

HABITS OF PORTUGUESE CONSUMERS ON THE ACQUISITION AND CONSUMPTION OF CHILLED AND FROZEN FOOD PRODUCTS

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Abstract

The consumption of cold-chain products, such as dairy, meat, fish, fresh juices and vegetables, ready to eat meals or desserts, is very meaningful in the context of the whole food supply chain since these products are pivotal in most western households. The consumption of cold-chain products in Portugal is still unexplored. Hence, this work aimed to carry out a questionnaire survey to characterize the Portuguese consumers' habits on the acquisition of fresh, refrigerated and frozen food products. Also, the buying frequency of different types of refrigerated food products was investigated, as well as the buying in different food retail stores: local convenience neighbourhood stores, small/medium supermarkets or large retail stores.

The instrument used in the present study to carry out the investigation proposed was a questionnaire survey. The questionnaire included questions to characterize refrigerated dairy food product consumer habits, and also some questions were included aiming at knowing the sociodemographic characteristics of the people involved. The data was collected between 20th of June and 6th of July 2020, using an internet platform. The questionnaire was disclosed to people by different internet tools, like e-mail and social networks. The participation was voluntary and confidentiality of the answers obtained was guaranteed. Ethical issues were respected in the design and application of the questionnaire. The sample size consisted of 136 individuals, all adult citizens, who voluntarily answer the questionnaire. The treatment of the data was made using an Excel database and spreadsheet functionalities.

The result showed that Portuguese consumers purchase refrigerated and frozen foods mostly in shopping centre supermarkets or small/medium supermarkets. The neighborhood stores or outdoor markets are rarely used to purchase this type of product. Regarding refrigerated products, Portuguese consumers buy them mostly every week in case of dairy products (59.4%), charcuteries (42.3%), fresh fish (52.9%) and meat (54.7%) and also fresh vegetables - IV gamma products (51.4%). The refrigerated pre-prepared meals are purchased very rarely (44.9%) or not at all. In Portugal, due to the influences of the Atlantic Ocean and the Mediterranean Sea, there is a tradition of eating fish daily. Concerning the frozen food products, the frequency of purchasing is lower as compared with refrigerated foods, being a monthly frequency for most types of products. It was also observed that Portuguese consumers demonstrate preferences for fresh products instead of refrigerated or frozen ones when it comes to their nutritional and textural quality (94.2%), but prefer the later when it comes to their conservation capacity and longer shelf-life (53.2%). Some recognize that canned foods offer some advantages, particularly related to the convenience of storage (35.0%), shelf-life (37.7%) or reduced storage costs (33.1%). Finally, these results indicate a great level of confidence of Portuguese consumers in the refrigerated (87.5%) and frozen (83.8%) foods stored in supermarket's display cabinets

This work allowed establishing some patterns regarding the Portuguese consumers' habits and preferences regarding refrigerated and frozen food products. They

prefer to shop these products in shopping centre supermarkets, with a frequency that is mostly weekly for refrigerated foods and monthly for frozen foods. Finally, they trust the quality of refrigerated and frozen food products displayed in supermarket cabinets and tend to rely on the expiring date information provided in the package.

Key words: *Consumption habits, Refrigerated food products, Questionnaire, Portuguese survey.*

1. Introduction

The market of refrigerated and frozen food products is vast and encompasses many challenges of different nature, some linked with sustainability, like for example the high energy needed to store, transport and display foods in sales points, and others directly impacting product quality and safety, like for example oscillations in temperature that can lead to physical, chemical, microbial or enzymatic undesirable modifications. Due to these interconnections, food safety is intimately related to refrigeration or freezing, and this, in turn, is related to food waste. Perishable food products must be maintained under refrigeration or freezing at controlled temperature ranges throughout the entire supply chain. This encompasses the domain of the so-called cold chain, which includes the cooling steps applied to keep the food under a desired temperature range, such as production, pre-cooling, transport, storage, distribution and, at the end of the chain, the domestic refrigeration/freezing [1 - 5].

The display of refrigerated and frozen products in selling shops, and particularly larger supermarkets or retail stores, can encompass diverse types of equipment, being the refrigerated cases with doors one of the most selected options in recent years. The presence of doors provides several advantages over the standard open display case design, like for example, optimize energy expenditure, provide better temperature distribution, and ensure better product quality, thus maximizing shelf-life [6 - 8]. Although there are recognized advantages in using display equipment with glass doors, there are still many shops and retail points which remain using open display cases. There are some advantages for the consumer that help explain this option, such as customer convenience by picking the product right off the shelf without the need to open doors, provide a more complete visual and tactile customer experience, and also the potential unfavourable impact of display case doors on product sales. Nevertheless, latest research has evidenced that the use of closed glass doors on vertical or horizontal display cabinets did not impact on sales volume or even on the consumer experience since consumers start to understand that these options provide higher products safety and better quality [9].

