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Functional food consumption by Portuguese university community: knowledge, barriers and motivators

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Abstract

This study aims to understand the attitudes, behaviors, and perceptions concerning the consumption of Functional Foods (FF) and to analyze the role of some socio-demographic factors. Cross-sectional study recruited a random stratified sample from universities. A web-based questionnaire was applied and data were analyzed using SPSS and FACTOR software. A large percentage of the respondents consumes FF regularly, mainly in intermediate meals, despite their poor knowledge about FF. Taste, price, convenience, lack of knowledge on how much to consume, and uncertainty on how to prepare FF are barriers to consumption. Consumers feel the need to eat it, believe in its safety, and have more confidence in the products than those who do not consume them. Benefits are not a motivator for the consumption. Bachelors and women are those that consume more FF in a daily/weekly basis; although age and scientific area did not have impact on the frequency consumption. The findings help food companies identify target market segments where introducing FF or increasing existing FF are most likely to succeed; as well as indicators for educational, public health and regulatory administrations.

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Introduction

Nowadays, food is not only seen from the perspective of satiating hunger or provide nutrients need by human metabolism, but also from the perspective of preventing diseases related to nutrition, and improving physical and mental health – so these features have gained prominence, and have become extremely important factors to consumers (Pappalardo & Lusk, 2016; Topolska *et al*., 2021).

Functional foods (FF) are a recent category of food products, marketed as having health benefits and have been considered as one of the areas of greatest potential growth in the food industry (Camacho *et al*., 2019). However, it should be noted that FF can only solve health problems if consumers are willing to buy them, which is the motivation for this study in the Portuguese context.

To date, many studies have investigated the factors that may predict people acceptance and consumption of FF, and a wide range of influential factors have been reported. However, studies conducted in different contexts pose challenges to gaining a clear and comprehensive understanding of the factors influencing consumer behaviour towards FF. The variety of factors and the complex relationships between them make it difficult to describe general trends, which would benefit scientists and functional food manufactures when developing and launching FF (Szwacka-Mokrzycka & Kociszewski, 2019). The wide range of influential factors also poses challenges for communicating and marketing professionals in the FF industry when developing accurate and precise communications strategies and other promotional materials designed to improve consumers acceptance of FF.

Thereby, in developed societies, the FF products market is dynamic, has boomed in recent years and it will continue to expand (Vicentini *et al*., 2016), thus reflecting the positive association made by consumers of these products to the adoption of healthy eating habits (Domínguez Díaz *et al*., 2020). Major producing FF brands are present in the Portuguese market, which may reveal the interest of consumers for this type of products; on the other hand, the topic of FF is relatively recent among Portuguese people, and there is a shortage of research in the area, such as encompassing consumer behavior and marketing. According to Chammas *et al*. (2019), gyms, schools and universities, and the internet could be useful communication and marketing routes to promote FF. In fact, public and private universities represent a population which include consumers with large range of socio-demographic characteristics (such us gender, age, educational level, scientific area, etc.).

The aim of this study was thus to investigate the attitudes, behaviors, and perceptions of the Portuguese university community towards this type of food. The development of these products is technically challenging, as well as

expensive; therefore, a better understanding of consumers' profile could be a key success factor for the market.

The paper is structured as follows. First, the approaches and findings of previous consumer studies on FF are explored. Thereafter, research hypotheses are developed; followed by the description of population, sampling procedure, data collection, and analysis. Finally, the results and discussion are presented with a focus on practical implications for marketing and advertising strategies in the consumption of FF, regarding the role of health public and governmental administration.

1. Background

1.1. *Concept and origin of functional foods*

Numerous definitions of "functional food products" have been proposed, but there is no official, universally accepted terminology standard of "functional foods" so far (Martirosyan & Miller, 2018). The concept was firstly introduced and developed in Japan and thereafter followed by the United States and Europe (Iwatani & Yamamoto, 2019). It was first promoted in the mid-1980s by Japanese scientists who studied the relationships between nutrition, sensory satisfaction, fortification, and modulation of physiological systems. In 1991, the Japanese Ministry of Health introduced rules for approval of a specific health-related food category called FOod for Specified Health Uses (FOSHU), which included the establishment of specific health claims for this type of food (Siró *et al*., 2008). European stakeholders only pay attention to its importance in the 1990's (Vicentini *et al*., 2016); FF were introduced in the European market via multinational food companies, such as Nestlé, Danone, Unilever, and Kellogg's.

An operative definition of functional products has been proposed in the European Union, within the FUnctional FOod Science in Europe (FUFOSE) project: an FF is a food product that makes a positive impact on one or more physiological functions of the organism, and besides its main nutritional properties improves the human health and is beneficial in decreasing the risk of diseases (Diplock *et al*., 1999). The FF products are consumed as a part of the normal diet rather than as capsules, pills, or other forms of food additives and can contain active biological compounds such as polyunsaturated free fatty acids, omega-3, fiber, carotenoids, vitamins, minerals, or probiotics (Camacho *et al*., 2019). Nutrient-rich ingredients like fruits, vegetables, nuts, seeds, and grains are often considered functional foods as well. Oats, for instance, contain a type of fiber called beta-glucan, which has been shown to reduce inflammation, enhance immune function, and improve heart health (Bashir & Choi, 2017). Similarly, fruits and vegetables are packed with antioxidants, which are beneficial compounds that help protect

against disease (Pem & Jeewon, 2015). According to Jung *et al.* (2018), the consumption of FF containing such active biological compounds as omega-3, fibers, probiotics, vitamins, and minerals would assist individuals to meet the recommended intakes of these essential nutrients and maintain overall health. It has also been demonstrated that FF with reduced sugar, fat, and sodium would have physiological benefits and/or reduce the risk of chronic disease, beyond basic nutritional functions (Lim *et al.*, 2016).

