Research Article

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Breakfast habits and knowledge: Study involving participants from Brazil and Portugal

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Abstract: Breakfast has been considered one of the most important meals of the day. While breakfast habits and their consequences on children's health and performance are well documented, studies on the adult population are still lacking. The aim of this study is to observe the breakfast consumption habits of Portuguese and Brazilian adults to understand the importance attributed to this meal, which leads people to have breakfast or to skip it, and also what types of food are consumed. To achieve these objectives, a questionnaire survey was carried out in both countries, and the data were collected through the internet. A convenience sample consisting of 694 participants (380 from Brazil and 314 from Portugal) were used in this study, all were adults who gave informed consent to participate in the research. The results showed that the majority of participants consumed breakfast every day (74.4% in Brazil and 78.3% in Portugal), and they did it at home (94.4 and 94.3% for Brazilians and Portuguese, respectively). The results also showed that the reasons for consuming breakfast and skipping it are very similar in both countries. People say they do not have breakfast because they do not want to eat in the morning or they do not have time. The reasons to always have breakfast include providing energy, satiety from night fasting, preventing hunger until lunch, because they like it, or simply because it is a habit. The level of knowledge was slightly higher among Portuguese than Brazilian participants and was found to vary according to the habits of having breakfast or skipping it and also according to country, sex, BMI class, and school level. In conclusion, breakfast habits were found to be very similar in both countries', but the knowledge was higher among the Portuguese than the Brazilian participants. Breakfast is linked to a healthy lifestyle, and individuals' behaviours and beliefs must be taken into account to promote health and well-being, thus diminishing the burden of noncommunicable diseases related to improper eating habits and dietary patterns.

Keywords: breakfast, food habits, nutrition, health, food consumption, questionnaire survey

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1 Introduction

Breakfast is the first and referred by many as the most important meal of the day [1]. The body needs energy and nutrients to function, especially after many hours of fasting since the last meal, that is, dinner the day before. Some studies suggest that as age increases, the number of people skipping breakfast increases, especially among teenagers, and this habit recovers again in adults. With the progressive omission of breakfast, there is also a tendency among people who eat breakfast to lighten or

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reduce its content with ageing, notably decreasing the intake of energy and nutrients [2].

A healthy breakfast provides essential nutrients for daily activities and is linked to long-term, lifelong health status [3]. Breakfast provides the energy to start the day; for this reason, it is one of the most important dietary intakes, covering 25–30% of the daily nutritional needs and including foods from three basic groups: dairy products, cereals, and fruits. However, despite the nutritional relevance of breakfast, new lifestyles induce fast meals, so it becomes one of the least consumed or poorly prepared meals [2]. The lifestyle of today's society, with the increase in the number of individuals who live alone and lack time to have proper meals, has also been associated with the decline in breakfast consumption [4]. The lack of breakfast is associated with many health problems and reduced performance in cognitive and psychosocial functions, as well as academic performance [3]. In addition, children who do not eat this meal have difficulty concentrating, besides feeling tired due to reduced energy levels at the end of the day [3].

Studies suggest a positive relationship between breakfast consumption and a healthy lifestyle, linking frequent breakfast consumption with a low risk of overweight and abdominal obesity [4]. People who eat breakfast have been reported to be leaner, have a lower body mass index (BMI), have better nutrient intake, are less depressed, and have better cognitive performance than people who do not eat breakfast [5].

Skipping breakfast may be associated not only with weight gain, but also with harmful changes in risk factors for cardiovascular disease and diabetes, which affect metabolic and hormonal responses to late-morning foods [5]. It has also been reported that higher consumption of carbohydrates at breakfast is significantly related to a lower BMI. Conversely, not having breakfast or having breakfast but consuming high-fat and low-fibre foods is associated with a higher BMI. Meanwhile, other authors have reported that a breakfast rich in protein and fat may have metabolic benefits in patients with type 2 diabetes mellitus [6]. Many studies report that breakfast cereals and other fibre-rich foods are associated with a lower risk of obesity. Eating fibre-rich foods in the morning can improve blood sugar control and possibly prevent a low blood sugar level between meals. Regarding appetite, some studies report a greater feeling of satiety after eating these fibre-rich foods, but less after a low-fibre and/or high-fat breakfast [7]. Preliminary studies of breakfast eating suggest that eating this meal may reduce fasting total and LDL (low-density lipoprotein) cholesterol, oxidised LDL, and serum triglycerides. Furthermore, the slow absorption and digestion of starch at one meal (i.e. breakfast) may improve carbohydrate tolerance at the next meal [7].

This brief overview of knowledge on the assumed link between breakfast habits and health indicators justifies the need to obtain a clear picture of current breakfast patterns, to assess the need for public health measures, and, when necessary, develop stimulus messages or strategies that address target populations [8]. When it comes to breakfast consumption, many individuals have their habits, definitions, and beliefs, which are variable with societal or cultural influences, among other factors. These beliefs can also influence consumption [5]. Hence, the objective of this study was to evaluate the eating habits related to breakfast and the foods consumed, as well as assess the knowledge about breakfast and its effects on health among the citizens of two different countries (Portugal and Brazil). Although they share some common cultural and linguistic features, they also differ in terms of societal and geographical influences, namely, Mediterranean Europe vs Latin America.

