

Breakfast Cereal Products Consumption and Consumer Preferences: A study on Dietary Fibre Content Awareness

Keywords: Breakfast Cereals; Ready-to-Eat Cereals; Consumer Awareness; Dietary Fibre

Abstract

It is well established that BCP could have several health benefits, mainly related to its fibre content. This study aimed to evaluate the BCP consumption in Portugal, the reasons behind the consumers' choices, and evaluate consumer awareness on fibre content and health benefits. The hypotheses were that i) consumers are not aware of the dietary fibre benefits nor the relationship between daily intake and benefits; ii) BCP are a good strategy to increase fibre intake. The novelty of this work is related to the fibre awareness evaluation and whether the increase in fibre content on BCP could increase its consumer interest. A cross-sectional study with both quantitative (survey) and qualitative (focus group) approaches was performed. A total of 1126 participants completed the survey, and two focus group were performed, one focus group with people with 24-31 years old and another with parents with ages between 33-41 years old. It was assessed the effect of parenting on BCP perception, consumption, and purchase. More than half of the Portuguese population consume BCP at least once a week, mainly at breakfast, for convenience, taste, and healthiness. Granola and flakes are the mainly consumed by adults, and extruded and flakes by children. Consumers identify a lack of products that combine taste and healthiness.

Fibre content does not determine the BCP purchase, and consumers are not aware of all the health benefits of fibre nor its daily recommendation. When enlightened, consumer defended that this information should be shared massively, as well as how to achieve its recommended amount. The BCP approach is different among adults with or without children. Consumers demand for healthy & tasty BCP. Informed consumers on fibre benefits (besides the satiety and intestinal health) and daily recommended amount have higher willingness to purchase BCP rich in fibre.

Introduction

Many studies have determined the health benefits of dietary fibre (DF). A more recent Global Burden of Disease study estimated 877,850,000 deaths caused by a diet low in fibre (less than 23.5 g/d) [1]. Higher total DF and insoluble DF intake is highly associated with a lower risk of overweight and elevated waist-to-hip ratio, blood pressure, cholesterol, triacylglycerols, and homocysteine [2]; lower risk of circulatory, digestive, and non-cardiovascular non-cancer inflammatory diseases [3]; cereal and fruit fibre intake is related with decreased risk of diabetes [4:5]. On the contrary, a diet high in rapidly absorbed carbohydrates and low in cereal fibre is associated with risk of type 2 diabetes [4], and gestational diabetes risk [5].

Both European Food Safety Authority (EFSA) and Food and Agriculture Organization (FAO) recommend a minimum DF intake



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of 25 g/day [6] and the U.S. Department of Health and Human Services recommend 33.6 g/day for men between 19-30 years and 28 g/day for women of the same age [7]. However, the intake amount is still under the recommendations in EU countries [6, 8] and the USA [9].

Breakfast cereal products (BCP) are widely consumed worldwide (1.6 kg per capita in 2020) [10], and due to its popularity and nutritional profile (carbohydrates as the main ingredient), this product could represent a good strategy to increase fibre intake. The higher consumption per capita is found in North America (6.8 kg/capita) [11], followed by Europe (4.5 kg/capita) [12] and Australia & Oceania (2.7 kg/capita) [13]. The lowest consumption levels occur in Africa and Asia (both 0.7 kg/capita) [14, 15]. In Portugal, half of the population consumes BCP [16], similarly to other countries, namely, Australia [17], Spain [18] and UK [19]. Previous studies have demonstrated that the average intake of breakfast cereals is higher among children than among adults [19,20]. In Portugal, the overall average consumption is 15 g/day; for 10-17 years teenagers, it increases to 26 g/day, and for children under ten years old, the daily intake is 29 g [21].

Two systematic reviews on studies comprising nutrient analysis of breakfast cereals, concluded that BCP help reduce cholesterol, improve bowel function, lower the risk of diabetes and cardiovascular disease, is associated with lower mortality, and its regular consumption is associated with lower body mass index, lower risk of obesity, and it is associated with well-being feeling especially those rich in fibre [22-24]. Moreover, the consumption of BCP is associated with healthier dietary patterns regarding carbohydrates, DF, fat and micronutrients intake [24].

This study aimed to evaluate the BCP consumption patterns focused on Portugal as a representative country with Mediterranean diet; the reasons why consumer chooses this food product, and also to evaluate the consumer awareness on fibre content and health

benefits. Therefore, both quantitative and qualitative approaches were addressed by an online survey and two Focus Group, respectively.

Materials and Methods

Online survey

A questionnaire was spread online to collect information on consumption habits, consumer preferences, and perceptions towards BCP. It was conducted in the Portuguese language, using Google Forms, and the mean survey time was 5 minutes. The inclusion criteria were living in Portugal, reading and understanding the Portuguese language, and being at least sixteen years old. The socio-demographic characteristics that were collected included age, gender (male, female, rather not say), living region, nationality, education (lower than high school, high school, technical school, university degree or higher), occupation, number of people in the house and number of children under 18 years old living in the house. The questionnaire was open to answers for four months (from July to October 2020), and the sharing was encouraged at the end of the questionnaire.