1.2. *Functional food market trends*

As mentioned above, the market has witnessed a growing awareness of consumers who, through consumption behaviors, influence manufacturers' decisions (Szwacka-Mokrzycka & Kociszewski, 2019). Betting on this, agro-food sector carries great risks because costly development of new products to the market does not guarantee they will be accepted by consumers (Vicentini *et al.*, 2016). Health and wellness has been one of the most important drivers of innovation in food and beverage markets. However, the development of new foods presents many marketing and technological challenges to product developers with high reported failure rates in functional foods (Bogue *et al.*, 2017). Reasons for failure in the functional foods market include: too many benefits from a single brand, benefits that are often not relevant to the consumer, relying on the selling power of the ingredient rather than the benefit, and using nonrelevant carriers (Mellentin, 2009). On the other hand, this is a very attractive sector for entrepreneurial investment, since consumers are willing to pay more for FF – which, in some cases, may reach an increase of 30-50% versus conventional product alternatives (Vecchio *et al.*, 2016). The trends driving growth in the functional food market include: consumers interested in the prevention of health issues, the increasing cost of healthcare, the steady increase in life expectancy, and the desire of the aging for improved quality of life in their later years (Bogue *et al.*, 2017). Recently, the sudden outbreak of COVID-19 amplified the need for eating healthy in order to boost human immunity – and this is providing a growth opportunity for the global health food market (Koncept Analytics, 2020).

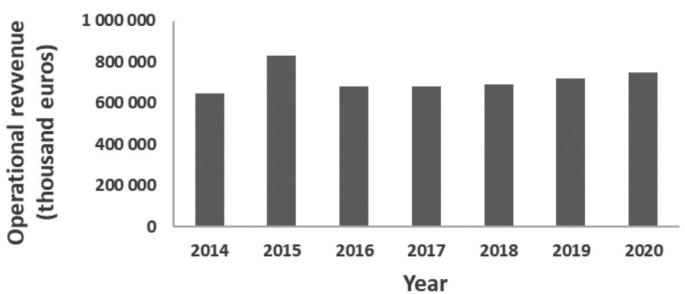
The global FF market was worth USD 187.5 billion in 2019 and is expected to reach USD 352.3 billion by 2027 – this is growing at an estimated annual average rate of 8.2% over the forecast period. The Asia Pacific region is expected to grow at the highest compound annual growth rate of 9.0% over that period. Moreover, the rising consumption of processed food in emerging countries, such as India and China, is likely to drive the demand for FF across the Asia Pacific region (Grand View Research, 2019).

In Europe, the acceptance of FF is much lower than that of USA, because people are more skeptical about the benefits of this type of product. On the other hand, there are differences in consumption between the inhabitants

of the various countries in Europe, and these foods are quite popular in Germany, UK, France, Russia and Italy. Germany is one of the leading markets for foods with health benefits – and also the country with the largest number of companies that market at least one FF in their portfolio (Kamble & Deshmukh, 2020). There is no data about FF market in Portugal.

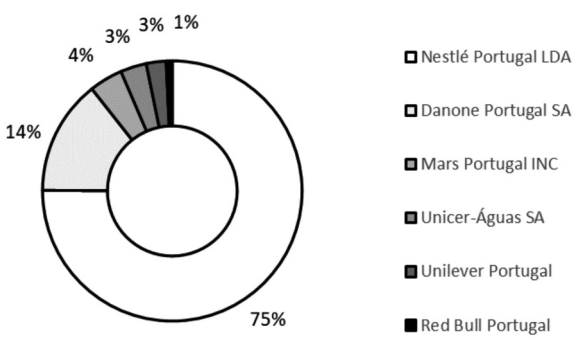
The key players in value chain of FF in the world are: Unilever, Sanitarium Health & Wellbeing Company, Royal Friesland Campina, Raisio Group, Standard Functional Foods Group Inc., Nestlé S.A., Murray Goulburn, Meiji Group, Glanbia Plc., Kraft Foods Inc. (Kamble & Deshmukh, 2020). Based on this information, we used the SABI database to compile information about the operating revenues of the most important FF companies in Portugal for the last 5 years (Figure 1).

Figure 1 - Evolution of operational revenues of the top six Portuguese companies that manufacture FF



In Figure 2, we can observe the company sharing (100% = 758.174 thousand euros) in 2020.

Figure 2 - Market share of the top six Portuguese companies that manufacture FF in 2020



1.3. *Consumption of functional foods*

The consumption of FF, which is the dependent variable in this study, is defined as the frequency of consumption and is measured on a 5-point semantic scale, ranging from 1 = never to 5 = every day.

We conceptualize that variations in the consumption of FF depend on four groups of factors: knowledge about FF concept, barriers, food choice motivators perceived and socio-demographic characteristics. It is thus hypothesized that all four groups of factors are significant determinants of functional food consumption. Each is discussed briefly in turn.

H1: *The knowledge about the concept of FF is associated with the consumption of FF.*

Consumers' knowledge has been identified as an important predictor of their functional food acceptance and consumption (Baker *et al*., 2022).

According to Sääksjärvi *et al*. (2009), the knowledge is crucial in this kind of product setting that is characterized by features that are more numerous and complex than those of food in general, and in which the benefits yielded by functional foods cannot be easily assessed.