2 Materials and methods

2.1 Instrument

The questionnaire consisted of four sections (Appendix), intended to evaluate sociodemographic characteristics, breakfast consumption habits, and knowledge. In the first part, the sociodemographic (age, gender, professional situation, level of education, size of the household, etc.) and anthropomorphic (weight and height) characteristics were addressed. In the second part, the consumption habits of the respondents were evaluated, through the answer to questions about the frequency of eating breakfast, reasons to consume or not consume breakfast; differences noted if skipping breakfast and the place where they consume it. The third part consisted of indicating which foods the respondents usually consumed for breakfast among the various options provided in seven food groups (drinks, dairy products, bread and cereals, charcuterie/eggs, fat-rich products, fruits/nuts, sweets/pastry). Finally, the fourth and last part evaluated the participants' knowledge about the benefits of breakfast through a set of statements that had to be answered on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

2.2 Sample and data collection

The questionnaire was prepared on the internet platform Google Forms. The invitation to participate in the survey was sent through social networks and email, following a snowball procedure. The survey was carried out on a convenience sample because of the facility of recruitment and more straightforward disposition to participate of free will. Even though convenience samples have some disadvantages, they are very advantageous for exploratory research [9,10]. The study included individuals over 18 years of age from Portugal and Brazil. Participants under 18 were excluded because of being under the legal age, and since the questionnaire was applied through computational means, it was not possible to obtain the authorisation of the legal guardians. Data collection took place between November 2020 and July 2021.

Informed consent: Informed consent has been obtained from all individuals included in this study. Each participant could only access the questionnaire after agreeing to participate and expressing informed consent, knowing that no personal identification would be collected.

Ethical approval: All ethical principles were strictly obeyed when preparing the questionnaire and collecting the data, following international standards and the Declaration of Helsinki [11]. The questionnaire was previously evaluated and accepted by the Ethics Committee of the Polytechnic Institute of Viseu, with reference number 09/SUB/2020. The conducted research is not related to either human or animals use.

2.3 Data analysis

The age of the participants was classified as young adults (between 18 and 30 years), adults (between 31 and 50 years), and senior adults (51 years or over).

To calculate BMI, the following formula was used:

$$\text{BMI}(\text{kg}/\text{m}^2) = \frac{\text{Weight (kg)}}{\text{Height (m}^2)}$$

The participants' BMI was then classified according to the BMI classes of the World Health Organization (WHO): underweight – BMI < 18.5; normal weight – 18.5 ≤ BMI < 25; overweight – 25 ≤ BMI < 30; obesity – BMI ≥ 30 [12].

For data analysis, different basic descriptive statistical tools were used, such as for example, frequencies. For each of the items used to assess knowledge, some indices were calculated as the mean values for all participants (globally and separated by country). Also, the responses were used to calculate the knowledge of each participant, as the mean value of all eight items, after reversing the items that were false. This variable knowledge varied between a minimum of 1 and a maximum of 5, corresponding to the same range as the Likert scale used. These values were used to define categories of knowledge as follows:

- Very low knowledge: $1 \leq \text{value} \leq 2$;
- Low knowledge: $2 < \text{value} \leq 3$;
- High knowledge: $3 < \text{value} \leq 4$;
- Very high knowledge: $4 < \text{value} \leq 5$.

The relative influence of the sociodemographic variables on the level of knowledge was assessed through a tree classification analysis. For this, a classification and regression tree algorithm with cross-validation was used [13]. The minimum change in improvement was equal to 0.0001, meaning that variables going from one level to the next must meet this threshold to be included in the tree. The minimum number of cases for parent and child nodes was established as 50 and 25, respectively, meaning that nodes with a smaller number of cases were excluded from the tree. A level of significance of 5% was considered in all statistical analyses and it was performed using the SPSS (version 28) software.

3 Results and discussion

3.1 Sociodemographic and anthropometric characterisation of the sample

Figure 1 presents the sociodemographic characteristics of the participants in the study. The study involved 694 subjects, distributed across both countries, with slightly higher participation from Brazil (n = 380, 54.8%), which is natural considering its greater size as compared with Portugal (n = 314, 45.2%). It is worth referring that the sample used was recruited through convenience; therefore, it was not proportional to the population of both countries involved. There were more women (76.9%) than men in the study, which also relates to the mode of recruitment and considering that women are, in general, more willing to freely participate in surveys without any compensation, either monetary or in kind, which was the present case. The predominance of female participants has been reported in many studies [14–17].

The participants were aged between 18 and 85 years, being on average 38 ± 13 years, with an average age higher for men than for women (39 ± 16 and 38 ± 12, respectively). The distribution according to the age classes defined is 33.7% of young adults (aged between 18 and 30 years), 46.1% of adults (from 31 to 50 years), and 20.2% of senior adults (aged 51 or over) (Figure 1).