The main objective of the survey was to understand how regularly the consumer eats BCP (do not consume, less than once a week, 1 to 2 times per week, 3 to 6 times per week, 1 or more times per day) and why (taste, texture, convenience, healthy, the variety of products, money-saving or other). What kind of products were preferred (flakes, flakes with chocolate, granola, muesli, extruded cereals for adults, extruded cereals for children, breakfast cereals especially rich in fibre – exemplary images were given with the question, see Figure 1) was also questioned. In the case of having children, participants also indicated which breakfast cereal products are preferred to give to their children. Consumers were asked about their choice criteria (brand, sensory quality, price, healthier, low sugar content, energy content, salt content, and fibre-rich). It was also asked if the consumer had the habit of reading nutritional information. The questions related to fibre content were made to know if the consumer is aware of fibre intake requirements. An additional goal was to understand if the provision of fibre-related information would have an impact on the importance given by consumers to this nutrient. The group of questions about fibre were:

- i. Do you give importance to the fibre content at the moment of purchase?
- ii. Did you know that it is recommended to intake at least 25g per day of fibre?

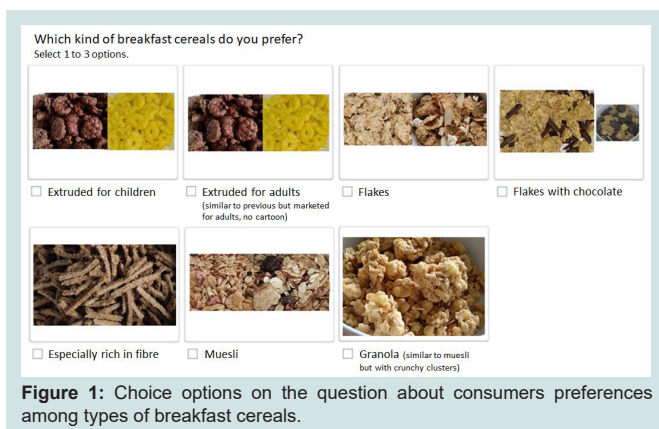


Figure 1: Choice options on the question about consumers preferences among types of breakfast cereals.

- iii. Which one of the following do you know as a benefit of fibre intake? (I do not know, regulation of intestinal transit, lower risk for obesity, lower risk for hypertension, lower reduces triacylglycerols, lower risk for high cholesterol, reduction of risk for some cancers, lower risk for related digestive diseases, lower risk for diabetes).
- iv. It was given the information about fibre intake health benefits (all of the above) when fibre intake is at least 25 g per day and that in Portugal, the mean fibre intake is only 18 g per day. Then it was asked: Does this information make you want to be more aware of fibre content in cereals products? Why?

For participants that answered not to consume BCP, the above questions were not made, and instead, it was asked what they eat at breakfast, why they do not consume BCP and if they would consider buying (7-point scale from 1-definitely would not consider to 7-definitely would consider) a BCP with high fibre content, health benefit-nutritional composition that would taste good and contribute to food industry sustainability.

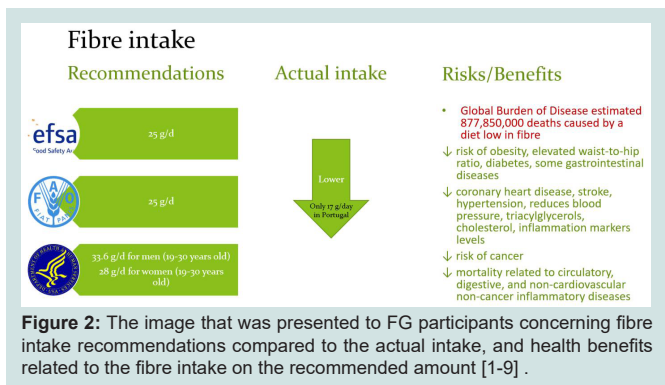
Focus Group

In order to collect consumers' beliefs, opinions, and attitudes towards breakfast cereals as a meal and the products in the Portuguese market, two focus group (FG) interviews, with eight participants each, were performed. Participants were recruited among the university community. In one FG, participants were between 24 and 31 years old with no children, three men and five women. The other FG had four men and four women, ages between 33 and 41 years old, with one to two children.