Urala and Lähteenmäki (2007) argue that consumers are unlikely to pay extra for a functional food, compared to an equivalent "conventional" one unless there are clear and salient perceived benefits. Empirical evidence supports this – Labrecque *et al*. (2006) found that knowledge had a positive impact on acceptance of functional foods. Similarly, Carrillo *et al*. (2013) attribute low consumption of functional foods in Spain to a lack of knowledge. According to Ares and Gámbaro (2007), the consumption of FF is negatively influenced by the lack of consumer understanding of the term functional food.

Therefore, consumer awareness of FF concept could have a significant impact on consumers' perception and acceptance of these kind of products.

H2: *The perception about barriers is associated with the consumption of FF.*

Following Downes (2008), there are two types of barriers for a healthy lifestyle: personal (lack of motivation and lack of time) and environmental barriers (lack of social support and lack of resources). In relation to the barriers, Verbeke (2005) also reported that the loss of flavor in FF compared to foods classified as conventional is something that consumers are unlikely to accept. In fact, sensory attributes, such as taste, flavor and texture, remain

very important for consumers (Çakiroğlu & Uçar, 2018; Kolbina & Ulrikh, 2020).

Among the features of food products that are particularly important for consumers, packaging deserves special attention. So, trust in the information provided on the label constitutes a key element for its acceptance, since the claimed benefits of FF may not be directly experienced by consumers in the short-run (Sajdakowska *et al*., 2018). Therefore, although communication and information are unable to change the characteristics of the products, they can shape the attitudes of consumers – and influence their choices and behaviors (Guiné *et al*., 2020), thus making it possible for them to choose what and where to buy without requesting an opinion from third parties (Vicentini *et al*., 2016).

In addition, the price has high importance in influencing consumers' attitudes, behavior and preferences about FF (Zafar & Ping, 2020) and can also be considered a perceived barrier.

H3: *The perception about motivators is associated with the consumption of FF.*

One of the most frequently mentioned motivators is health (Topolska *et al*., 2021). Regarding high costs of curative medicine, disease prevention is crucial, and there is evidence that FF consumers understand the role of this kind of product in maintaining good health (Camacho *et al*., 2019). Added to this, in the studies of Rezai *et al*. (2014) and Urala & Lähteenmäki (2007), the perceived reward was also reported to be the best predictor of consumption of FF.

According to Çakiroğlu & Uçar (2018), the factors most influencing the purchasing decisions of consumers were that "functional foods are necessary" and "functional foods are a part of healthy diet".

Another important feature for functional products is to be "reliable". Social trust, processing method and cultural values may also affect consumer willingness to use FF (Siegrist *et al*., 2015).

Finally, safety is also an important issue for consumer purchase decisions of FF. Consumers who are convinced of the safety of FF are more willing to consume them (Rasanjalee & Samarasinghe, 2019).

H4: *The socio-demographic characteristics of consumers are associated with the consumption of FF.*

Previous studies identified that the consumption of functional foods varies across socio-demographic segments (Topolska *et al*., 2021; Zanchini *et al*.,

2022). Regarding age, consumer behavior can change over time, especially in the case of new products or new technologies. In addition, women appear to be more receptive to FF than men, who demonstrate a less critical and more traditional understanding of eating. People who are most familiar with the concept of FF are people with higher educational qualifications and so FF are perceived differently by consumers according to schooling level (Chammas *et al.*, 2019; Rojas-Rivas *et al.*, 2018). However, according to Huang *et al.* (2019), consumers with less education are the least reluctant to accept FF.

2. Materials and methods

2.1. *Research instrument*

A questionnaire was prepared consisting of 21 questions mostly taken from studies previously published in the English studies (Mundhe, 2015; Urala, 2005; Urala & Lähteenmäki, 2007), and later translated to Portuguese (Corso & Benassi, 2012; Oliveira & Cardoso, 2010). The first part included 11 questions about knowledge of the FF concept and consumer behavior regarding these products. Such questions had dichotomous answers, five-level Likert scale, and single and multiple choice.

Several aspects were evaluated by using a single-item likert scale, such as those concerning knowledge about FF, concept, food groups, biologically active compounds, and brands associated with FF. For those who did not know what a FF was, a definition was given at the beginning to proceed with answering. To validate the correct knowledge of respondents who claim to know the concept, three phrases were given to be classified as true or false – the FF are: i) foods that contain biologically active compounds, ii) promote health and prevent diseases, and iii) combined with a balanced diet and a healthy lifestyle (Diplock *et al.*, 1999; Jung *et al.*, 2018). The second part of the questionnaire contained socio-demographic questions. The questionnaire was approved by the Ethics Committee of Maiêutica/ISMAI (decision no. 3/20, April 28, 2019).

2.2. *Data collection and sample*

The data collection methodology consisted of applying a web-based survey, using the open-source survey software Limesurvey v. 2.57.1. Disclosure of the questionnaire was sent, via e-mail, to all Portuguese universities with a request to share it with their community. This sampling technique was chosen

based on two facts: (i) we work at university, so sharing information between universities is easier than through social networks, supermarkets or alike under anonymity; and (ii) we took advantage of social context attributes (such as group cohesiveness) because generation of real time responses via internet and the like is more likely to convey meaningful data (Gupta *et al*., 2020).

The questionnaire was available between April 28 and June 3, 2020. The answers obtained were exported from the LimeSurvey online software to Microsoft Office Excel software v. 2016.