The great majority of respondents had a university degree (47.7), but there were also expressive percentages of participants with a master's degree (19.7%) or doctorate (PhD) (15.7%). Participants with basic school or middle school were residual (0.7 and 3.5%, respectively). Concerning professional activity, 20.8% were students, 8.6% had a part-time job, 7.6% were unemployed, and 3.2% were retired. Most were employed in a full-time job (59.8%).

Once the present research was about eating habits, and it is known that some anthropometric factors can influence people's eating patterns [18–20], also, these data were collected, through self-reporting questions, namely, weight and height. Although this practice allows obtaining of useful data, otherwise not possible to collect through an online questionnaire, the results must be interpreted with care because they can represent the participant's perception. Self-reported anthropometric measures might be inaccurate, unintentionally or purposely, by feeling uncomfortable with the real values, this being a limitation of this kind of assessment of the anthropometric measures [21,22].

Table 1 presents the anthropometric measures of the participants in the study. With respect to weight, the values varied between a minimum of 37 and 145 kg, with a mean value of 69.30 ± 15.70 kg for the whole sample (65.86 ± 14.33 kg for women and 80.77 ± 14.34 kg for men). Regarding height, a minimum value of 1.26 m and a maximum of 1.95 m were recorded, and the average value for the global set of participants was 1.66 ± 0.08 m (1.63 ± 0.07 m and 1.76 ± 0.07 m, for women and men, respectively).

BMI was calculated based on the values of weight and height and varied from 16.33 to 58.08 kg/m^2, with a mean value equal to 25.01 ± 4.97 kg/m^2 (lower for women than men: 24.67 ± 5.09 vs 26.13 ± 5.09, respectively). What concerns the BMI classes is that the percentage of participants classified as underweight was very low in general (3.7%) and practically non-existent for men (0.6%). The great majority were classified as having a normal weight (55.0% for the global sample and higher for women than men – 57.3 and 47.5%, respectively). The percentage

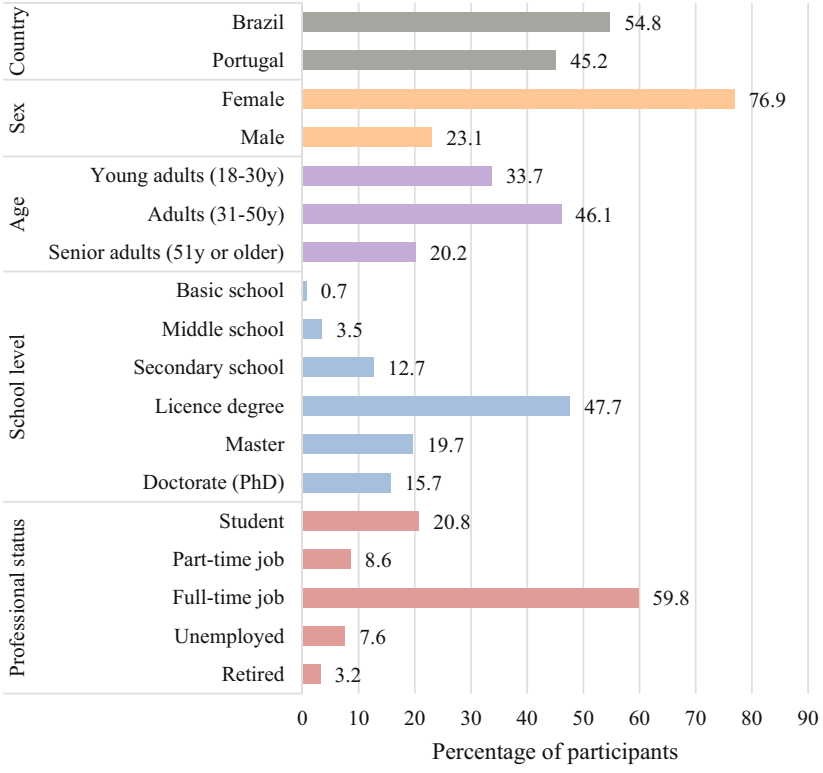

Figure 1: Sociodemographic characterisation of the sample (N = 694).

Table 1: Anthropometric characteristics of the participants

			Mean value ± standard deviation		
	Minimum	**Maximum**	**Global**	**Women**	**Men**
Weight (kg)	37.00	145.00	69.30 ± 15.70	65.86 ± 14.33	80.77 ± 14.34
Height (m)	1.26	1.95	1.66 ± 0.08	1.63 ± 0.07	1.76 ± 0.07
BMI[1] (kg/m^2)	16.33	58.08	25.01 ± 4.97	24.67 ± 5.09	26.13 ± 5.09
			Distribution by BMI classes (%)		
Underweight (BMI < 18.5)			3.7	4.7	0.6
Normal weight (18.5 ≤ BMI < 25)			55.0	57.3	47.5
Overweight (25 ≤ BMI < 30)			25.5	23.6	31.9
Obesity (BMI ≥ 30)			15.7	14.4	20.0

[1]BMI – Body mass Index = weight/height[2].

of overweight participants varied from 23.6% (for women) to 31.9% (for men), and for the obese, the shares were also high (14.4 for women and 20.0 for men). It should be noted that the data from anthropometric measurements and the BMI values may have some inaccuracies since the data were self-reported, which is one of the limitations of anthropometric data not directly measured [22].