FG were conducted online via video conference calls (via Zoom software since were organised during COVID19 Pandemic) and recorded after all participants signed informed consents and agreed with the recording. After the video calls, the meetings were transcribed to text by question/topic. Afterwards, the information was analysed and organised by topics, highlighting the main conclusion, and pointing out the other different ideas that participants pointed. The questions concerned the following main topics: (i) type of diet and most important concerns about diet and foods; (ii) BCP choice and why; (iii) BCP choice for the children and why (question only applicable for the FG with parents); (iv) importance given to the fibre in one's diet and for the choice of BCP; (v) how the given information about fibre benefits and recommended intake amount can influence diet and purchase choices. After question iv, information about fibre benefits was provided as represented in Figure 2 and the influence of this information was then discussed with question v.

Statistical analysis

Online survey data was analysed using SPSS version 22 software (SPSS Inc., Chicago, IL, United States). A chi-square exact test was performed to assess differences between gender and age groups. Statistical significance was defined by a $p < 0.05$. Qualitative research (Focus Group) data was analysed using the content analysis method [25]. First, it was performed a pre-analysis consisting in a free-floating reading and structuring the categories and sub-categories. Afterwards, the interviews texts were allocated to each sub-category. The interpretation of data was performed by merging theoretical concepts and empirical data.



Results

Breakfast cereals consumption: quantitative study (online survey)

The online survey allowed to collect information about BCP consumption patterns. A total of 1126 participants completed the survey, of which 81.6% were women and 3 participants selected “rather not say”. There was a wide age distribution; 36.3% of participants were 18 to 30 years old, 25.8% were 31 to 40 years old, 21.1% were 41-50 years old, 13.2% were 51 to 60 years old, and 3.6% were 61 to 80 years old. Only 3.5% of participants were not Portuguese (the majority from Brazil ($n=26$) and Spain ($n=4$)). The majority had a high education level (82.4% had an university degree), which is mainly due to the questionnaire spread method and the lower internet skills of lower education level people. This sample is not fully representative of the level of education in Portugal, where only 21.2% of the population has a high education level [26]. There were 42% of participants that have children living in the same house. Most of the participants [59.9%] are BCP consumers and the following results are relative to the participants that consume BCP.

Consumption moment and frequency: More than half of the respondents consume BCP (59.9%, 674 individuals). Of those, 81.9% eat it at breakfast, 42.8% during the afternoon, 17.4% at supper, 15.6% in leisure situations, 8.9% as a meal substitute and 7.0% in the middle of the morning (Figure 3). More commonly, consumer eats BCP ‘1 to 2 times a week’ (32.5%) or ‘3 to 6 times a week’ (32.3%). Fewer participants selected ‘Less than 1 time a week’ (24.6%), but the option with fewer choices was ‘1 or more times per day’ (10.5%).

Consumption choices: When asked for the reasons to consume BCP, the most selected reason was convenience (55.8% of the participants selected this option) (Figure 4), followed by taste (47.0%), crunchiness (32.8%), healthiness (31.2%) and because there is a large variety of BCP (25.2%). The “Other reasons” (4.7%) that the participants most pointed were related to varying the breakfast, as they indicate that sometimes they consume BCP to shift their common breakfast or because they “do not always have bread available in the morning”, as mentioned by some participants. Two other reasons that were pointed out were (i) related to constipation/regulation of intestinal transit and (ii) related to satiety; participants indicated that with BCP, they feel “less hungry all morning” (4/34 participants in each reason).

After the question where the participants could select more than one option, it was asked to select only the one main reason to buy and

eat BCP (Figure 4). For 36.5% of the participants, the main reason was convenience. The taste was the main reason to 21.7% of the respondents healthiness was selected by 18.7% of the participants, the variety of products by 11% and crunchiness by 8.8%. The other reasons that participants indicated were for satiety all morning (4/13), to vary breakfast (2/13), to regulate intestinal transit (1/13), for the presence of fibre (1/13), by indication of a nutritionist (1/13) and to be able to consume yoghurt in the morning. There were significant differences among consumers with different ages ($p<0.001$) in this question. For older participants (age > 51 years old), healthiness was the main reason to consume BCP, 51% of the 51-60 years old consumers and 45% of the 61-80 years old participants selected healthiness. In contrast only 7% of the 18-30 years old consumers selected healthiness, 13% of the 31-40 years old consumers and 26% of the 41-50 years old consumers. This may indicate that older adults have more tendency to believe in the healthiness of BCP than younger adults or older adults are more worried about healthy eating. For the younger consumers the main reason to consume BCP was convenience, 41% of the 18-30 years old consumers and 44% of the 31-40 years old consumers selected convenience and few older consumers selected convenience: 22% of the 51-60 years old consumers and 10% of the 61-80 years old consumers.

The next questions were related to the type of BCP that consumer prefers and the BCP that their children prefer (Figure 5). The percentages are related to the total of participants that answered the questions. The first question about the participants favourite BCP was answered by 674 participants and the second question about the BCP that are preferred by the participants’ children was answered by 201 participants. They could select more than one option and the BCP were presented in the question divided into groups: i) flakes, ii) flakes with chocolate, iii) granola, iv) muesli, v) extruded cereals for adults, vi) extruded for children, vii) breakfast cereals especially rich in fibre.