A stratified random sampling procedure, according to the type of institution and the 9 scientific areas, was applied according to the population data reported by the Instituto National de Estatística / National Institute of Statistics (2018) – so a final sample of 467 was obtained (Table 1). Respondents who did not authorize participation in the study, and those presenting incomplete questionnaires were dropped.

Table 1 - Sample description (%, N=467)

Scientific area	**Type of institution**		**Sample**	**INE**
	Public	**Private**		
Agriculture, Forestry, Fisheries & Science Veterinary	2.8	0.0	2.8	2
Arts & Humanities	7.7	1.7	9.4	10
Social Sciences, Business, Journalism & Law	25.5	6.4	31.9	33
Natural Sciences & Mathematics & Statistics	5.6	1.5	7.1	7
Education	2.6	0.9	3.4	3
Engineering & Manufacturing Industries & Construction	17.3	3.0	20.3	21
Health & Social Protection	12.2	3.9	16.1	15
Services	1.4	1.3	5.4	5
Information & Communication Technologies	2.6	1.1	3.6	3
Sample	80.3	19.7	100	
INE - Portuguese National Institute of Statistics	81.8	18.2		

Source: Instituto Nacional de Estatística (2018).

2.3. *Statistical analysis*

All data were encoded and later processed by IBM SPSS v. 27.0 and FACTOR (Lorenzo-Seva & Ferrando, 2020) statistical software.

Data analyses included descriptive and inductive statistical analyses. In the univariate analysis, parametric tests were performed for the mean, such as the T-test for independent samples; and tests for proportion, such as the binomial test (Keller, 2017). In the bivariate analysis, the chi-squared test, the Mann-Whitney U test, and the Kruskal-Wallis test are used to verify the existence of an association between two variables. When considering the barriers, The 5-point Likert scale was converted into a binary variable with the following criterion: totally disagree and disagree were grouped into "Disagree", while totally agree and agree were grouped into "Agree"; the cases in which the response was neither disagree nor agree were dropped. The decision-making for all tests was of a significance level equal or lower then 5%. In the multivariate analysis, exploratory factor analysis was conducted, determining how well the items were grouped and how well they measured the same factor (Bryam, 2016). The configuration of analysis was: Parallel Analysis (PA), Robust Diagonally Weighted Least Squares (RDWLS), promin-type rotation, polychoric correlations, and 95% confidence intervals (Lorenzo-Seva & Ferrando, 2006). Finally, Cronbach's Alpha was calculated to control the reliability level for each dimension found.

3. Results

3.1. *Characterization of the sample*

Regarding the 467 respondents, 71.1% were female. From Table 2, it can be seen that students who were attending a degree, had an average age between 20.3 and 28.2 years, depending on the academic degree at stake (as expected); as for teachers, the academic degree most represented is a doctorate, with an average age of 51.2 years.

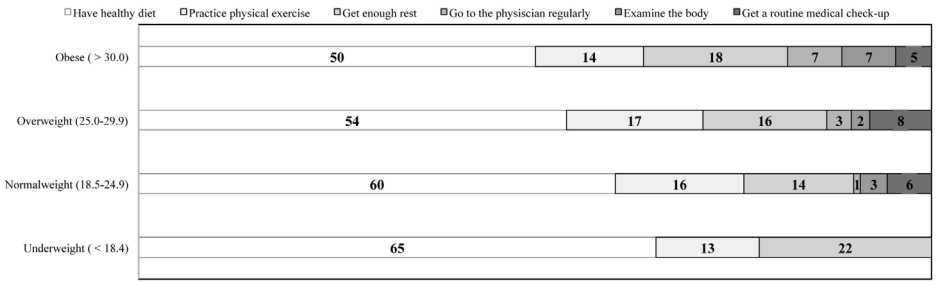
The researchers are MSc or Ph.D. holders, with an average age of 34.1 and 40.7 years, respectively. Finally, the largest percentage of other staff, either possessing BSc or MSc, ranged in age between 24 and 67 years. This wide range was expected, considering that includes from young technicians to the directors of university departments. In fact, it covers a wide range of consumers age and academic degree, as previously explained.

Table 2 - Respondents' age statistics (N=467)

Activity	Statistics	High school	Professional diploma	Bachelor	Master	Doctoral
Students	N		4	177	58	12
	min-MAX		18-25	18-56	18-56	23-50
	Median		19.0	21.0	21.0	26.0
	Mean		20.3	23.1	27.4	28.2
	Standard deviation		3.3	6.7	8.8	7.3
Teachers	N			13	22	58
	min-MAX			22-64	28-68	29-73
	Median			44.0	47.5	52.0
	Mean			45.2	47.9	51.2
	Standard deviation			12.1	8.7	8.4
Researchers	N				15	26
	min-MAX				23-56	28-57
	Median				31.0	38.5
	Mean				34.1	40.7
	Standard deviation				9.5	7.4
Other	N	13		36	22	11
	min-MAX	26-59		24-67	27-65	33-58
	Median	42.0		43.0	44.5	48
	Mean	43.3		43.7	43.9	45.9
	Standard deviation	10.6		9.1	9.4	8.1

Regardless of the value of Nutritious Status (based on Body Mass Index), the most important behavior's health maintenance of Portuguese university community was to keep a healthy diet (57.7%), followed by practice of physical exercise (16.1%) and ensuring enough rest (15.2%), as shown in Figure 3. Therefore, the attitude of respondents is aligned with the focus of study, which involves having a healthy diet.