According to Gaio et al. [23], based on the results from the First Portuguese Health Examination Survey (INSEF 2015), a very high prevalence of overweight (39.1%) and obesity (28.6%) were identified. It was further observed that, although the incidence of overweight was higher for men, the prevalence of obesity was higher for women. The authors concluded that some sociodemographic factors influenced overweight and obesity, such as age, marital status, education, and smoking, although this last only for women. The situation in Brazil is very much similar to that in Portugal and is estimated to bear enormous costs resulting from noncommunicable diseases directly resulting from overweight and obesity (cancer, cardiovascular diseases, chronic respiratory diseases, neoplasms, digestive diseases, musculoskeletal disorders, diabetes, kidney diseases, sense organ diseases, and neurological disorders [24,25].

3.2 Breakfast habits

The results presented in Figure 2 show that the frequency with which the participants take breakfast is very similar in both countries. A vast majority of respondents say they always have breakfast (78.4 and 74.4% in Portugal and Brazil, respectively), with smaller percentages for those who do it only sometimes (around 9%) and a residual number say they never take breakfast (3.2 and 3.7% in Portugal and Brazil, respectively). In the United Kingdom, most people regularly consume breakfast, and about half of them sometimes consume breakfast away from home, which might be attributed to time constraints and the accelerating pace of everyday life [26,27].

With respect to the place where the participants take their breakfast, in both countries, the great majority do it at home (94.4% of Portuguese and 94.3% of Brazilians). A small percentage take breakfast at work (2.6% of the Portuguese and 4.7% of Brazilians). For 2.0% of Portuguese, the coffee shop is also a place where they have breakfast, and 0.3% do it at school or university. For Brazilians, these possibilities have a very low expression (0.5% for each, coffee shop and school/university). The habit of taking breakfast at home is positive because meals eaten outside the home tend to be larger portions, have a higher caloric content, and are usually unhealthier food options when compared to home-cooked meals [28].

For those participants who did not take breakfast every day (68 in Portugal and 97 in Brazil), the reasons not to have it were questioned, and the results are shown in Figure 3. These results highlight that the main reasons for skipping breakfast are lack of time (for 36.8% of the Portuguese and 30.9% of the Brazilian participants), or simply not wanting to eat in the morning (39.7 and

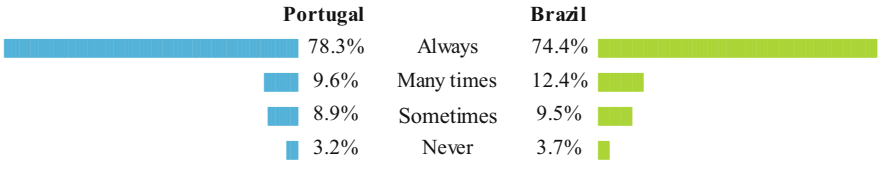

Figure 2: The frequency with which the participants take breakfast.

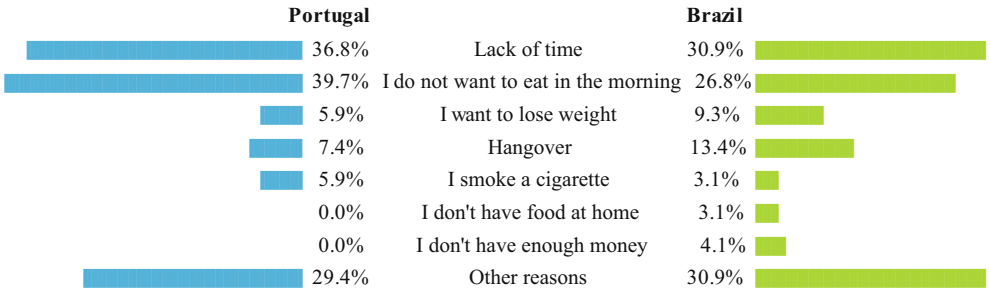

Figure 3: Reasons pointed out to skip breakfast.

226.8%, respectively). Other less relevant reasons include a feeling of a hangover or wanting to lose weight, these reasons were expressed by more Brazilian than Portuguese participants. Factors such as not having enough money or not having food at home are not invoked by the Portuguese but are real for some Brazilians. This research was conducted between November 2020 and July 2021, so it was under the COVID-19 pandemic, and it is known that this global situation has affected many habits, namely, those related to food consumption. Also, the economic availability of families might have been affected due to loss of employment and/or reduction in the net household income. These reasons can directly impact the financial availability to buy food, and this could have been more evident in Brazil, which faced a very extreme crisis due to the pandemic. Aguiar et al. [29] reported the psychological and social impact of COVID-19 among people residing in Portugal, and Santos and Moreira [30] addressed the economic impact of the pandemic, which affected especially some sectors, like, for example, tourism. In Brazil, the economic impact was also reported in the work by Menezes et al. [31], and consumer behaviour was also shaped according to determinants resulting from COVID-19 [32]. One of the reasons pointed out was related to the lack of time. To this matter, it is known that the modern way of life tends to be quite frenetic, and people seem to be always rushing to and from work, most especially [33]. This may explain why some people do not take the necessary time to have a proper breakfast, as recommended. Some participants believe that by not having breakfast, they will lose weight (5.9% of Portuguese and 3.1% of Brazilians). However, this might be a myth because, according to several studies, skipping breakfast may be associated with weight gain or higher BMI values [5].