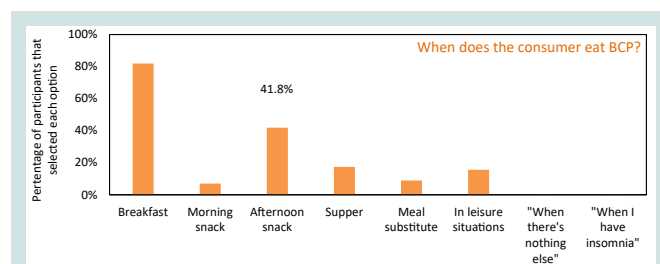


Figure 3: Percentage of participants that consume breakfast cereals that selected each option about when they consume breakfast cereals.

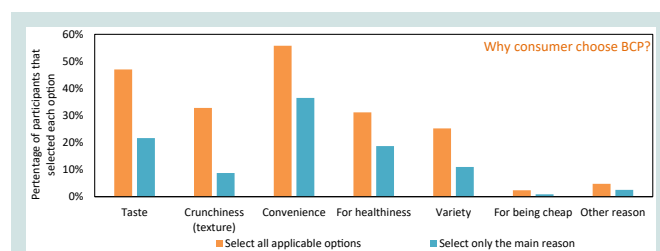


Figure 4: Percentage of participants that selected each option about what the reasons are to consume breakfast cereals. The first column corresponds to the question where it was asked to the participant to select all the applicable option and the second column correspond to the question where it was asked to the consumer to indicate the main reason (and only one) to consume breakfast cereals.

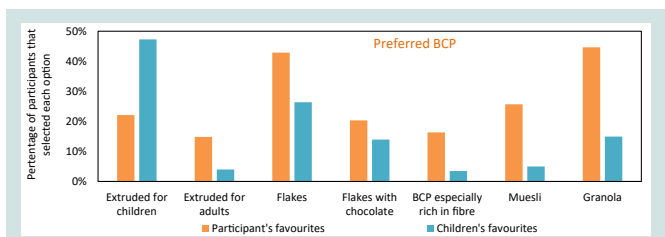


Figure 5: Percentage of participants that selected each option about their preferred breakfast cereals (first column) and the breakfast cereals that are preferred by participant's children (second column).

Granola (44.7%) and flakes (42.9%) are the most consumed type of BCP by the participants in general, followed by muesli (25.7%). The less consumed BCP are BCP especially rich in fibre (16.3%) and extruded for adults (with no cartoon-like packaging) (14.8%). The main reason the consumers rarely eat 'Extruded BCP for adults' or 'BCP especially rich in fibre' is probably related to the taste of these products. As seen in the previous question (Figure 4), the taste is the second main reason for the consumption of BCP after convenience, which is common for all type of BCP.

Children eat mostly 'Extruded BCP for children' (47.3%), which is referred to the BCP with a cartoon-like type of packaging, followed by flakes.

Nutritional composition awareness and fibre content& benefits: When asked about how often participants read the BCP's nutritional information, either the list of ingredients and/or the nutritional table, the most selected options were 'Always' (38.7%) and 'Sometimes' (37.2%). Fewer people indicated that never (7.7%) and 'Rarely' read it (16.3%). A recent study verified that consumers use food nutrition labels to make purchase decisions (70%), but few people read them for all foods (38%) and most people (69%) read them only for selected foods [27].

When asked about fibre (Figure 6), a considerable number of participants (36.4%) indicated that fibre content does not influence their choice on BCP purchase. Nevertheless, the majority of participants said they look for BCP rich in fibre but are flexible on buying others BCP too. There were 14.8% of participants responding that only buy BCP rich in fibre. Which aligns with the fact that 16.3% of participants indicated BCP especially rich in fibre as their favourites (Figure 5).

It was also performed a statistical analysis to compare gender and age groups and it was verified that women (compared to men) and older adults give more importance to the fibre content in BCP. More women selected the *Only buy BCP rich* in fibre option (16.3%) than men (8.7%). Similarly, less women selected the *Fibre content does not influence my purchase* (34.3%) than men (46%). Those differences were significant ($p < 0.05$) and demonstrates that women give more importance to fibre intake than men. Comparing age groups, significant differences were found ($p < 0.001$). The option *Only buy BCP rich* in fibre was mainly selected by 61-80 years old people (40% of this group selected this option contrast to 10-21% of the other age groups). And 60% of the 51-60 years old selected the *I seek for BCP rich in fibre but also buy other BCP* (45-48% of the other age groups selected this option).