Figure 3 - Attitude's health maintenance and Nutritious Status



3.2. *Attitudes regarding functional food consumption*

Our study found that 46.1% of respondents consume FF daily; however, those who consume FF daily and weekly add up to 80.0%. Another important result was to understand in which meals are the FF products preferentially consumed. The analysis was done on individual meals and in terms of meal combinations. Breakfast was the most frequently chosen meal by the Portuguese university community (78.0%). The afternoon snack was mentioned secondly by the respondents (64.1%), followed by the morning snack (39.2%). Additionally, the combination of breakfast and afternoon snack (16.2%), followed by breakfast, morning snack, and afternoon snack (12.8%) were the most chosen.

One also realizes that 73.2% (p=0.000) of respondents never or rarely confirm whether the FF has the desirable functional characteristics at the moment of consumption, with only 3.9% saying that it always does.

3.3. *Determinants of functional food consumption*

3.3.1. Knowledge about FF concept

In this study, knowledge about FF not only refers to its scientific concept but also how the consumer recognizes this type of food, biactive compounds, and brands.

Thirty-three percent of the respondents claimed to know the definition of FF at the beginning of the questionnaire. From those, 68.2% answered the three questions correctly, and 24.7% answered the second and third questions correctly – meaning that they do not have the scientific knowledge about FF, yet they know their benefits. In related studies, authors also presented a low prevalence of knowledge in Spain (23%), Italy (31%), Mauritius (32%), and

Lebanon (41%) (Chammas *et al*., 2019; González-Dias *et al*., 2020); although a high prevalence of knowledge of FF was reported in Sweden (84%) and USA (69%) (Kwon *et al*., 2020; Somehagen *et al*., 2013).

The most important FF products selected by respondents were, firstly and foremost – fruits and vegetables (47.5%; n=467), secondly – fish and fishery products (37.8%; n=222), and thirdly – oilseeds (27.4%; n=84) and whole cereals (25.0%; n=84).

It was also found that most respondents (more than 50%) recognize bioactive compounds. They identified fiber as the most suitable biological compound in FF (80.5%), and prebiotic/probiotics being the least suitable choice (56.3%) – between omega 3 and vitamins (74% and 73%, respectively) and antioxidants and calcium (67% and 63%, respectively). These results are similar to those obtained in several countries all over the world, such as Finland, Mexico, West Indies, and China (Badrie *et al*., 2007; Cong *et al*., 2019; Rojas-Rivas *et al*., 2018; Urala & Lähteenmäki, 2007).

The percentage of respondents who associated correctly Becel's brand to FF was statistically equal to those who did not (p=0.355). The 50% correct recognition of Becel's brand as FF might be explained by the fact that in a university context, there are not only young people who are concerned with health in general (Rodríguez-Tadeo *et al*., 2017), but also middle-aged people who are specifically concerned with cholesterol reduction (which is the benefit claimed by Becel for elderly people). Becel was the first brand advertised in Portugal as a food with health benefits; and so, it is a brand that cross generations. The three brands of the Danone Group present in the study were those that obtained the strongest identification as FF by the respondents: Activia (79.8%, p=0.000), Actimel (71.0%, p=0.000) and Danacol (64.0%, p=0.000); while Mimosa (34.0%, p=0.000) and Adagio (14.0%, p=0.000) did not. Vitalis (15%; p=0.000), Luso (17%; p=0.000), and Red Bull (3%, p=0.000) were not acknowledged as functional drinks by the respondents of this study. These results are very different from those reported for leading brands in the global market of functional drinks, also named energy drinks (Marketline, 2019).

An association between knowledge about the FF concept and consumption frequency was proven (p=0.000; see Table 3).

Table 3 - Consumption frequency (%) and knowledge of FF (Mann-Whitney U test, p=0.000)

Knowledge	**Consumption frequency**				
	Never	**Rarely**	**Monthly**	**Weekly**	**Daily**
No	0.2	2.4	1.7	8.4	20.3
Yes	2.6	14.3	7.5	17.1	25.5

As mentioned before, knowledge of respondents about FF is mainly focused on their beneficial health effects. Inspection of our results indicates that response to consumption by knowledgeable consumers is opposite, depending on whether they believe or not in their health-promoting features. It appears that those knowledgeable consumers that believe in FF health effects exhibit a higher frequency of consumption than their unknowledgeable counterparts – in monthly, weekly, or daily bases. Conversely, this effect is reversed in the case of non-regular consumers; those consumers that apparently do not believe on the healthy features of FF tend to consume even less thereof than their knowledgeable counterparts – in terms of a higher fraction of consumers that intake FF rarely or even none. Therefore, previous knowledge of FF enhances both positive and negative responses, whichever appropriate.

The hypothesis H1 is supported by our results: The knowledge about the concept of FF is associated with the consumption of FF.

3.3.2. Barriers perceived

Table 4 shows that associations between consumption frequency and barriers perceived by respondents exist at 5% of significance level.

The most important barriers for respondents that consume daily and weekly were price and availability of the product; followed by sensory characteristics, lack of knowledge how to prepare the food as well how much to consume.

Unlike previous studies, which show that consumers are willing to pay more for functional products that make health claims (Chammas *et al*., 2019; Vecchio *et al*., 2016), the respondents in this study considered that price was one of the major barriers for them to frequently consume FF.

We also verified that the loss of flavor in FF compared to foods classified as conventional is something that consumers are unlikely to accept; this fact was also reported by Verbeke (2005). Finally, new foods (such as FF) are not accepted due to a lack of knowledge about how much to consume and how to prepare FF.