These same participants, who do not always take breakfast, were asked if, when they skipped this meal, they felt any differences. 60.3% of the Portuguese (41 out of 68) and 59.8% of Brazilians (58 out of 97) informed that they feel the differences when not taking breakfast. The results (Figure 4) showed a very similar trend for participants from both countries, with most noticing the differences sometimes (45.9 and 39.0% for Portuguese and Brazilian participants, respectively). Figure 5 shows the discrepancies identified by the participants who do not take breakfast in both countries. Once again, the trend was very similar, whereby the sense of feeling hungry at lunch was the most significant difference felt by the Portuguese (70.7) and Brazilians (75.9%), but other reasons include the mood, cognitive performance, and the level of energy. According to several studies, missing breakfast is associated with reduced performance in cognitive and psychosocial functions, in addition to feeling tired due to reduced energy levels at the end of the day [34].

The reasons for always taking breakfast were also investigated (Figure 6). Of those participants who always have breakfast (246 participants in Portugal and 283 in Brazil), a great majority do it to have energy (55.7 and 62.5%, respectively, for Portuguese and Brazilian participants), but other reasons were also very relevant, namely, prevent feeling hungry until lunch, feeling hungry in the morning, or just because it is a habit and people enjoy having breakfast.

3.3 Foods and beverages consumed at breakfast

The foods and beverages taken during breakfast are very divergent among people. A continental breakfast is a

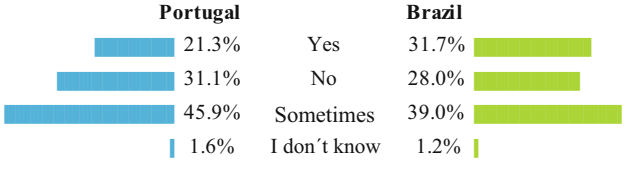

Figure 4: Answers to the question "If you do not take breakfast, do you feel any difference?".

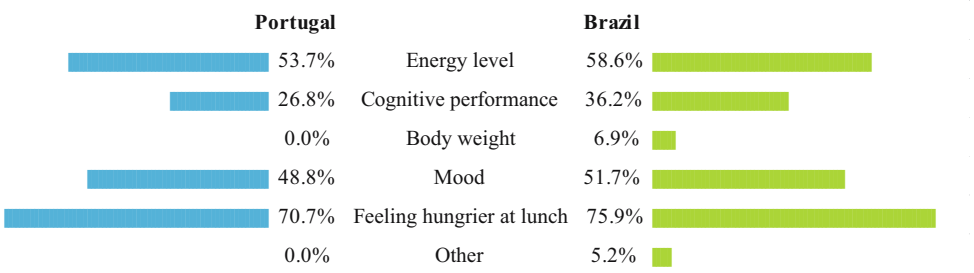

Figure 5: Differences observed when skipping breakfast.

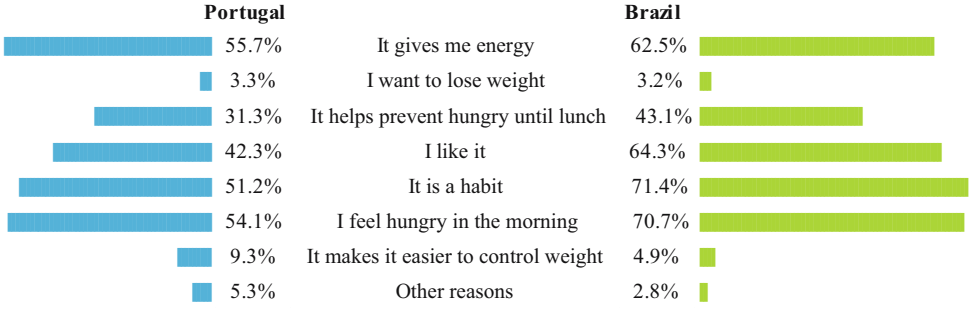

Figure 6: Reasons pointed out to always have breakfast.

light morning meal typically consisting of pastries and baked goods, fruits, toast, and coffee. It usually follows the European breakfast, which can be appreciated in France or the Mediterranean areas. A continental breakfast can include the following: baked products or pastries, bread, fruits, jams and spreads, coffee, tea, hot chocolate, or juice. Other optional foods can be included, like breakfast cereals, eggs, meats, sliced cheese, porridge, or oatmeal. Figure 7 shows an example of breakfast with whole cereal cookies, fruits, nuts, dairy nuts, and natural orange juice. In contrast, British breakfast is a denser meal, comprising bacon, eggs, and sausages, accompanied by grilled tomato, mushrooms, fried onions, toast, and marmalade. As for drinks, it typically includes tea or coffee. It can also comprise orange juice, cereals, and fruits. Delley and Brunner [8] studied breakfast eating patterns and the motivations for a healthy breakfast among Swiss people. They observed a trend for consuming a continental breakfast and a prevalence of dairy products, concluding that this could be considered a moderately healthy meal. Tea has been reported as one very healthy beverage, containing bioactive compounds and other rather essential components

Figure 7: Example of foods/beverages present in a continental breakfast.

for the human body [35–40]. With respect to coffee, if it is consumed in very high doses may be related to some diseases, like hypertension [41], but in mild dosages has been reported as having multiple health benefits [42–44].

