition than in the blind one, it revealing the positive effect of MSC label on consumer perception.

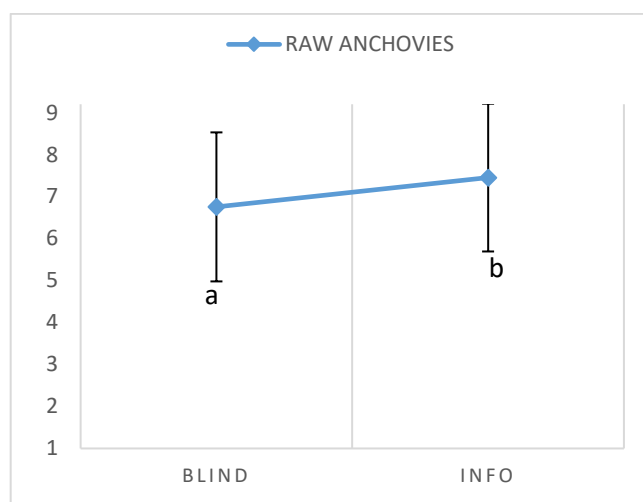


Figure 9. Raw anchovy overall liking (average of 54 consumers \pm standard deviation): difference between informed and blind evaluations

Also, for the appearance (Figure 10), a significant difference between liking for the anchovies evaluated in blind and in informed sessions ($p = 0.025$) was found. This result confirmed the previous one.

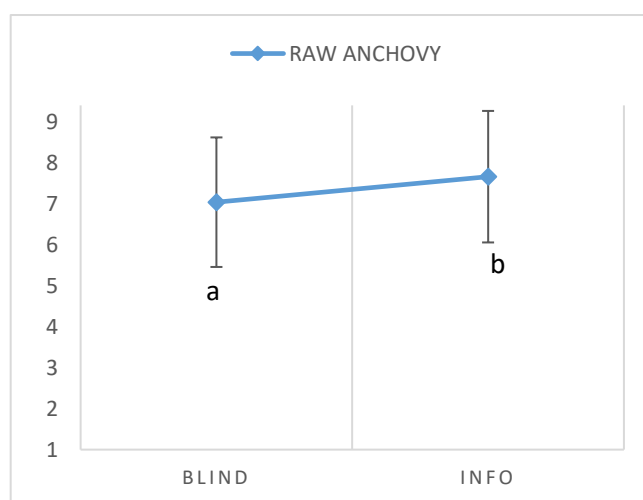


Figure 10. Raw anchovy appearance (average of 54 consumers \pm standard deviation): difference between informed and blind evaluations

Even though the smell in informed condition was more liked than in blind one, we did not find a significant effect of the MSC label on the liking for smell of raw anchovies (table 10), probably because consumers were unable to evaluate in a properly way the smell of anchovies.

Table 10. Blind and informed smell evaluations of raw anchovies

Variable	Observations	Min	Max	Mean	Std. dev
<i>Smell_blind</i>	54	1.0	9.0	6.6	1.97
<i>Smell_info</i>	54	1.0	9.0	7.1	1.70

The results of sensory evaluation of cooked anchovies are shown in table 11. There are not significant differences in terms of all the evaluated variables (overall liking, and liking of smell, taste and texture properties) with except for the appearance ($p = 0.043$). In particular the appearance of MSC certified anchovies was more liked than that of blind anchovies (figure 11).

Table 11. Blind and informed evaluations of cooked anchovies

Variable	Observations	Min	Max	Mean	Std. deviation
<i>Overall_blind</i>	54	1.0	9.0	7.4	1.48
<i>Overall_info</i>	54	1.0	9.0	7.9	1.47
<i>Smell blind</i>	54	2.0	9.0	7.6	1.27
<i>Smell info</i>	54	1.0	9.0	7.9	1.53
<i>Taste blind</i>	54	1.0	9.0	7.7	1.59
<i>Taste info</i>	54	2.0	9.0	7.9	1.29
<i>Texture blind</i>	54	1.0	9.0	7.4	1.66
<i>Texture info</i>	54	3.0	9.0	7.8	1.18