The hypothesis H2 is supported by our results: The perception of the academic community about barriers is associated with the consumption of FF.

Table 4 - Barriers and consumption frequency (% respondents, Mann-Whitney U test)

Barrier		**Consumption frequency**					
		Never	**Rarely**	**Monthly**	**Weekly**	**Daily**	***p-value***
Taste/smell	Disagree	1.6	7.5	2.3	7.5	18.9	0.031
	Agree	1.3	8.8	5.9	18.6	27.7	
Aspect	Disagree	2.2	8.9	3.2	8.6	23.0	0.023
	Agree	1.0	6.7	5.4	17.6	23.3	
Price	Disagree	0.3	1.9	1.6	2.7	6.8	0.038
	Agree	2.5	16.4	8.2	19.9	39.4	
Availability/ convenience of the product	Disagree	1.8	5.7	1.4	5.4	14.3	0.020
	Agree	1.4	11.4	6.4	14.3	37.9	
Lack of knowledge about how much to consume	Disagree	1.0	5.9	2.6	7.5	18.0	0.024
	Agree	2.3	11.8	7.2	14.1	29.5	
Uncertainty of how to prepare the food	Disagree	1.3	6.1	1.7	7.7	19.9	0.013
	Agree	1.3	12.1	9.1	14.1	26.6	

3.3.3. Food choice motivators

In order to explore the motivators for consumption of FF, a group of items were grouped in factors. Because the cumulative explained variance obtained was 59.2%, the eigenvalue rule was applied (>1) – with a reduction of 18 items to 4 factors; although 5 items were accordingly excluded from the analysis, due to their low communalities (< 0.3). The adjustment of the model indexes was good: KMO = 0.80, RMSEA = 0.001, and CFI = 0.999 (Hair *et al*., 2018; Lorenzo-Seva & Ferrando, 2006).

The four factors found were named as Benefits, Safety, Confidence, and Necessity – as presented in Table 5.

The Cronbach's Alpha value for Confidence was less than 0.6 but, according to Cortina (1993), this is possible when there is an acceptable amount of association between items, but only small numbers of items involved.

Benefits explained 28.1% of the total variance followed by Confidence which explained 10.0% of the total variance. Finally, Necessity explained 8.2% of the total variance.

This study also showed, by using the Mann-Whitney U test, that the perception of Safety (p=0.001), Confidence (p=0.001) and Necessity

Table 5 - Factor analysis and description of scales

Factor	Item	Mean	St. Dev.	Loading	Cronbach's Alpha
Benefits	– Functional foods can have undesirable effects.	2.846	1.004	0.659	0.645
	– If used in excess, functional foods can be harmful to health.	3.253	1.148	0.751	
Safety	– The safety of functional foods has been very thoroughly studied.	3.137	0.842	0.520	0.599
	– Using functional foods is completely safe.	3.812	0.832	0.729	
Confidence	– Functional foods have better quality.	3.173	0.967	0.371	0.401
	– Functional foods cause the health benefits referred to in advertising.	2.816	0.878	0.546	
Necessity	– Functional foods are completely necessary.	1.865	1.003	0.788	0.709
	– For a healthy person it is worthless to use functional foods.	1.797	1.001	0.743	
	– Functional foods are a fad that will pass.	2.107	0.967	0.578	
	– Functional foods are a total sham.	1.876	0.976	0.682	

(p=0.000) are significantly higher for a regular consumer than non-consumers; regarding the Benefits (p=0.263), the importance is equal for both groups.

The hypothesis H3 is supported by our results: The perception of the academic community about motivators is associated with the consumption of FF.

3.4. *Socio-demographic characteristics*

Women tend to consume FF with a higher frequency than men. No association was found between frequency consumption and age index (Index Mundi, 2019) or the scientific area (see Table 6).

Table 6 - Socio-demographic characteristics and consumption frequency (% respondents, Mann-Whitney and Kruskal-Wallis association test)

	Socio-demographic characteristics	Consumption frequency					*p-value*
		Never	Rarely	Monthly	Weekly	Daily	
Sex	Female	1.1	9.4	7.3	20.3	33.0	0.033
	Male	0.7	7.3	1.9	5.1	12.4	
Age Index	Early working (15-24)	0.7	5.0	5.7	11.5	17.0	0.527
	Maximum working (25-54)	2.2	10.0	3.5	11.7	23.3	
	Mature working (55-64)	0.0	1.7	0.2	1.7	4.6	
	Seniors (65+)	0.0	0.2	0.0	0.2	0.6	
Scientific area	Agriculture, Forestry, Fisheries & Science Veterinary	0.2	0.2	0.4	0.9	1.1	0.368
	Arts & Humanities	0.2	1.5	0.4	2.8	4.5	
	Social Sciences, Business, Journalism & Law	0.6	4.5	4.1	8.4	14.3	
	Natural Sciences & Mathematics & Statistics	0.2	1.3	0.2	2.1	3.2	
	Education	0.0	0.9	0.4	0.9	1.3	
	Engineering & Manufacturing Industries & Construction	0.9	4.7	0.9	4.7	9.2	
	Health & Social Protection	0.2	1.5	2.1	3.2	9.0	
	Services	0.0	1.3	0.4	1.3	2.4	
	Information & Communication Technologies	0.4	0.9	0.2	1.3	0.9	
Academic degree	None	0.4	0.8	0.2	1.3	0.9	0.051
	Bachelor	0.6	7.5	6.0	12.8	21.4	
	Master	0.0	4.3	1.9	6.9	12.0	
	Ph.D.	1.7	4.1	1.1	4.5	11.6	

Irrespective of the frequency consumption, BSc holders are the most frequent consumers among all academic degrees, followed by Masters and Ph.D. holders. Similar findings were reported by other authors (Chammas *et al.*, 2019; Huang *et al.*, 2020; Rojas-Rivas *et al.*, 2018).