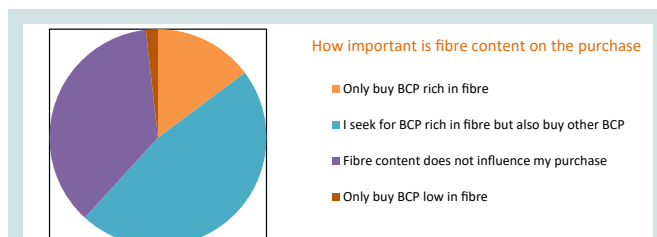


Figure 6: Percentage of participants that consume BCP that selected each option about their preference towards fibre content.

When the participants were asked "Did you know that, for an adult, the recommended amount of fibre intake is at least 25 g per day?", most of the participants (53.7%) indicated to know that fibre consumption is important but were not aware of the necessary daily amount. Only 10.4% answered that did not know and 35.9% of participants knew the recommended amount. This is a great percentage of informed people which could be explained by the high scholarship level of the majority of participants (82.4% have an university degree).

Then, it was presented the several fibre benefits and it was asked to participants to select all options that corresponded to fibre health benefits. 'Regulation of intestinal transit' was the most known benefit once 92% of participants selected that option. 'Lower risk for digestive related diseases' and 'lower risk for obesity' were the next most selected options (46.9 and 46.3%). There are also people that were aware of the following benefits: 'lower risk for high cholesterol' (37.2%), 'reduction of risk for some cancers' (33.5%), 'lower risk for diabetes' (30%), 'lower risk for high triacylglycerols' (29.8%), 'lower risk for hypertension' (25.8%). Only 6.7% of the participants selected the 'I don't know' option.

Next, participants were informed that the consumption of a daily amount of at least 25 g per day of fibre was associated with lower mortality [3], which is related to the fact that fibre presents all the benefits presented as options in the previous question[2,28,29]. Then, it was asked "Does this information make you want to be more aware of fibre content in cereals products?" and a 5-point scale was given to the answer where 1 stands for "Absolutely NOT" and 5 stands for "Certainly YES". Most people (42.5%) selected point 5 and oppositely only 3.3% selected point 1 (Figure 7).

In the next open answer question, people that chose 4 or 5, indicated that this change of habit was mainly due to willingness for improving health/well-being or prevent disease (57% answers to this optional question). Moreover, because of the awareness about the benefits or the recommended amount versus the actual intake: "I was not aware that the lack of fibre could bring so many health problems"



Figure 7: Percentage of participants that selected each option. 1 stands for "Absolutely NOT" and 5 stands for "Certainly YES".

or, similarly, “This is a new information for me and a very important one”, “Knowledge is power”, “I learned what I did not know”. Some participants referred to the information about the actual DF intake amount is lower than recommended, e.g., “Because now I know that the amount I ingest is not enough”, “I had no idea I ingest so low amount of fibre”.

Some answers more related to the BCP were” Because until now I was not aware of the nutritional profile of BCP”, “I will now choose BCP with more fibre”, “Because it is easy to choose the BCP with higher fibre content”, “[to consume BCP rich in fibre] would be a quick and simple way of increasing my daily intake of fibre”, “They are a practical way to obtain the dietary fibre” and “To join the useful to the pleasant”. It was also referred “For my health and for my family health” and “Because it is important for my family”.

People that chose 1, 2 or 3 indicated that they were “already aware of the health benefits of fibre” and “already consume high fibre amount”; that they pursue fibre intake in other foods and “I steel valorise the consumption of fruits and vegetables”; “I am going to give more importance to fibre in BCP but not excessively “and “It could be an important information but I don’t believe it would be influencing my purchases”; “I rarely eat cereals thus I only eat for pleasure and not for nutritional benefit”, or they believe that have already “a balanced and fibre-rich diet”. Different type of answers was, “Laziness of reading labels” and “Because I am faithful to a brand”.

Participants who do not consume breakfast cereal products: The participants that do not consume BCP mainly consume bread, either fresh, toasted or sweetbreads (75.9%) at breakfast. The next food products more selected were milk/vegetable milk (44.3%), soluble coffee or cereals drink (39%), fruit (35.6%), butter (32.6%) and ham and/or cheese (29.8%). Thus, most people eat bread or toasts with butter, ham and/or cheese and drink coffee or milk. Other foods (17.4%) indicated by participants included eggs, milkshakes, oat, homemade granola, fresh cheese, protein supplements or bars, buttermilk, espresso coffee and soup.

The reasons to not consume BCP revealed that most people simply just prefer other kinds of breakfast (46.7%). Nevertheless, also a substantial number of consumers consider that BCP is not healthy (31.6%). The third main reason for people not to consume BCP is as simple as that they never created the habit. A small number of consumers do not consume BCP for disliking the taste (4.6%) or the texture (4%), which is understandable that only few participants indicated these reasons, since there is a vast variety of BCP in the market. Some other reasons pointed out were: (i) related to calories, sugar content and diet: “I do not feel satiated”, “They are very caloric” or “(...)have too much sugar”, “Excess of sugar, lack of protein and fibre”, “My nutritionist said it is not good”, “I am on intermittent fasting”.(ii) due to not ingestion of milk: “I do not drink milk” or “I dislike milk” was pointed several times.