Table 2 presents the foods and beverages that are consumed at breakfast by the participants in this study. As in previous cases, a generally similar trend can be observed for the participants from both countries. Concerning beverages, it is worth noticing the high consumption of coffee, dairy beverages, tea, water, or natural juices and the low consumption of soy-based drinks. Coffee is a very popular drink in these countries, being produced in Brazil and brought to Portugal since the naval expansion in the 15th century. Lately, many research works

Table 2: Typical foods and beverages consumed at breakfast

	Portugal (*n*)	Brazil (*n*)		Portugal (*n*)	Brazil (*n*)
Beverages					
Water	90	136	Milk and fruit shake	24	32
Skimmed milk	61	36	Natural fruit juice	43	57
Semi skimmed milk	70	62	Industrial fruit juice	10	17
Soya drink	25	8	Liquid yogurt	49	46
Aromatised milk	2	1	Coffee	144	202
Milk with coffee	91	150	Tea	59	73
Milk with chocolate	23	44	Others	24	22
Other dairy products					
Natural yogurt	81	75	Cheese	141	230
Aromatised yogurt	36	34	Whey cheese	34	146
Yogurt with fruit pieces	26	27	Others	16	33
Bread and Cereals					
White bread	95	190	Corn flakes cereals	15	3
Whole bread	90	109	Sugary cereals	21	1
White sliced bread	15	80	Chocolate cereals	27	4
Whole sliced bread	31	112	Muesli	60	24
Sliced bread with multi cereals	59	59	Granola	26	72
Toast with ham and cheese	17	21	All-Bran fibres	11	6
Toast with butter	111	74	Others	41	71
Porridge	30	17			
Charcuterie and eggs					
Pig ham	72	43	Sausage	4	5
Turkey ham	51	36	Eggs	57	178
Smoked loin	6	3	Others	40	46
Salami	9	20			
Fats					
Butter with salt	124	183	Olive oil	26	54
Butter without salt	38	33	Others	17	27
Vegetal cream/Margarine	71	50			
Fruits and nuts					
Apple	105	94	Kiwi	58	20
Pear	41	31	Mango	37	56
Orange	90	51	Papaya	35	223
Banana	103	229	Red fruits	50	33
Avocado	19	66	Nuts	69	27
Tangerine/grapefruit	28	16	Other fruits	11	47
Sweets and bakery					
Whole cereal cookies	38	30	Pancakes	29	44
Chocolate cookies	17	25	Crepes	12	8
Maria type cookies	30	24	Waffles	7	7
Water and salt cookies	19	46	Cakes/pastry	17	88
Puff pastry croissant	14	9	Jams	53	21
Brioche croissant/Brioche bread	33	6	Others	7	32
Ham and cheese brioche	3	17			

have been developed about the health effects of coffee, reporting beneficial neuroprotective [45] and immunity-enhancing [43] properties, and confirming that coffee intake did not increase the risk of heart failure [46]. With respect to dairy products, their consumption is recommended for the uptake of proteins, minerals, like calcium, and fat-soluble vitamins, such as vitamin D. Besides, they have probiotics that enhance the microbiome and the immune system and are inversely related to hypertension or atherosclerosis [47,48]. However, some studies also refer that long term usage of dairy products can increase the incidence of some diseases like cancer [49].

Other dairy products as cheese or yoghurt are also consumed at breakfast, but these with a lower expression. A previous work by Guiné et al. [22] investigated the consumption of dairy products in Portugal and Brazil, and reported low consumption patterns, specifically for milk, cheese, or yoghurt.

Regarding the consumption of bread and cereals, it was found that the participants generally consume foods from this group at breakfast, with a high incidence of bread in its different forms but a low incidence of cereals. It is very important to consume foods from this group at breakfast because, apart from providing energy and fibre, they have been reported to be significantly related to a lower BMI [6]. However, the consumption of whole cereals should be higher because of the higher contents of dietary fibre, which has many proven benefits for human health [50–52].

The group of charcuterie and eggs includes foods particularly rich in protein. In this group, there was a greater adherence to eggs; however, significant consumption of hams was also noted. Protein consumption at breakfast is important, especially for patients with diabetes mellitus 2, as there are reports that a breakfast rich in proteins and fats can have metabolic benefits for these patients [6].