The hypothesis H4: The socio-demographic characteristics of the academic community are associated with the consumption of FF – is partially supported by our results.

4. Discussion

Functional food industry continues to experience new innovations and sales growth (Koncept Analytics, 2020), and the development of new functional foods and beverages remains a continued focus for international and national food companies (Zanchini *et al.*, 2022). As mentioned before, this study aims at understanding the determinants on consumption of FF such as the level of knowledge, barriers, motivators, and socio-demographic characteristics, regarding Portuguese market context. It differs from other studies because we used a representative sample of respondents from universities, which allow us to cover a wide range of consumers age, academic degree and specially scientific area of knowledge; additionally, it has the cohesiveness social impact mentioned as a positive effect for this type of study by Gupta *et al.* (2020).

We verified that healthy snacks and breakfast products must be considered as key growth of FF categories in food sector. Demand for whole cereals with fiber, probiotic dairy products, oilseeds, or simply fruit pieces are a reality for FF consumers due to the big difference in the choice of FF consumption, for intermediate meals, compared to the lunch and dinner. Even more than one meal per day is considered, the preferred combination continues to add intermediate meals, thus reinforcing the previous explanation.

The respondents revealed low level of knowledge concerning FF, and this fact was not associated to the scientific area of academic education in the university. Therefore, it can be explained by Portuguese economic development and the geographical position of Portugal, compared to the more developed countries.

First of all, the price of FF is too high compared to other categories of foods; and so, Portuguese's purchasing power is not enough to buy expensive food, in general – similar finding was obtained with students from the University of Alicante in Spain (González-Dias *et al.*, 2020). Therefore, even that there could be a niche market for FF, the right price must be fair according to the health claim when compared to the conventional ones. We then suggest two strategies: implement a discount to attract a wide range of consumers and gain trust of the client; or maintain the high prices but increase awareness about food added benefits and trust in brand. Secondly, we should consider the peripheral location of Portugal, and so a time gap may exist between the launch of FF in the strong markets (such as Germany) and in our country. Finally, consumers from north and central Europe countries have been considered more open-minded to consume FF than those from peripheral countries (Küster-Boluda & Vidal-Capilla, 2017). Probably, we can assume that Portuguese are less open-minded when related to FF; this is so, based on our results: (i) the sensory characteristics of FF (taste, texture,

aspect); and (ii) lack of knowledge about how much to consume FF and how to prepare FF were considered barriers to consumption. Considering that today is already possible to manufacture functional foods with the similar physicochemical characteristics, technological properties, and sensory acceptance than conventional foods (Pimentel *et al.*, 2021), these barriers can presumably associated with some fear of unknown foods, or risk perception associated with their consumption (Morawska *et al.*, 2016).

Therefore, we suggest short-term marketing strategies implying eating habits – such as promotional campaigns in schools and universities (distribution of free samples and introduction of FF in canteens), dissemination of FF concept and its benefits through internet and TV (for all ages); and advertisement that may include a more descriptive leaflet inside the food package, brochures or leaflets available at sales outlets, and further detailed information at the company's or brand's website for the middle-age and old people. Therefore, we believe that market demand for FF will presumably increase if educational strategies (to increase knowledge and to reduce barriers), marketing strategies (advertisment and labelling), and regulatory strategies (legal and clear information about the health claims) are implemented through a joint intervention between manufacture companies (marketers), information channels (internet, TV), schools, gyms and sport clubs, and government administration (such as education, public health, and regulation) – based on the facts that, by one side, consumers are increasingly concerned about their health and pay more attention to their lifestyle together with the healthiness of their diet; and that, by the other side, reducing noncommunicable diseases and the promotion of a healthy diet are on top of international and national policymakers' agenda (Topolska *et al.*, 2021). However, it would be very useful to accomplish all these actions, to have a specific definition of functional foods from the European Union in order to better specify the characteristics of these products and to delimit which foods can be included in this category (Zanchini *et al.*, 2022).

In particular, we also believe that marketers must pay more attention to the labels. This is based on the fact that a significant high percentage of respondents never or rarely confirm whether the FF has the desirable functional characteristics at the moment of consumption. One possible cause is the time spent in shopping is reduced, thus making consumers focus their attention mainly on the front package labelling (González-Dias *et al.*, 2020). The marketplace is filled with different package labels, but their true effects remain unclear; however, label changes perceptions and behaviors toward consumption (González-Dias *et al.*, 2020; Ikonen *et al.*, 2020). Reasons for failure of labelling in the FF market include too many benefits from a single brand, benefits that are often not relevant to the consumer, and relying on the selling power of the ingredient rather than the benefit (Bogue *et al.*, 2017).