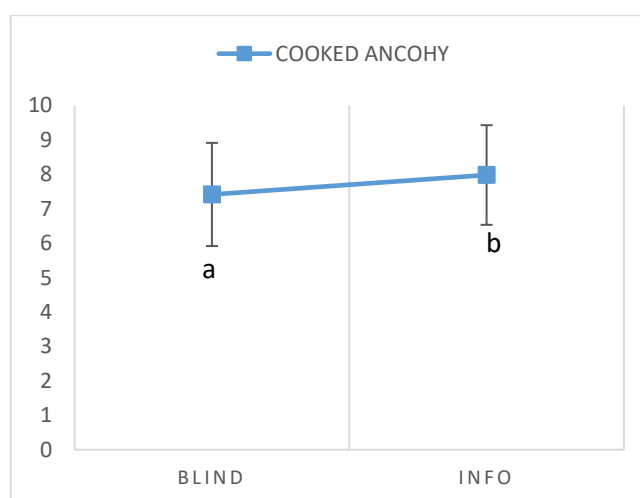


Figure-11. Cooked anchovy appearance (average of 54 consumers \pm standard deviation): difference between informed and blind evaluations

Also, for the price, there were no significant differences between the blind and informed sessions, as it is shown in table 12.

Probably this effect may be due to a lack of knowledge about the price for kilograms of fish with certification label, since most of the local specialized shops do not sell fresh fish with a certification label, despite supermarkets which sell packed products.

Table 12. Price evaluations

Variable	Observations	Min	Max	Mean	Std. deviation
<i>Price_blind</i>	54	2.00	18.0	6.86	3.55
<i>Price_info</i>	54	3.00	15.0	6.90	2.54

Even though the liking of raw tuna in informed condition was always higher than in blind one, we did not find any significant effect of the MSC label information (table 13).

Table 13. Blind and informed evaluations of raw tuna fish

	Observations	Min	Max	Mean	Std. deviation
<i>Overall_blind</i>	54	1.0	9.0	7.1	1.43
<i>Overall_info</i>	54	3.0	9.0	7.6	1.39
<i>Apparence_blind</i>	54	2.0	9.0	7.4	1.45
<i>Apparence_info</i>	54	4.0	9.0	7.8	1.30
<i>Smell_blind</i>	54	1.0	9.0	6.8	1.52
<i>Smell_info</i>	54	3.0	9.0	6.8	1.86
<i>Price_blind</i>	54	2.0	75.0	16.8	18.53
<i>Price_info</i>	54	8.0	75.0	10.9	10.52

The results of the test on cooked tuna samples show a similar trend of the raw samples, this confirms the trend stemming from the previous experiments (Table 14).

Table 14- Blind and informed evaluations of cooked tuna fish

Variable	Observations	Min	Max	Mean	Std. deviation
<i>Overall_blind</i>	54	2.0	9.0	6.6	1.66
<i>Overall_info</i>	54	3.0	9.0	7.0	1.70
<i>Apparence_blind</i>	54	1.0	9.0	6.4	1.91
<i>Apparence_info</i>	54	2.0	9.0	6.9	1.85
<i>Smell_blind</i>	54	3.0	9.0	6.9	1.61
<i>Smell_info</i>	54	2.0	9.0	7.4	1.56
<i>Taste_blind</i>	54	2.0	9.0	6.8	1.85

<i>Taste_info</i>	54	3.0	9.0	7.1	1.84
<i>Texture_blind</i>	54	2.0	9.0	7.1	1.70
<i>Texture_info</i>	54	2.0	9.0	6.6	2.24

5. Conclusions

By means of FG interviews, differences in fish species appreciation between countries and according to consumers' geographical location (seaside vs internal areas) were noted. A higher fish intake for participants from seaside areas was correlated with product availability, better supply chain, dietary habits, and traditions. Moreover, the behaviour of people living in internal areas was more sensitive to sensory and physical attributes, price, certification, lack of trust and freshness. Besides, knowledge, age, marital status, and number of individuals in a household contributed to a change in consumer's perception of fish.