Breakfast cereals consumption: qualitative study (focus groups)

Several topics were discussed during the two focus groups which allowed a deeper understanding about the results on the quantitative study. The discussions that took place during these sessions are summarized in Table 1 according to the categories and sub-categories of data and the correspondent sentences from participants.

Discussion

Our study showed that more than half of the Portuguese population consumes BCP which is slightly higher than the results of the Mark test market study, which verified that 49.7% of Portuguese consume BCP, being this consumption more frequent among the youngest, where 74.0% of individuals that are 15 to 24 years old consume BCP [16]. The higher percentage of participants that are BCP consumers in this study may be justified by the fact that those who consume BCP may be more willing to participate and complete the survey as they are more related to the matter than individuals that are not BCP consumers. The high education level of the sample can also contribute to this scenario. These results are also in alignment with consumption patterns in other countries where approximately half of the population eats BCP [17,18].

The online survey results showed that people who do not consume BCP consider it caloric or not healthy, which aligns with previous results on products healthiness awareness. [30] found that consumers consider a healthy snack to be low in calories, fat, salt, and sugar and high in whole grain, oats, bran, nuts, seeds, pulses, and fruit. Additionally, studies showed that consumers’ perception of the healthiness of BCP could be improved when consumer is forced to evaluate nutritional table and labels combined [31]. Additionally, the fact that they do not drink milk was often indicated as the reason to not consume BCP. In fact, 74% of participants that consume BCP, indicated that consume it with milk (data not shown), which shows that the main cultural habit of consuming BCP is with milk.

Diet patterns and concerns

The first question made in both Focus Group intended to reveal the consumers’ approach towards diet and foods in general. Previous studies showed that consumer is increasingly concerned about eating patterns because of the known effect of food consumption on the health and weight control [32,33]. Consumers in both groups showed a relative preoccupation with diet and, in general, trying to have a careful diet, but not too strict. The reason why people may or may not follow a healthy eating pattern is still not fully understood, but it is known to be influenced by genetic, biological, behavioural, psychological and environmental variables [34]. Nevertheless, the past years’ food trends involve health benefits. Consumer awareness about the connection between diet and health has increased as well as the demand for functional and healthy foods. Recent trends show that consumers have gained awareness about the link between diet and emotional health, thus demanding functional and healthy food and ingredients to address mental and emotional health [35].

BCP consumption patterns and market perception

The main reason for the BCP consumption is convenience, followed by taste and then healthiness. Similarly, a recent survey in the USA presented the same question and “It is easy to prepare” and “It is tasty” were the most selected options (83 and 70%, respectively) and “It is inexpensive” was the less selected option (33%) [27]. Focus Group participants explained that the convenience of BCP in the morning is important because of the brief time they have for breakfast but also because they simply like it. The fact that healthiness was the third reason most selected shows that consumers consider it healthy even if they mentioned other characteristics in first. It is expected

Table 1. Categories and sub-categories of data from Focus Group interviews.