The consumer market of cold-chain foods includes several families of products, such as dairy, meat, fish, fresh juices and vegetables, ready to eat meals or desserts, to cite the most relevant. Although refrigerated and frozen foods have different requirements of temperature-moisture control, in both cases there is no doubt that this control is essential to guarantee product quality and safety [10 - 13]. The consumption of cold-chain products is very meaningful in the context of the whole food supply chain, since these products are pivotal in most western households. The consumer perceives the quality of a food product as much more than just the sensory properties of the product. Quality is a complex construct bearing many dimensions, which impact consumer buying intentions. While the product characteristics are concrete attributes of the product as perceived by the consumer, the buying motivations are abstract and drive consumer behaviour across a wide range of products [14, 15]. On the other hand, the questions linked with food safety go beyond the domain of the consumer preferences or motivations, since these issues impact directly on human health as individuals or on the public health on a broader sense. Hence, food safety assumes an extreme importance for the food industries and retailers/sellers as well as food services due to foodborne illness derived directly or indirectly from the ingestion of etiological agents. The World Health Organization estimated that per year 600 million people (corresponding to 1/10th of the world population) fall ill after eating contaminated foods, and 420 thousand ends up dying [16, 17]. On a study undertaken in Portugal [18], the authors analysed diverse foods on sale in Portugal, searching for *Listeria monocytogenes*, and confirmed its presence in 72 out of 1,035 samples, mostly in raw products like for example milk, meat or fish. Nevertheless, they also detected *L. monocytogenes* in some fermented (ready-to-eat) products, identifying the consumption of fresh cheese as a potential risk for Portuguese consumers [18].

The consumption of cold-chain products in Portugal is still unexplored, unlike other markets, which have already been investigated, like for example bread [19, 20], street food [21], or beverages [22, 23]. Hence, the objective of this work was to carry out a questionnaire survey directed to the consumers of daily consumed refrigerated food products, such as yoghurts, milk, butter, cheeses, cold meats and packaged meats, etc., to characterize the Portuguese consumers' habits on the acquisition of fresh, refrigerated and frozen food products. Also, the buying frequency of different types of refrigerated food products was investigated, as well as the buying in different food retail stores: local convenience neighbourhood stores, small/medium supermarkets or large retail stores.

2. Materials and Methods

The instrument used in the present study to carry out the investigation proposed was a questionnaire survey. The questionnaire included questions to characterize refrigerated dairy food product consumer habits, and also some questions were included aiming at knowing the sociodemographic characteristics of the people involved.

The data was collected between 20th of June and 6th of July, using an internet platform. The questionnaire was disclosed to people by different internet tools, as e-mail and social networks. The participation was voluntary and confidentiality of the answers obtained was guaranteed. Ethical issues were respected in the design and application of the questionnaire. The sample size consisted of 136 individuals, all adult citizens, who voluntarily answer the questionnaire. The treatment of the data was made using an Excel database and spreadsheet functionalities.

3. Results and Discussion

3.1 Sociodemographic characterization of the sample

Figure 1 shows the sample characterization in terms of gender, age, marital status and number of people in the household.

Regarding the distribution by gender, it was quite even, with 59% of women against 41% of men (Figure 1(a)). The participants' age ranged from 19 to 71 years old. To better characterize the age of participants, its distribution was grouped in classes of 5-year range (Figure 1(b)). The age class with a higher percentage of participants (20%) was 46 - 50 years old. From data, it can be verified that 50% of the participants belonged to the range of 41 - 55 years old, corresponding to intermediate aged adults. Also, an expressive part of the sample (about 40% of the participants) was aged up to 40 years old. The other approximately 10% had ages from 55 to 71 years old. Concerning the marital status (Figure 1(c)), most participants (53%) were married, 35% were single and 12% were divorced or widowed. Finally, it was also asked about the number of persons that usually live in each participants' household (Figure 1(d)), and the results showed that for the majority of households (56%) there were 3 or more persons. In 25% of the cases, 2 persons live in the home, and just 14% of participants declared they live alone.

Other aspects of the participants' characterization were also investigated, namely level of education, area of work or studies, current professional status and average family income, and these results are shown in Figure 2.