The economic analysis confirmed the results obtained by FG. Particularly, the best-worst (BW) scaling method was used to reveal the importance of cues that were found relevant in the FG. In particular, the Italian population was classified into four groups, based on the relative importance of each cue: *Label sensitive* group (n=196); *Price sensitive* group (n=200); *Sensory sensitive* group (n=316), and *Wildly caught* sensitive group (n=291). The Spanish population instead was classified into *Catch area sensitive* group (n=234); *Sensory sensitive* group (n=121); *Price and freshness sensitive* group (n=144) and *Species sensitive* group (n=501).

The sensory evaluation performed with Italian consumers on red tuna and anchovies, was useful to assess the effect of MSC label information on hedonic evaluation of fish. Even if the information on certification label was not always significant, that improved the liking of both raw and cooked fish.

Annex 1: Focus group guide

PS: This focus group guide is to be used only by the moderator and not to be shared with the participants. This is aimed to serve as a guide for the moderator to be able to structure the progress of the focus group.				
Overall time:				
	Theme of Focus Group section	Instructions	Questions & Probing	Objectives
Section 1 Time: 5 min	Introduction of the moderator. Explanation about on-going recording and facilities (food and drinks). Description of the objectives of focus group discussion.	The moderator starts presenting himself and introducing the focus group: Ask everyone to present themselves (name, origin profession interests) After the round of presentations, summarize the information about all participants (Name, origin, and occupation). Use a post it to identify the name of each member of the panel in order to make the discussion friendlier.	Icebreaker: What do you think about the ongoing situation regarding the covid? Do you think it is going to get better any time soon?	Create a relaxed, friendly, and pleasant environment. Let the participants talk; try to establish a contact with them, showing interest in what everyone says. Introduce participants. NB: Notes and recordings of all discussion need to be gathered (Translated Verbatim). Write down the points of dispute and the attitudes NB: Ask the participants for their permission to record or write their statements in order to reinforce the trust environment.
Section 2a Time: 10-15 min	Discussion on fish preferences Try to stimulate the discussion on fish.	Ask the participants general information about their perception and appreciation of fish Ask others to comment. Use post it to write the participants ideas on a board in order to be able to visualize the ideas and be able to discuss them with the panel.	What words or phrases come to mind when you think of fish? What situations you associate with fish? (If the question is unclear to the participants, try to give them hints such as ; is there any particular time or event where you prefer to consume fish. What do you like best about fish?	Understand participants' general point of views to facilitate data interpretation and be able to focus their attention on the topic of discussion.
Section 2b Time: 10-15 min	Discussion on trends and concerns when consuming fish	Ask the participants about their opinions on the fish market and their concerns when consuming fish Same as the previous state, the use of post it to write down the ideas is mandatory	What are your problems or concerns when consuming fish? What trends do you see happening in the fish market?	Advantages/disadvantages/benefits/risks of fish consumption. Have a general understanding of the main factors influencing consumer' choice and purchase behaviour
Section 3a Time: 10-15 min	Discussion on consumer preferences and specific characteristics for each type of fish	Ask the participants about the types of fish that they like to consume and the characteristics. Write in post it those preferences in order to have a support for the discussion later on.	What are the types of fish that you prefer to consume the most? What are the characteristics that you like in the type of fish that you like to consume?	Get an overall understanding of the participant's preferences.
Section 3b Time: 10-15 min	Focus on intrinsic attributes Focus the discussion on the intrinsic characteristics (sensorial and physical attributes) of the product	Explain to the panel what intrinsic cues are and give each member the time to get a full understanding of this section's argument.	What is the impact of the intrinsic characteristics of fish on your purchase behaviour	Explore the most important intrinsic cues of fish for consumers Explore the consumer's preferences regarding the consumption of fresh or frozen, the way they prefer or buy the fish (already cleaned and packaged or in bulk, from local markets or from grand distribution) Explore perceptions of implications on environment, health, market, prices, etc.