Category	Sub-category	Participants sentences
<i>Diet patterns and concerns</i>	Relative care for a balanced diet	<p>"I try to have a balanced and varied diet, with several meals along the day, but I'm not too strict"</p> <p>"I try the most to have a balanced diet with exception of special occasions like Christmas"</p> <p>"I try to eat healthy but with no restriction, just not to eat too much of what is less healthy and try to vary in the foods I eat"</p> <p>"I worry about nutrition, and I like to know what is in the food, what should I eat or not, but I try not to limit myself too much, I only have special attention to the nutrients that can be missing in my diet because of being vegetarian".</p> <p>"I have special attention to the amount of fat I ingest"</p> <p>"I try to ingest the maximum of nutrients variety in a meal"</p> <p>"I try not to eat too much of harmful foods, such as foods rich in fat"</p> <p>"I always eat fruit and vegetables and in every meal I try to ingest a protein source and carbohydrates"</p>
	No preoccupation with diet	<p>"I have no worries about diet at all"</p> <p>"What I eat along the day is random and every day may be different even regarding the meals' time. All I do is to try to reduce the number of times I eat fried foods"</p>
<i>BCP consumption patterns</i>	Consumption for convenience, liking, satiation and healthiness	<p>Consumption in the morning:</p> <p>"If I don't have time to eat at home at all, I grab a yoghurt and BCP, and I eat it on the way"</p> <p>"I feel more satiated and healthier when comparing to eating bread in the morning"</p> <p>Consumption as a snack:</p> <p>"(...) it is practical, there is a great variety of flavours, there is BCP for everyone and every moment, either if I want something healthier or something tastier and I believe there is BCP with a good balance of healthiness and tastiness, and those are the BCP I generally eat".</p> <p>Consumption as meal substitute:</p> <p>"(...) if I am alone and not in the mood to cook".</p>
	No consumption	<p>"Prefer to eat toasts and juice than milk and BCP"</p> <p>"BCP have too much sugar and that is why I prefer pure oat grains"</p> <p>"I do not have the habit, sometimes I eat a little amount when my daughters are eating it, and I like it, but I simply do not have the habit of eating it"</p>
<i>Market perception</i>	Satisfied	<p>"Nowadays, there is large diversity of BCP, all shapes, colours, tastes"</p> <p>"(...) we just need to search for it"</p>
	Not satisfied	<p>"R&D on BCP could be beneficial to improve healthiness without compromising flavour/taste because there are the healthier BCPs and the tasty ones could be healthier because the healthy ones are not those that we prefer to eat"</p> <p>"BCP for children are still full of sugar, and that makes no sense, I believe there are new alternatives now to avoid that amount of sugar"</p>
<i>How parents manage the children's BCP consumption</i>	Younger children (< 4 years old)	<p>"I did not present the BCP for children to my children because they are not healthy (too much sugar) and I know that when they meet these kind of BCP they will want it"</p> <p>"My daughters eat healthy organic cereals as snacks"</p> <p>"My daughter eats oatmeal once to twice a week. We do not give them BCP because they are not healthy"</p> <p>"She like the sweet, extruded cereals, but we do not want to give it to her regularly because it is less healthy"</p>
	Older children (> 7 years old)	<p>"There has to be a balance between sugar content and children liking to eat it, and it is difficult to conciliate what we would like them to eat and what they like to eat. The BCP with more fibre have bad taste for example"</p> <p>"My children eat the BCP they want, because they like to diversify and eat differently each time, thus they eat occasionally the less healthy BCP"</p>
<i>Fibre awareness</i>	Fibre content have no influence on BCP purchase	<p>"I try to intake fibre by eating fruit, vegetables and grains and when buying BCP I do not look at the fibre content"</p> <p>"I do not pay attention to fibre content because I always eat the same thing"</p> <p>"The fibre content is not a decisive factor for my BCP choice, I worry more about sugar content, caloric value and mineral content"</p>
	Fibre content have slight influence on BCP purchase	<p>"I always look at the fibre content in the food products, including on BCP"</p> <p>"When in doubt about two or more BCP, I choose the one with higher fibre content"</p> <p>"I try to ingest fibre including in cereals, but I do not compare too many products"</p> <p>"If the label has the "rich in fibre" claim it is enough for me"</p>
Before the next section, participants were informed on the health benefits of dietary fibre as represented in Fig.2		
	Knowledge on dietary fibre health benefits and recommended daily amount	<p>"I was not aware that was the recommended amount nor the variety of health benefits and importance of the fibre"</p> <p>"This information is vital and should be shared!"</p> <p>"I think this is a crucial information and everyone should have access to it"</p> <p>"Population is not aware of the importance of fibre on health and not aware of the recommended amount which is way higher than I thought"</p> <p>"I was aware that fibre regulates intestinal transit and some other benefits but not all of them"</p> <p>"I had no idea that the fibre intake was so below the recommendations"</p> <p>"For me, it was more impactful that 25 grams is the minimum recommended amount, but we ingest only 17 grams per day, which makes us think if we are ingesting the minimum recommended amount"</p> <p>"I have no idea if I ingest the recommended amount or not, but probably not"</p> <p>"It should be communicated what we have to eat in order to ingest that daily amount of fibre".</p>

that taste was more important than healthiness because studies have demonstrated that consumers are not much willing to compromise on taste for health. Verbeke [36] concluded that willingness to compromise taste for health depends on socio-demographic features, but in general, that “is a highly speculative and risky strategic option”. Portuguese BCP consumers, eat BCP at least once per week, mainly at breakfast, but they are also largely consumed as a snack. Similarly, a study with American consumers (USA) participants indicated to consume ready-to-eat breakfast cereals more commonly (more than three meals per week) for breakfast and as snacks and less commonly at lunch or dinner [27].