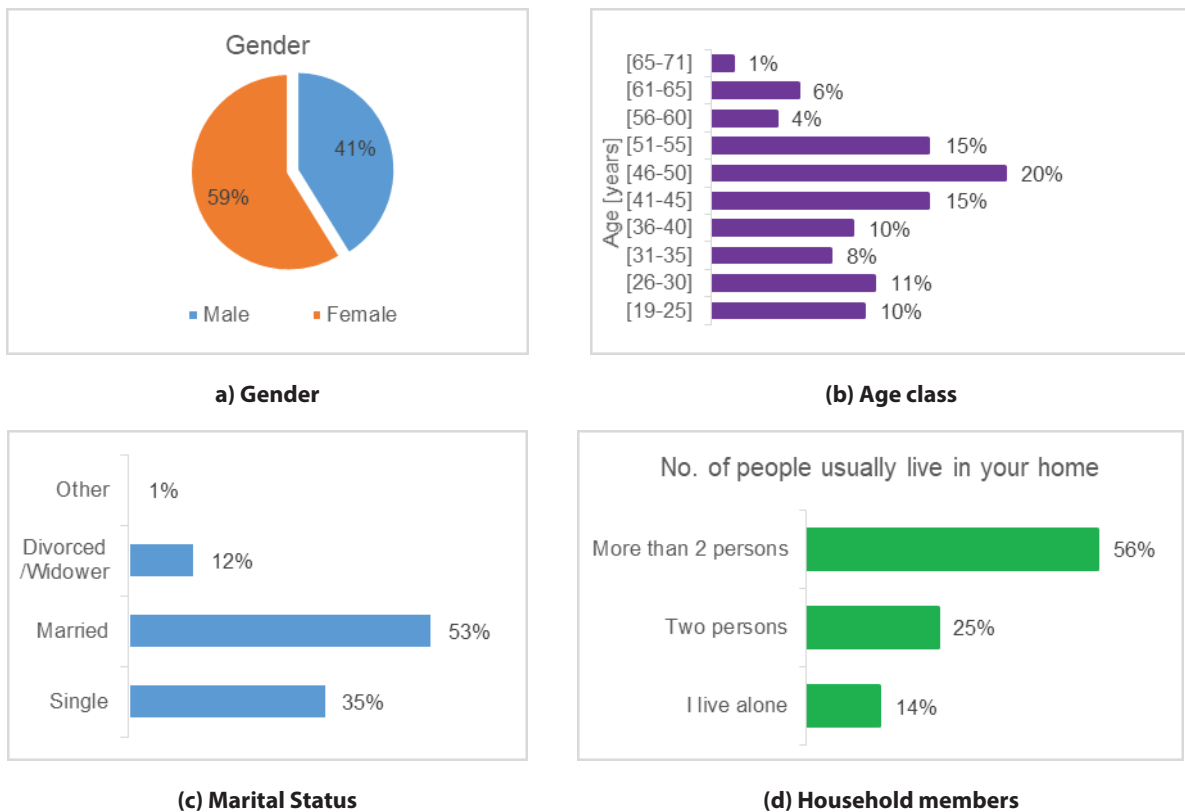


Figure 1. Sample characterization of the participants: gender, age, marital status and number of people in the household

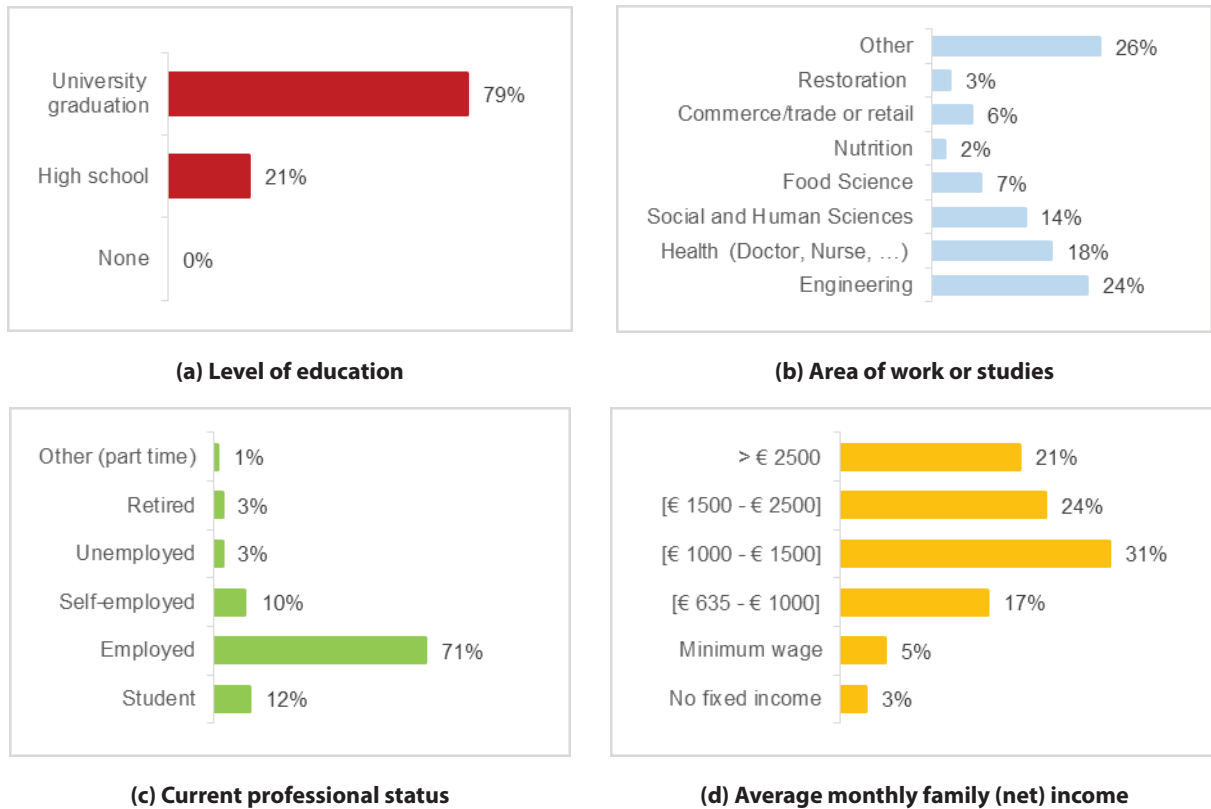


Figure 2. Sample characterization of the participants: education, professional area, professional status, and income

According to the results, most of the participants (79%) had university graduation and the other remaining 21% had completed high school. Regarding the main academic area (Figure 2(b)), one can verify that 24% of the participants were from engineering areas and 18% were from areas related to health. Results in Figure 2(b) also reveal that 7% of participants were in the area of food science, 6% in commerce/trade or retail, and 3% in the area of restoration (includes: cafés, bars, hotels, etc.); these all together represented about 16% of the participants. An important percentage of participants declared to have a different study or professional area than those listed (26%). Concerning the present professional status (Figure 2(c)), the great majority

(71%) declared to be employed, 10% created their own employment, and 12% were students. Other information collected referred to the participants' household average monthly net income (Figure 2(d)). The results show that the majority of respondents have an average household net monthly income up to 1500 €. This reflects that most respondents have a considerable purchasing capacity, taking into account the average salary in Portugal. Minor percentages of participants declared to earn only the minimum wage (5%) or not having a fixed income (3%).