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Overall time:				
	Theme of Focus Group section	Instructions	Questions & Probing	Objectives
Section 3c Time: 10-15 min	Relation between intrinsic cues, catch zone and origin Focus the discussion on the origin and catch zone for the product.	Explain the differences between the two concepts (origin of the product and catch zone) Illustrations can be used in order to ensure a full differentiation of the two concepts	Do you accord an importance to the origin and catch zone of fish? According to you, what are the relationships between origin, catch zone and intrinsic cues Where do you consider the fish that you consume in terms of sensorial attributes compared to fish from another country?	Explore attitudes and acceptance on fish depending on its origin and catch zone. Explore the relationship between catch zone, origin and intrinsic attributes. Understand the main changes that the consumer notices when changing either the catch zone, origin, or both at the same time. It is important that all participants understand the difference between catch zone and origin
Section 4 Time: 20-25 min	Explore the extrinsic attributes of fish The moderator is going to guide the discussion in order to focus the discussion about the extrinsic cues related to fish.	Explain what extrinsic cues are and give the panel time to think about what is the most important to them Give everyone the time to speak freely, let the panel members interact with each other. A general statement is going to be given to the participant's thinking process (q1) otherwise other questions (q2, q3,q4,q5) can be used to inspire the participants and give them a clear direction of the needed information.	1- What are the other important factors other than the sensorial and physical attributes that are important to you? 2-What do you look for packaging wise when buying fish? 3-Are there any characteristics when choosing one brand compared to another, what are your motives when choosing? 4-What do you think about fish price and its impact on your purchase and consumption behaviour? 5-What are the main benefits or inconvenient from consuming fish?	Understand the importance of factors such as packaging, brand, pricing, label, trust of the vendor. Understand the dynamics between fish and health.
Section 5 Time: 10-15 min	Explore the links between intrinsic and extrinsic values The moderator is going to tend to recapitulate all of the information collected previously and try to search for links	Use post it to write key information discussed earlier and engage the panel members by trying to find relationships between the different characteristics	According to you, what is the relationship between price, sensorial attributes, physical attributes, origin catch zone certification and pricing?	Get a recapitulative overview of the discussion from the beginning of the focus group Explore attitudes and factors related to the consumer' behaviour

<p>PS: This focus group guide is to be used only by the moderator and not to be shared with the participants. This is aimed to serve as a guide for the moderator to be able to structure the progress of the focus group.</p>				
<p>Overall time:</p>				
	<p>Theme of Focus Group section</p>	<p>Instructions</p>	<p>Questions & Probing</p>	<p>Objectives</p>
<p>Section 6 Time: 5-10 min</p>	<p>Final consideration After the end of section 5, validate the information collected throughout the discussion</p>	<p>Provide each participant the time to explain him/herself about the output of the discussion.</p> <p>Make sure only one person speaks at a time. At the end of the focus group provide an oral summary using the board made from the beginning to the end.</p> <p>Thank the participants for attending.</p>		<p>Get an overall summary of the statements made from the beginning to the end of the discussion</p> <p>Ask participants for suggestions, general observations to improve the flow of the focus group next time</p>

Annex 2. Abbreviations of the best to worst attributes

Abbreviations	Full name
qual_t	Fish label
spec_t	Fish species
area_t	Catch area
fresh_t	Freshness
pric_t	Price
type_t	Type of production
sust_t	Sustainability
sea_t	Wild caught
seas_t	seasonal
farm_t	Farmed
clean_t	Clean
tast_t	Taste
smel_t	smell

Annex 3. Anova test of clusters according to the sociodemographic characteristics of the population, Italy

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0007		
	Mean MSK	-4,66766	Adj R-squared	0,0007		
Zone	Partials SS	df	MS	F	Prob>F	
Model	2,1789913	3	7263306	2,40	0,0007	
error	2,1789913	3	7263306	2,40	0,0007	
Residual	2,1789913	999	2178991			
Total	2,1789913	1,000	2178991			

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0000		
	Mean MSK	1,0857	Adj R-squared	0,0000		
Zone	Partials SS	df	MS	F	Prob>F	
Model	7,1050007	3	2368335	2,00	0,1099	
error	7,1050007	3	2368335	2,00	0,1099	
Residual	3174,2050	999	3174205			
Total	3180,4101	1,000	3177751			

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0004		
	Mean MSK	-9,60359	Adj R-squared	0,0004		
Zone	Partials SS	df	MS	F	Prob>F	
Model	2,9076676	3	9692226	1,13	0,3289	
error	2,9076676	3	9692226	1,13	0,3289	
Residual	7913,9347	999	7908383			
Total	7916,8424	1,000	7907371			