As far as fats are concerned, although there is still a certain tendency to consume salted butter, some adherence to healthier fats such as unsalted butter or even olive oil has already been noted. A review by He et al. [53] emphasises that reducing salt intake diminished the risk of diseases, particularly cardiovascular disease, all-cause mortality, kidney disease, stomach cancer, and osteoporosis. On the other hand, the consumption of virgin olive oil has been associated with many health benefits [54]. A review by Foscolou et al. [55] evidences the role of olive oil in human health, including the prevention of cardiovascular disease, cancers, and diabetes mellitus. Also Gavahian et al. [56] reviewed the effects of olive oil on the antioxidant activity of the gut microbiota and its role in preventing non-communicable diseases.

It was also possible to verify that a high percentage of participants in both countries consumed fruits for breakfast, which is relevant, as diets rich in fruit can help with weight control and are related to a reduction in the risk of chronic diseases, such as diabetes, cardiovascular diseases, and some types of cancer [57]. Sun et al. [58] reviewed the multiple health effects resulting from fruits consumption, and came out with valuable recommendations: (a) Increasing the fruit intake by one serving per day could reduce the risks of cardiovascular diseases by 3%, stroke by 8%, coronary heart disease by 4%, and oral cancer by 49%; (b) Increasing the fruit intake by 200 g per day could reduce the risk of breast cancer by 6%; (c) Increasing the fruit intake to 100–500 g per day could reduce the risk of type 2 diabetes mellitus by 8–12%. The fruits more consumed by the Portuguese and Brazilian participants were bananas and apples. Besides their nutritional richness in macro and micronutrients, these fruits are among the most consumed worldwide and are reported to have many beneficial effects on human health. A review by Singh et al. [59] evidences the richness of bananas in bioactive compounds and their effects on the human body. Among these beneficial components, the presence of phenolic compounds, carotenoids, biogenic amines, and phytosterols stand out. Besides their role in fighting against oxidative stress, these components make bananas an ally in treating diseases of the gastrointestinal tract and reducing the risk of many chronic degenerative diseases. Also, apples have been investigated for their numerous roles as health enhancers, namely, to prevent cancer [60], improve cardiovascular functions, and prevent cardiovascular diseases [61], and reduce oxidative stress and markers of inflammation, lipid profile, and diabetes [62]. A review by Hyson [63] on apples and their components evidenced their relationship to human health.

Regarding the group of sweets and pastries, it was observed to be the group with the least expression in the breakfast of the Portuguese and Brazilian participants in this study. This is a good indicator, as researchers claim that excessive consumption of sugar is associated with an increased risk of caries, obesity, cardiovascular diseases, type 2 diabetes mellitus, and metabolic syndromes, among other problems [64]. In Portugal, the group with the highest expression was jams (n = 53), which are made in a high extent from fruits, and eventually some of them are with a reduced content of sugar, which is a trend for nowadays consumers, and whole cereal cookies (n = 38), which by being made with whole flour are healthier, especially in fibre content which is beneficial for health [58,65]. The third type of food for the Portuguese was the brioche croissant or brioche bread, which although being sweets,

Figure 8: Brioche croissant (left) and brioche bread (right).

are very low in sugar and richer in egg (Figure 8). These two products are very much appreciated in Portugal. In contrast, in Brazil, cakes/pastries are far more consumed ($n = 88$), followed by cookies made with water and salt ($n = 46$), and then pancakes ($n = 44$). Here we see more vivid differences between the two countries.

3.4 Level of knowledge

Another objective of this article was to assess the knowledge about breakfast, which was obtained through responses to eight statements, using a scale ranging from "completely disagree" to "completely agree," being the results presented in Table 3. For the first statement (1. Breakfast is considered by many as the most important meal of the day), it was observed that the majority of participants in both countries answered "strongly agree" or "agree," although there was an expressive percentage of those who answered "indifferent" and also some were against it, especially many among the Brazilians (24.7% "indifferent," 12.9% "disagree" and 6.6% "strongly disagree"). It is, in fact, defended by many that breakfast is a very important meal, even more than any other meal. For this reason, the nutritional composition of breakfast has been investigated in the past years [66,67]. Despite the energy contribution of breakfast being possibly lower when compared with other main meals, many researchers have reported that eating breakfast may be a predictor of healthy eating behaviour [8,68,69].

Table 3: Responses to the questions aimed at evaluating knowledge about breakfast

	Country[#]	Strongly disagree (%)	Disagree (%)	Indifferent (%)	Agree (%)	Strongly agree (%)
1. Breakfast is considered by many as the most important meal of the day	PT	2.0	3.2	18.8	29.7	46.3
	BR	6.6	12.9	24.7	25.3	30.5
2. I have several benefits if I eat breakfast every day	PT	2.6	2.2	10.9	24.9	59.4
	BR	3.2	4.5	13.9	23.7	54.7
3. Having breakfast improves intellectual performance, memory and concentration during the day	PT	0.6	3.5	13.1	25.2	57.6
	BR	3.2	5.0	18.3	18.3	55.2
4. By eating breakfast, I am reducing the risk of obesity by 30–50%	PT	2.9	7.7	29.4	28.7	31.3
	BR	6.4	7.4	43.1	20.9	22.2
5. Eating breakfast provides my body with about 20–25% of its daily energy needs	PT	1.3	3.9	25.4	34.0	35.4
	BR	3.5	4.0	28.0	29.1	35.4
6. It is important to have breakfast at home	PT	1.6	3.9	12.2	25.4	56.9
	BR	7.1	7.9	18.2	25.3	41.5
7. Breakfast characteristics should be the same for all age groups*	PT	33.2	33.5	18.8	8.0	6.5
	BR	31.4	24.8	21.9	9.2	12.7
8. As a rule, when breakfast is skipped, the feeling of hunger at lunch will be much less intense*	PT	46.5	20.2	12.2	8.3	12.8
	BR	44.9	14.5	10.6	9.2	20.8