Other data collected refer to the geographical situation, the district where participants lived - Figure 3.

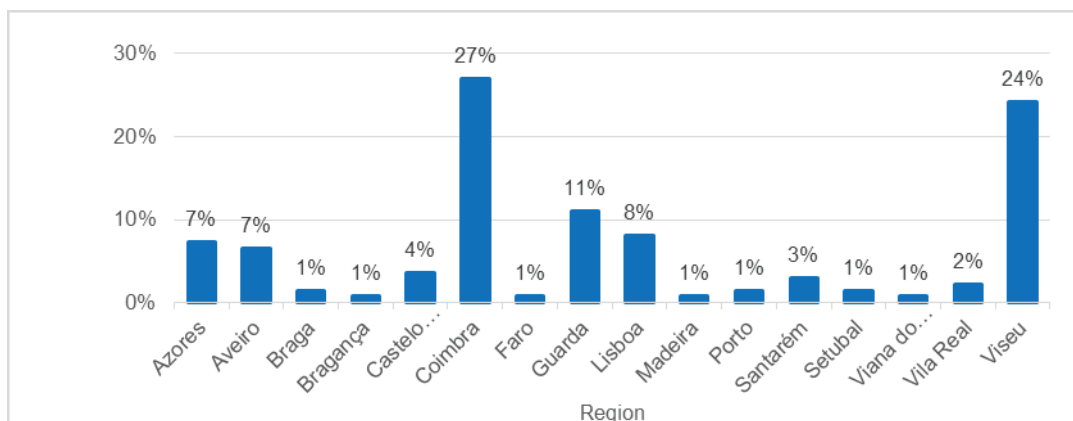


Figure 3. Regional distribution of participants

It shows that participated in the survey people from almost all the districts of Portugal mainland, but also from island regions (Azores and Madeira). However, an expressive percentage of participants lived in regions of central Portugal - Coimbra (27%) and Viseu (24%).

3.2 Purchasing habits of refrigerated food products by retail store

To characterise the Portuguese consumers' purchasing pattern regarding the place where they usually buy the perishable food products, it was asked the participants to select (from the options available) the frequency with which they usually shop refrigerated or frozen products, in each type of retail store, and Figure 4 shows those results.

Regarding shopping in large supermarkets located in shopping centres, the results show that 48.6% of people shop refrigerated or frozen products once a week, and 34.8% do it once a month (Figure 4(a)). The acquisition frequency of refrigerated or frozen products in small/medium supermarkets is smaller compared with the larger supermarkets, with 31.6% of people buying these products once a week, and 24.3% once a month (Figure 4(b)). On the other hand, the percentage of participants that declare

buying these products "very rarely" in small/medium supermarkets increase to 33.1% when compared with large supermarkets (12.3%). The majority of participants declare that they don't usually buy these food products in neighbourhood stores or outdoor markets: ~45% answered "very rarely" and ~25% answered, "don't buy". So, the results reveal that the majority of Portuguese consumers acquire refrigerated or frozen products weekly or monthly in supermarkets. Just around 15% of people buy these products once a week or once a month in small neighbourhood stores or outdoor markets.

3.3 Purchasing habits of refrigerated food products by type

Figure 5 presents the results of the Portuguese consumers' buying (and consequently consuming) habits of different fresh or refrigerated food products. A great majority of the participants answered that they buy dairy products, like milk, yoghurts, butter or cheese, very often (Figure 5(a)): 59.4% buy these products once a week, and 34.1% buy them once a month. Just 4.3% say that they rarely buy these products, and 1.4% don't buy them at all. These are very perishable products and the conservation requirements include very tight criteria in terms of conservation temperature,