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0004		
	Mean MSK	-9,65162	Adj R-squared	0,0004		
Zone	Partials SS	df	MS	F	Prob>F	
Model	3,0953774	3	1031792	1,46	0,2286	
error	3,0953774	3	1031792	1,46	0,2286	
Residual	713,9788	999	713888			
Total	717,0765	1,000	713647			

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0008		
	Mean MSK	1,49636	Adj R-squared	0,0007		
Zone	Partials SS	df	MS	F	Prob>F	
Model	6,277776	3	2092592	0,93	0,4276	
error	6,277776	3	2092592	0,93	0,4276	
Residual	2258,2826	999	2262211			
Total	2264,5602	1,000	2260307			

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0003		
	Mean MSK	1,6499	Adj R-squared	0,0003		
Zone	Partials SS	df	MS	F	Prob>F	
Model	11,999673	3	3999891	1,70	0,1666	
error	11,999673	3	3999891	1,70	0,1666	
Residual	2670,5073	999	2671801			
Total	2682,5067	1,000	2679490			

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0007		
	Mean MSK	1,10043	Adj R-squared	0,0007		
Zone	Partials SS	df	MS	F	Prob>F	
Model	2,602885	3	867628	0,07	0,9786	
error	2,602885	3	867628	0,07	0,9786	
Residual	3209,699	999	3213017			
Total	3212,3015	1,000	3207569			

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0003		
	Mean MSK	-9,50279	Adj R-squared	0,0003		
Zone	Partials SS	df	MS	F	Prob>F	
Model	1,506679	3	502226	0,69	0,5986	
error	1,506679	3	502226	0,69	0,5986	
Residual	727,4367	999	727684			
Total	728,9436	1,000	727684			

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0009		
	Mean MSK	-4,11802	Adj R-squared	0,0009		
Zone	Partials SS	df	MS	F	Prob>F	
Model	1,9697889	3	656596	1,68	0,0139	
error	1,9697889	3	656596	1,68	0,0139	
Residual	169,4327	999	169432			
Total	171,3986	1,000	170827			

Mediterranean cuisine						
	Number of sites	219	R-squared	0,0006		
	Mean MSK	-6,65002	Adj R-squared	0,0006		
Zone	Partials SS	df	MS	F	Prob>F	
Model	6,170006	3	2056669	0,11	0,9066	
error	6,170006	3	2056669	0,11	0,9066	
Residual	91,60059	216	424072			
Total	97,7706	219	422613			

Mediterranean cuisine						
	Number of sites	1,000	R-squared	0,0009		
	Mean MSK	-7,6906	Adj R-squared	0,0009		
Zone	Partials SS	df	MS	F	Prob>F	
Model	1,761809	3	587270	0,98	0,4006	
error	1,761809	3	587270	0,98	0,4006	
Residual	590,9707	999	591611			
Total	592,7326	1,000	591611			

Annex 4. Anova test of clusters according to the sociodemographic characteristics of the population, Spain