Portugal has a strong tradition in the consumption of dairy products and a wide variety of dairy functional foods are provided on the supermarket shelves (Vicentini *et al.*, 2016). As mentioned before, label can change consumption behavior and as consequence it can benefit single brands. Additionally, FF tends to be dominated by heavily branded market leaders (Gray, 2002). This is the case we observed in our study with Danone group and previously reported for Turkey market (Gok & Ulu, 2019). A study on cultural differences in consumers' reactions to foreign-market brand extensions suggest that global marketing managers should be concerned with segmenting consumers based on country; within the country, differences in thinking styles may prove to be important in designing strategies for introducing vertical line extensions and managing potential spillover effects on parent brands (Allman *et al.*, 2019). Analytic thinker style, typically from Western markets, tends to focus on parent and extension features – and tries to reconcile them; this might be the reason for Danone group brand preferences.

On the other hand, knowing that Portugal is a larger producer of good quality of bottled natural water, national identity affects preference for brands with local vs. global consumer culture positioning (Bartikowski & Cleveland, 2017); this might be the reason for higher Portuguese functional drinks' recognition (16% Vitalis/Luso versus 3% Monster/Red Bull).

This study allowed to construct four motivators for FF consumption in Portugal. Benefits describes the perceived healthy and desirable effects brought about by FF consumption. People choose to consume products not only for their attributes alone, but also for the benefits they bring; they tend to prefer FF that primarily communicate disease-related health benefits and carriers that bear an image of healthiness (Kraus, 2015; Van Kleef *et al.*, 2005). This factor was also reported to be the best predictor of consumption of FF in other studies (Rezai *et al.*, 2014; Szakály *et al.*, 2019; Urala, 2005). Safety gives a sense of trust and ensures minimization of the loss of something valuable, namely health (Annunziata & Vecchio, 2011; Kraus, 2015). The safety of FF was found as one predictor of consumer's willingness to purchase FF in other studies (Mirosa & Mangan-Walker, 2018). Understanding health confidence as a value, and in particular giving health the status of the highest value that is worth being cared for, makes it the most important motivator for the purchase and consumption of FF. However, there is a general lack of confidence in the information provided on the product labels, thus suggesting that taste (Huang *et al.*, 2019) and benefits and price-quality ratio are the most important features in selecting FF. As discussed before, consumers' inability to distinguish misleading pricing strategies calls for regulators to ensure fair and ethical market practices, especially for healthy food (Samoggia, 2016).

In Portugal, based on a university context, the consumer profile of FF can be segmented by people with an academic degree with special attention to women; without differentiation regarding age and scientific area of knowledge. Consumers with more academic degree are also better able to understand the information on labels and relate a particular functional ingredient to its benefit (Bornkessel *et al.*, 2014). The fact that woman is the largest consumer of FF on a daily and weekly basis agrees with the results reported by several studies (Bogue *et al.*, 2017; Büyükkaragöz *et al.*, 2014; González-Dias *et al.*, 2020; Niva & Mäkelä, 2007; Siró *et al.*, 2008). Two studies mentioned that women provide strong arguments for their health concerns, while men are more dismissive of those health concerns and feel that they are more relevant to females (Bogue *et al.*, 2017; Kapoor & Munjal, 2017). Therefore, advertising should take these considerations into account and to appeal to the male market segment.

5. Conclusions

The level of knowledge on FF by Portuguese university communities was low; and the most recognized foods were unprocessed ones, and dairy products with probiotics or bioactive elements aimed at reducing cholesterol in the case of processed foods – with little association to the concept of functional food. Portuguese people preferably eat FF at breakfast, or as mid-morning and/or mid-afternoon snacks. The taste, price, lack of knowledge of how to prepare them, and how much to consume are barriers to consumption. Confidence, safety and need create positive attitudes towards consumption; while health benefits by themselves do not.

The profile of respondents that frequently consume FF are preferentially female holding a BSc. degree (no matter the scientific areas). One also found that consumers associate better international brands than national ones and this is probably caused by marketing strategies based on differences in thinking styles, concerning with consumer based on country and within country.

While the main aim of the industry is to sell its products, it could be counter-productive for companies in the FF sector to resort to advertising content that creates mistrust or confusion in the consumer. These conclusions should help domestic and multinational food companies in Portugal to design market strategy based on the identification of the determinants for consumption of FF. Companies should have a corporate social responsibility to use marketing through persuasive communication (advertising and correct labelling) as strategy to induce attitude change, which in turn would lead to a change in their intention and consumption behavior. A message to

Portuguese people must be sent: FF are completely safe, efficient in the prevention of diseases, and needed to keep a healthy diet in a clear and easily-understood way (assured by regulatory administration); as well as encourage consumers to read packaging/labelling information. To increase the knowledge and concerns about FF, the education and public health government administrations can give support to reach the valuable mass and bring about the required cultural change – and thus avoid functional food failure in terms of demand.

6. Limitations and future research direction

The use of a questionnaire implies the risk of wrong and incomplete answers, compared to another data collection instruments, such as focus group and interviews (Xhakollari & Canavari, 2019; Costa & Strehlau, 2020; Cong *et al*., 2020). Unfortunately, due to COVID-19 government restrictions, the use of such alternative methods was impractical. It would be also better to monitor consumer awareness of FF trends over time rather than using a cross-sectional survey. Finally, the interpretation of the results should be made with caution due to the sample characteristics (stratification of Portuguese consumers from universities according to scientific area and type of institution, all over the continent and islands).

Building on this study, for future research we propose a comparative study conducted in both developing and developed regions on cultural and economic differences related to functional food. To develop the FF market, it is necessary to understand how consumers evaluate the health benefit information on labels and to consider the differences between specific FF types (e.g., fruit yogurt or probiotic yogurt). Finally, it is important to conduct an economic analysis of FF to identify reasonable price premiums over corresponding conventional products, and based on differences between specific health benefit claims.

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