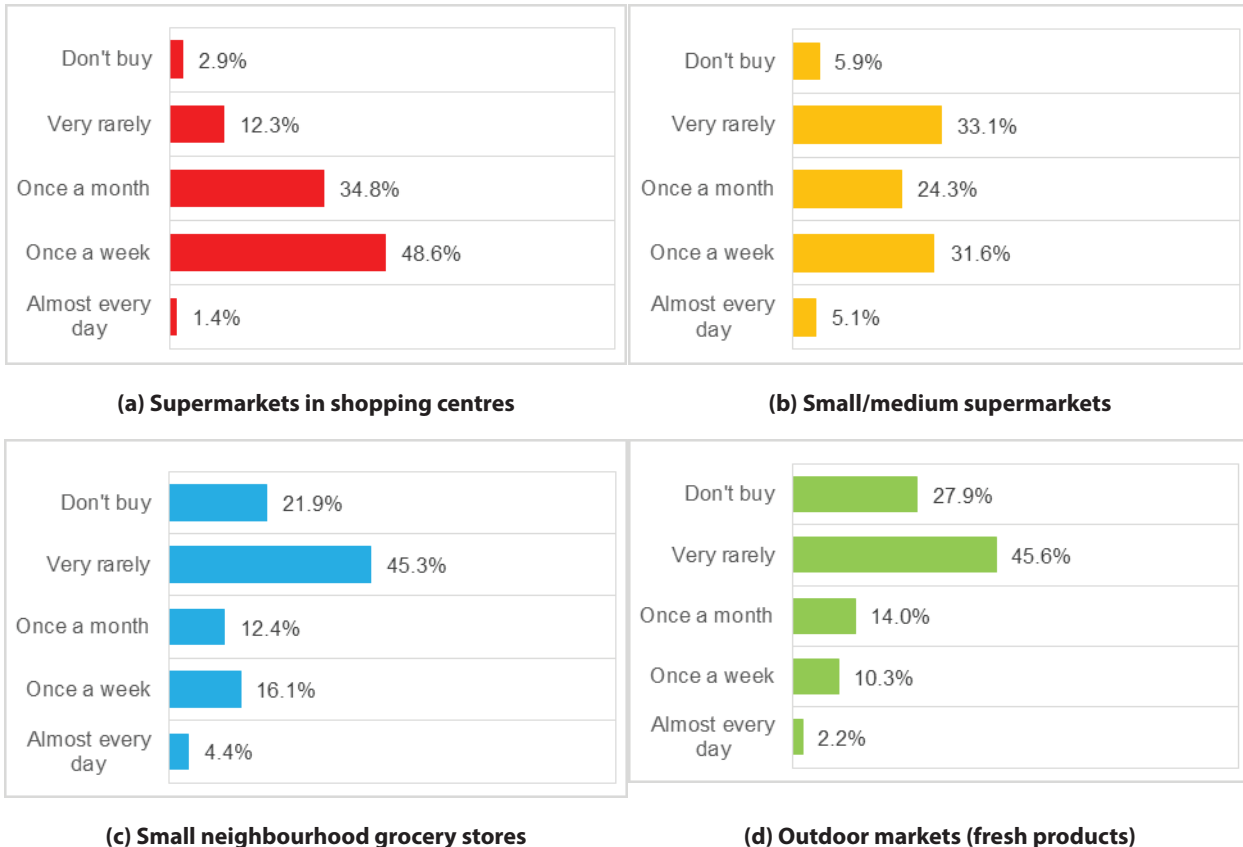


Figure 4. Results from the question: "How often do you usually shop refrigerated or frozen products, in each type of retail store?"



Figure 5. Results for question: "How often do you purchase the fresh or chilled products listed?"

to ensure their quality and safety. Compared to dairy products, the results reveal a low acquisition frequency for charcuterie products (ham and similar products). 42.3% of participants buy them once a week and 29.2% once a month. On the other hand, those that admit buying these products "very rarely" increase to 22.6%, as compared with dairy products (4.3%). In Portugal, there is a long tradition of consuming charcuterie products, but they are consumed with moderation since they are not so recommended for good health status, namely, they contain excessive salt [24]. On the other hand, the consumption of dairy is also deeply rooted in Portugal and these products are recognized as bringing health benefits, most particularly yogurts [25]. Similar patterns were obtained for the purchase of fresh fish (Figure 5(c)) or refrigerated meats like for example pork, chicken or beef (Figure 5(d)). For these

products, a little over 50% of participants buy them on a weekly basis, and nearly 30% buy them monthly. The same percentage (4.4%) declare to buy them almost every day. In Portugal, due to the influences of the Atlantic Ocean and the Mediterranean Sea, there is a tradition of eating fish on a daily basis, making usually one fish meal and one meat meal on a day. However, that is shifting since the prices of fish are much higher as compared with meat nowadays, although people recognize the health benefits of eating fish [26, 27].

A very different buying pattern is observed for the fresh "pre-prepared meals" (Figure 5(e)) since a low percentage of people declare buying these pre-prepared meals only once a week (6.6%) or once a month (13.2%). The great majority (44.9%) of the participants confirm they very rarely buy these

products, and a significant percentage (34.6%) say they don't buy them at all.

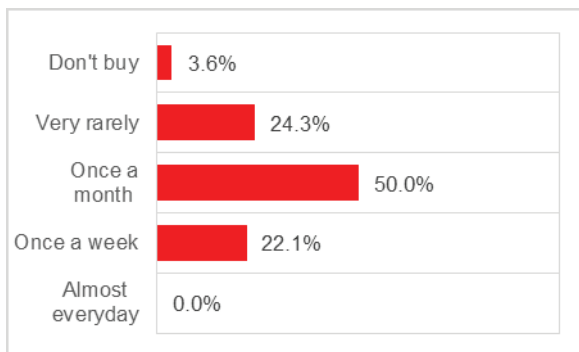
Concerning the buying habits of pre-prepared fresh vegetables and fruits (IV gamma products), Figure 5(f) show that 51.4% of the participants answered that buy these products once a week, 22.1% very rarely and 7.9% say they don't buy them at all. The majority of the fresh vegetables and fruits are available to the consumer in their original form, and therefore they are not exhibited to the consumer in refrigerated display cabinets. However, is it quite usual for retail stores to offer the consumer some alternative pre-prepared fruits and vegetables (cut, washed and ready to eat - the so-called IV gamma products) packed in

plastic containers (bags or cuvettes). Naturally that in his format the products need to be refrigerated and maintained in the under controlled storage temperature limits, in order to preserve quality and guarantee the safety of consumers [28].