The type of BCP consumed mainly are granola and flakes. The extruded for children are not very consumed by adults, which is possibly because they are often perceived as less healthy, as suggests previous studies [37]. However, children eat mainly extruded BCP for children (with cartoon-type packaging) and the second BCP most consumed by children is ‘Flakes’ maybe because it is one of the most BCP consumed by their parents and also the most commonly recommended by health professionals as paediatricians because of their lower sugar content [38]. Adults and children have the major consumption differences in granola and muesli, being these more eaten by adults, and in extruded BCP for children, which are more eaten by children as expected. More than half of the participants indicated other types of BCP than ‘Extruded for children’ as their children’s favourite, which could be conditioned by parents’ belief that these products are “not good to buy for children” as a recent study concluded [37]. In fact, Focus groups interviews showed that parenting affects BCP consumption patterns. Among the parents’ group, there were more granolas and muesli consumers than in non-parents group, which could be related to the fact that parents are more concerned about healthy patterns as models to their children or it could be related to age (participants of this group are approximately ten years older than the other group participants) as it is known that older people are more health conscious [39] in conjunction to the fact that granolas and muesli are perceived as healthy products [40]. Nevertheless, this belief could be wrong as previous studies showed that granolas have higher fat and saturated fat content than other BCP [38,41,42]. Moreover, children targeted BCP are perceived as less healthy as they have higher energy, sugar and sodium values and lower content in fibre and protein [43, 44].

When asked if they were satisfied with the products on the market, all participants recognised that there is a wide variety and BCP for all tastes and needs. In general, participants are satisfied with the BCP offer. However, there was also the general opinion that BCP formulations should be improved to combine healthiness and tastiness. In fact, previous studies already had shown that consumers are shifting healthiness perception into believing that foods can integrate both good taste and a high degree of healthiness (Luomala et al., 2015), which explains the frustration towards the BCP in the.

How parents manage the children’s BCP consumption

In the Focus Group of parents, it was asked if they gave BCP to their children, why and what type of BCP children eat. In general, participants’ answers indicate that younger children (< 4 years old) eat healthier BCP, and older children (> 7 years old) may eat a larger variety of BCP (Table 1). It could be simple flakes, flakes rich in fibre,

extruded BCP (for children) or granolas/muesli. Children can eat BCP at breakfast as well as for snacks, with milk, yoghurt or simple. Parents with younger children are more prone to avoid the children to get to know the existence of BCP for children¹ (and maybe that is the reason the participants of this group eat only granolas, muesli, or oat grains or no BCP at all). This behaviour is understandable since character/cartoon branding influences children’s food choices, mainly for energy-dense foods [45], and usually, paediatricians and general practitioners advise against the introduction of these products in the kid’s diet [46].

Fibre awareness

The fibre content of BCP is not very important for most consumers since it does not determine the purchase. However, women and older people seem to give higher importance to fibre content in BCP, which aligns with previous studies that have been demonstrating that women and older adults have more healthy eating habits [47]. The quantitative study showed that 36% of participants are not influenced by BCP fibre content during purchase. In fact, Focus Group participants who said that they are aware of fibre importance do not seek fibre, particularly on BCP, preferring fruits, vegetables, and grains as fibre source. Other participants indicate that fibre content influences their purchase and may compare fibre content between BCP when in doubt, as well as seek for the “rich in fibre” nutritional claim. Similarly, previous studies demonstrated that front-of-package information about fibre content increases the probability of choosing a healthy BCP [48,49]. Previous studies on willingness to eat bread revealed that consumers that are more concerned about health are the ones that are more willing to eat bread enriched in fibre compared to the consumers that give minor importance on health benefits [50]. Parents also have tried that their children intake fibre more through vegetables’ soup, fruit and vegetables in all meals than by BCP “nevertheless, as they frequently eat muesli and oat, I have no worries about my children’s fibre intake amount”. Consumers are not aware of all the health benefits of fibre or the minimum daily amount necessary to achieve those benefits and avoid the risks of a diet low in fibre. The reasons for participants to seek fibre intake are mainly regulation of intestinal transit and satiety.

However, after being informed about fibre intake recommendations and risks/benefits of fibre intake (Figure 2), participants indicated that they were not aware of all the health benefits of dietary fibre nor the daily recommended amount (Table 1). Similarly, a recent work showed that consumers (even consumers with background in nutrition) have very low awareness regarding fibre and health [51]. Participants demonstrated to incredibly valorise the information on health benefits and daily recommended fibre intake and even shocked that this is not massively publicised. Another shared concern was about incapacity to track the amount of fibre that they consume and suggested that they must be informed on what they should eat to reach the daily recommended amount (Table 1). This information makes the consumer get more attention to the amount of fibre in BCP and possibly choose BCP with higher fibre content. Previous studies on health concerns topics concluded that introducing front-of-pack nutritional labelling increases the chances of consumer choosing healthy BCP by 3.49% in average and fibre intake increases the probability by 3.24% [48].

¹In this work BCP for children is referred as BCP with cartoon-type packaging

Author contributions

Diva Santos contributed to the investigation, acquisition of data, analysis and interpretation of data, manuscript drafting. **José A. Lopes da Silva** contributed by supervising, manuscript drafting and editing. **Elisabete Pinto** contributed to the investigation, conceptualization, analysis and interpretation of data, manuscript drafting. **Manuela Pintado** contributed with supervision, funding acquisition, analysis and interpretation of data, manuscript drafting and editing.

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