. anova clus sex					
Number of obs =		1,000	R-squared =	0.0000	
Root MSE =		1.24631	Adj R-squared =	-0.0010	
Source	Partial SS	df	MS	F	Prob>F
Model	.0727294	1	.0727294	0.05	0.8287
sex	.0727294	1	.0727294	0.05	0.8287
Residual	1550.1833	998	1.5532899		
Total	1550.256	999	1.5518078		
. anova clus agerange					
Number of obs =		1,000	R-squared =	0.0095	
Root MSE =		1.24165	Adj R-squared =	0.0065	
Source	Partial SS	df	MS	F	Prob>F
Model	14.729993	3	4.9099977	3.18	0.0232
agerange	14.729993	3	4.9099977	3.18	0.0232
Residual	1535.526	996	1.5416928		
Total	1550.256	999	1.5518078		
. anova clus geo					
Number of obs =		1,000	R-squared =	0.0019	
Root MSE =		1.2464	Adj R-squared =	-0.0011	
Source	Partial SS	df	MS	F	Prob>F
Model	2.9494841	3	.98316136	0.63	0.5939
geo	2.9494841	3	.98316136	0.63	0.5939
Residual	1547.3065	996	1.5535206		
Total	1550.256	999	1.5518078		
. anova clus edu					
Number of obs =		1,000	R-squared =	0.0078	
Root MSE =		1.24274	Adj R-squared =	0.0048	
Source	Partial SS	df	MS	F	Prob>F
Model	12.039299	3	4.0130998	2.60	0.0510
edu	12.039299	3	4.0130998	2.60	0.0510
Residual	1538.2167	996	1.5443943		
Total	1550.256	999	1.5518078		
. anova clus job					
Number of obs =		1,000	R-squared =	0.0027	
Root MSE =		1.24716	Adj R-squared =	-0.0023	
Source	Partial SS	df	MS	F	Prob>F
Model	4.192153	5	.83843059	0.54	0.7468
job	4.192153	5	.83843059	0.54	0.7468
Residual	1546.0638	994	1.5553962		
Total	1550.256	999	1.5518078		
. anova clus income					
Number of obs =		1,000	R-squared =	0.0093	
Root MSE =		1.243	Adj R-squared =	0.0044	
Source	Partial SS	df	MS	F	Prob>F
Model	14.484562	5	2.8969124	1.87	0.0961
income	14.484562	5	2.8969124	1.87	0.0961
Residual	1535.7714	994	1.5450417		
Total	1550.256	999	1.5518078		
. anova clus family					
Number of obs =		1,000	R-squared =	0.0073	
Root MSE =		1.2468	Adj R-squared =	-0.0017	
Source	Partial SS	df	MS	F	Prob>F
Model	11.279119	9	1.2532355	0.81	0.6106
family	11.279119	9	1.2532355	0.81	0.6106
Residual	1538.9769	990	1.5545221		
Total	1550.256	999	1.5518078		
. anova clus fam_work					
Number of obs =		1,000	R-squared =	0.0031	
Root MSE =		1.24751	Adj R-squared =	-0.0029	
Source	Partial SS	df	MS	F	Prob>F
Model	4.8683728	6	.81139546	0.52	0.7924
fam work	4.8683728	6	.81139546	0.52	0.7924
Residual	1545.3876	993	1.5562816		
Total	1550.256	999	1.5518078		
. anova clus kids					
Number of obs =		1,000	R-squared =	0.0070	
Root MSE =		1.24197	Adj R-squared =	0.0060	
Source	Partial SS	df	MS	F	Prob>F
Model	10.841617	1	10.841617	7.03	0.0081
kids	10.841617	1	10.841617	7.03	0.0081
Residual	1539.4144	998	1.5424994		
Total	1550.256	999	1.5518078		
. anova clus quanti_kids					
Number of obs =		330	R-squared =	0.0138	
Root MSE =		1.291	Adj R-squared =	-0.0014	
Source	Partial SS	df	MS	F	Prob>F
Model	7.5578477	5	1.5115695	0.91	0.4767
quanti_kids	7.5578477	5	1.5115695	0.91	0.4767
Residual	540.00579	324	1.6666845		
Total	547.56364	329	1.6643272		
. anova clus diet					
Number of obs =		1,000	R-squared =	0.0232	
Root MSE =		1.23429	Adj R-squared =	0.0183	
Source	Partial SS	df	MS	F	Prob>F
Model	35.932946	5	7.1865892	4.72	0.0003
diet	35.932946	5	7.1865892	4.72	0.0003
Residual	1514.3231	994	1.5234638		
Total	1550.256	999	1.5518078		

6. References

- Braun, V., & Clarke, V. (2006). *Using thematic analysis in psychology*. January 2014. <https://doi.org/10.1191/1478088706qp063oa>
- Charmaz, K. (2011). Grounded Theory Methods in Social Justice Research. *The SAGE Handbook of Qualitative Research, January 2011*, 359–380. https://books.google.com/books?hl=en&lr=&id=qEiC_ELYglC&pgis=1
- Felice D. Billups. (2003). Conducting Focus Groups with College Students: Strategies to Ensure Success. *Management*, 127, 2–3.
- Oude Ophuis, P. A. M., & Van Trijp, H. C. M. (1995). Perceived quality: A market driven and consumer oriented approach. *Food Quality and Preference*, 6(3), 177–183. [https://doi.org/10.1016/0950-3293\(94\)00028-T](https://doi.org/10.1016/0950-3293(94)00028-T)