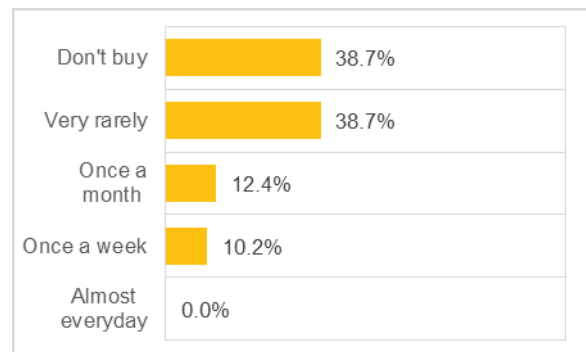
Considering the global refrigerated food products listed in Figure 5, a very few percentage of participants admit buying these products daily.

3.4 Purchasing habits of frozen food products by type

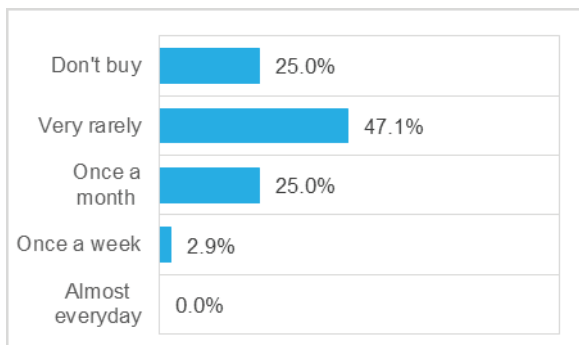
The frequency with which consumers purchase different frozen products was also investigated, and the results are presented in Figure 6.



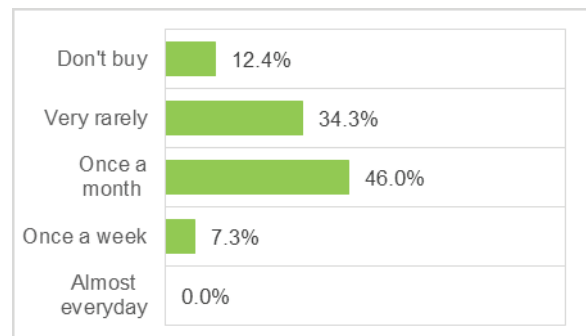
(a) Frozen fish



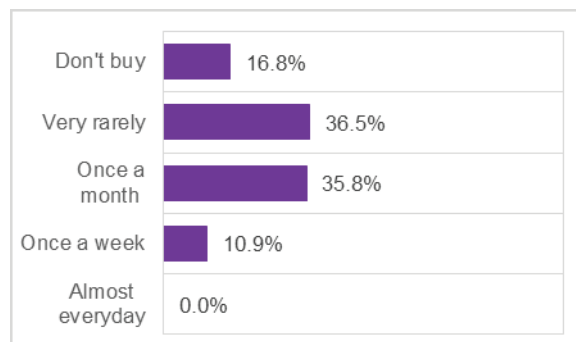
(b) Frozen meat (pork, chicken, Beef, etc.)



(c) Pizzas and other frozen meals (pre-prepared)



(d) Ice creams

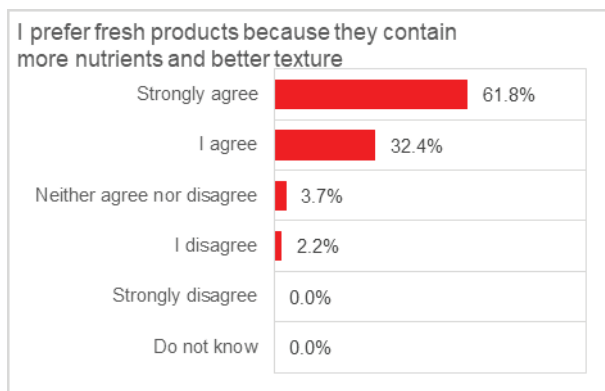


(e) Pre-prepared frozen vegetables

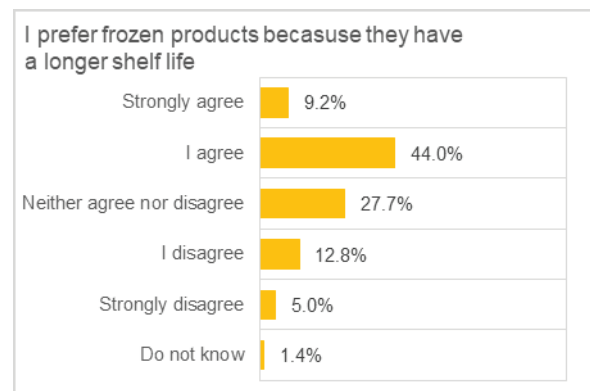
Figure 6. Results for question: "How often do you purchase each of the frozen products listed"

A great percentage of participants acquire frozen fish products quite regularly: 50% buy once a month and 22.1% buy once a week (Figure 6(a)). This is quite understandable because for many wild fish species captured at sea the whole fish or derived products are processed and frozen on ships, immediately after capture. Additionally, some of these food products can experience a complimentary transformation in land processing plants, before being sent for commercialization. On the other hand, 24.3% buy frozen fish very rarely, and a small percentage don't

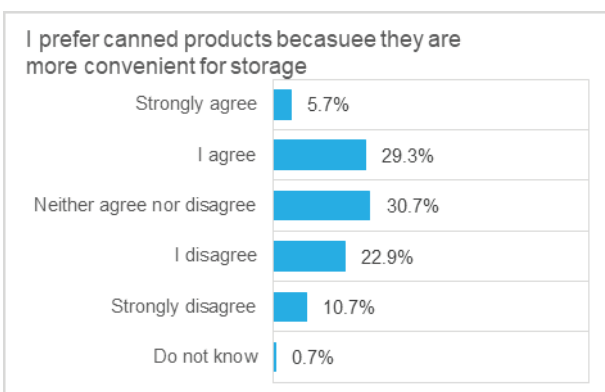
buy at all (3.6%). For these consumers, there is fresh fish easily available for sale in Portugal, since it is a coastal country with a high fishing area in the Atlantic Ocean. As can be observed in Figure 6(b), the buying frequency of frozen meat products is very low. A great part of participants doesn't buy frozen meat products (38.7%) and equal percentage buy them very rarely. Just 10.2% and 12.4% admit buying frozen meat products weekly or monthly, respectively. Results in Figure 6(c) reveal also a quite low purchasing frequency for pizzas and other pre-prepared frozen meals. Only 25% of the



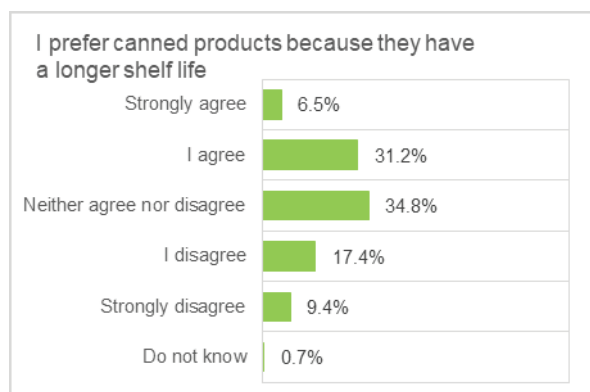
(a)



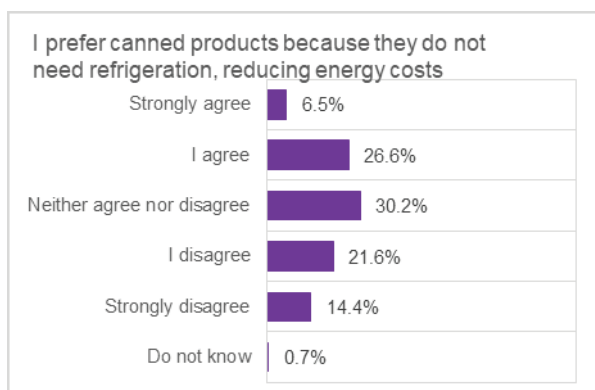
(b)



(c)



(d)



(e)



(f)

Figure 7. Results for question: "Regarding the purchasing/consumption habits of food products, indicate in which extent you agree with the following statements"

participants admit buying these food products once a month, but the majority, 47.1% buy them very rarely, and 25% don't buy them at all. Concerning ice-creams (Figure 6(d)), 46% answered that buy them once a month, and 7.3% once a week. An important percentage of participants buy them very rarely (34.3%) or don't buy (12.4%). Relatively to pre-prepared frozen vegetables, almost half of participants buy them very rarely (36.5%) or don't buy (16.8%). However, 35.8% and 10.9% admitted buying them once a month or once a week, respectively. In global, the analysed classes of frozen foods are not purchased daily, which is understandable, given that these products can be purchased and then stored for some time in domestic freezers.

3.5 Preferences for perishable food products according to conservation method

The questionnaire also included some questions about the consumer preferences about perishable food products that require cold storage (refrigeration or freezing), as compared with other conservation methods, namely canned products. In this way, the participants were asked to indicate their agreement with different statements, expressed on a scale with 5 levels fixed at the extremes, with "strongly disagree" and "strongly agree". A don't know option was also available. Figure 7 shows the results obtained for these six statements.

About the statement "I prefer fresh products because they contain more nutrients and better texture", the great majority of the participants indicated to be favourable (Figure 7(a)), since 61.8% answered strongly agree and 32.4% agree. Just a residual percentage indicated the neither agree nor disagree option (3.7%) or disagree (2.2%). These results are somehow expected and understandable because it is widely known that conservation methods, in general, modify the texture of the food products. The freezing process impacts some nutritional components, although slightly, [29] but regarding texture, the impact is very strong since textural characteristics are highly influenced by the internal strength of the freezing water molecules inside the food [30].

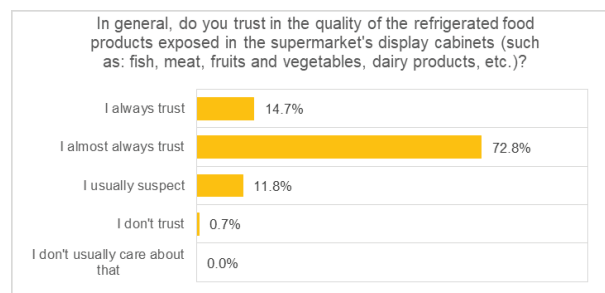
Concerning to the sentence "I prefer frozen products because they have a longer shelf life", the results (Figure 7(b)) show that 9.2% of the participants strongly agree and 44% agree. Still, there are some participants that are indifferent (27.7% neither agree nor disagree). The conservation capacity and long shelf life seem not important for 5% of participants.

Quite similar preference results were verified to the three next questions related to canned products; namely: "I prefer canned products because they

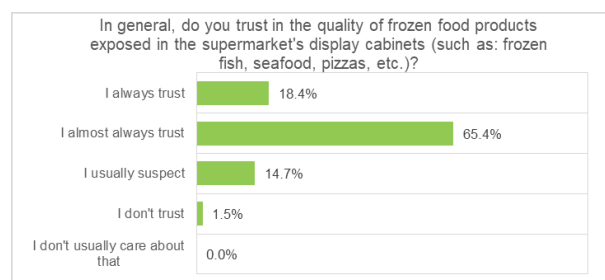
are more convenient for storage"; "I prefer canned products because they have a longer shelf life" and "I prefer canned products because they do not need refrigeration, reducing energy costs" (Figures 6(c) to (e)). For these statements, about 6.5% of the participants strongly agree and close to 30% agree. A considerable percentage of participants (~30%) indicated neither agree nor disagree, and close to 30% declared to disagree. These results indicate that for some people (about 35%) canned products are more convenient to store, have a longer shelf life and don't need additional energy for conservation, thus influencing their preferences about frozen foods.

Regarding the last statement "only buy fresh products" (Figure 6(f)) 26.3% have a neutral opinion, but about 40% assume to exclusively purchase fresh products, i.e., 28.5% answered agree, and 11.7% strongly agree. This option to purchase only fresh products implied that these participants have the time to shop very frequently and have easy access to shops.

It was also asked the participants to indicate the level of trust about the quality of the refrigerated food products (such as fish, meat, fruits and vegetables, dairy products, etc.) exposed in the supermarket's display cabinets. A similar question was also included to evaluate the confidence relative to the quality of frozen food products exposed in the supermarket's display cabinets. The results for those questions are shown in Figure 8.



a)



b)

Figure 8. General consumer confidence in refrigerated and frozen food products exposed in the supermarket's display cabinets

The results revealed a high level of confidence in the quality of the refrigerated and frozen food products stored in this type of display equipment: 14.7% always trust and 72.8% almost always trust in the quality of refrigerated foods and in the case of frozen foods 18.4% always trust and 65.4% almost always trust the quality.

Additionally, it was asked if the participants' opinion about their confidence in the expiration date or indicative period for the consumption of food products, indicated on the package (Figure 9).

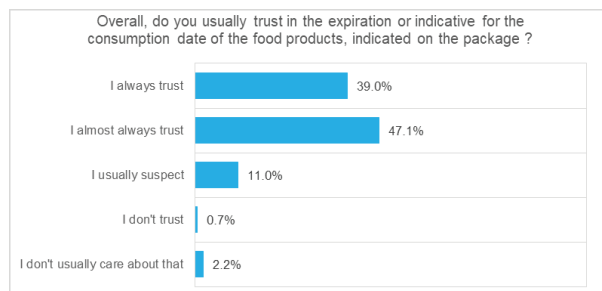


Figure 9. Result for the question: "Do you usually trust in the expiration date or indicative period for consumption of the food products, indicated on the package?"

The results are indicating that the majority always trust (39%) or almost always trust (47.1%) in this type of information. However, there are still 11% who usually suspect and 0.7% who don't trust in the product expiration date indicated in the package. Also, 2.2% of the responders declare that usually don't care about the expiration date of the food product.

4. Conclusions

- The result obtained in this survey showed that Portuguese consumers purchase refrigerated and frozen foods in shopping centre supermarkets or small/medium supermarkets. Neighbourhood stores or outdoor markets are rarely used to purchase this type of product.

- Regarding refrigerated products, Portuguese consumers buy them mostly every week in case of dairy products, charcuteries, fresh fish and meat and also fresh vegetables (IV gamma products). The refrigerated pre-prepared meals are purchased very rarely.

- Concerning the frozen food products, the frequency of purchasing is lower, being a monthly frequency for most types of products (frozen fish, ice-cream, frozen pre-prepared foods), while frozen meat is purchased very rarely.

- Additionally, it was observed that Portuguese consumers demonstrate preferences for fresh products instead of refrigerated or frozen ones when it comes

to their nutritional and textural quality, but prefer the later when it comes to their conservation capacity and longer shelf-life. Some recognize that canned foods offer some advantages, particularly related to the convenience of storage, shelf-life or reduced storage costs.

- Finally, consumers in Portugal demonstrate a high level of trust in the refrigerated and frozen foods available on the market and in the equipment used to display them in stores.

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