*False statement. [#]PT – Portugal, BR – Brazil.

Table 4: Indices for items used to evaluate knowledge

	Indices[#]		
	Global	**Portugal**	**Brazil**
1. Breakfast is considered by many as the most important meal of the day	3.85	4.15	3.60
2. I have several benefits if I eat breakfast every day	4.29	4.36	4.22
3. Having breakfast improves intellectual performance, memory, and concentration during the day	4.26	4.36	4.17
4. By eating breakfast, I am reducing the risk of obesity by 30–50%	3.60	3.78	3.45
5. Eating breakfast provides my body with about 20–25% of its daily energy needs	3.93	3.98	3.89
6. It is important to have breakfast at home	4.07	4.32	3.86
7. Breakfast characteristics should be the same for all age groups (after reversing the scores)	3.65	3.79	3.53
8. As a rule, when breakfast is skipped, the feeling of hunger at lunch will be much less intense (after reversing the scores)	3.65	3.79	3.53

[#]Scale from 1 (the lowest knowledge) to 5 (the highest knowledge).

For statement two (2. I have several benefits if I eat breakfast every day), the results obtained from the participants of both countries were very similar, and mostly with answers as "strongly agree" (59.4% for Portugal and 54.7% Brazil) or "agree" (24.9 and 23.7%, for Portugal and Brazil, respectively). This demonstrates that participants are aware of the beneficial effects of having breakfast regularly. Studies have associated breakfast consumption and, depending on its composition, with cardiometabolic health [70], blood sugar levels [71], or weight control [72].

Statement three (3. Having breakfast improves intellectual performance, memory, and concentration during the day) also showed a very high rate of agreement and similarly by participants from both countries (57.6 and 55.2% of "strongly agree" for Portugal and Brazil, respectively). Research by Manippa et al. [73] showed that breakfast improved physiological status and mood, as well as short-term verbal memory. Also, Wesnes et al. [74] and Frisvold [75] reported that breakfast improved cognitive functions and achievements in schoolchildren.

For statement four (4. By eating breakfast, I am reducing the risk of obesity by 30–50%), although a high number of participants agreed or strongly agreed, the highest percentage of "indifferent" responses (43.1% for Brazil and 29.4% for Portugal) was observed, indicating that there are doubts as to the accuracy of this information. A meta-analysis by Ma et al. [76] confirmed that skipping breakfast is associated with an increased risk of being overweight and obese. Another meta-analysis by Horikawa et al. [77] evidences a positive association between skipping breakfast and being overweight and obese, independent of cultural diversity among countries.

Statement five (5. Eating breakfast provides my body with about 20–25% of its daily energy needs), got very similar responses for participants from both countries, with a general trend to "agree" or "strongly agree." Still, this is another aspect where the percentage of those who have doubts is high (25.4 and 28.0% for Portugal and Brazil, respectively). Breakfast provides macro and micronutrients that are pivotal for the proper functioning of the human body. Skipping breakfast limits the amount of energy consumed during the day [78,79]. Additionally, those who skip breakfast tend to have reduced intakes of many nutrients, including vitamins (A, E, C, B_6, and B12, folate), dietary minerals (iron, calcium, phosphorus, magnesium, potassium), or dietary fibre, and these are rarely compensated with other meals [80,81].

Statement six (6. It is important to have breakfast at home) also seems to gather the agreement of most participants, which recognise that home-prepared breakfast tends to be healthier than other options, like having it in a café or just buying breakfast items on-the-go. Yip and Ensaff [26]

Table 5: Frequency of participants in the classes of knowledge

Class	**Global (%)**	**Portugal (%)**	**Brazil (%)**
Very low knowledge ($1 \leq$ value ≤ 2)	0.6	0	1.1
Low knowledge ($2 <$ value ≤ 3)	8.7	4.8	11.8
High knowledge ($3 <$ value ≤ 4)	45.8	42.5	50.3
Very high knowledge ($4 <$ value ≤ 5)	43.1	52.6	36.9

reported that people are shifting their breakfast habits towards the sector of breakfast on-the-go products, but these ready-to-eat products tend to have a low nutritional profile with very high levels of total sugars.

Items seven and eight were presented to the participants as wrong statements (7. Breakfast characteristics should be the same for all age groups; 8. As a rule, when breakfast is skipped, the feeling of hunger at lunch will be much less

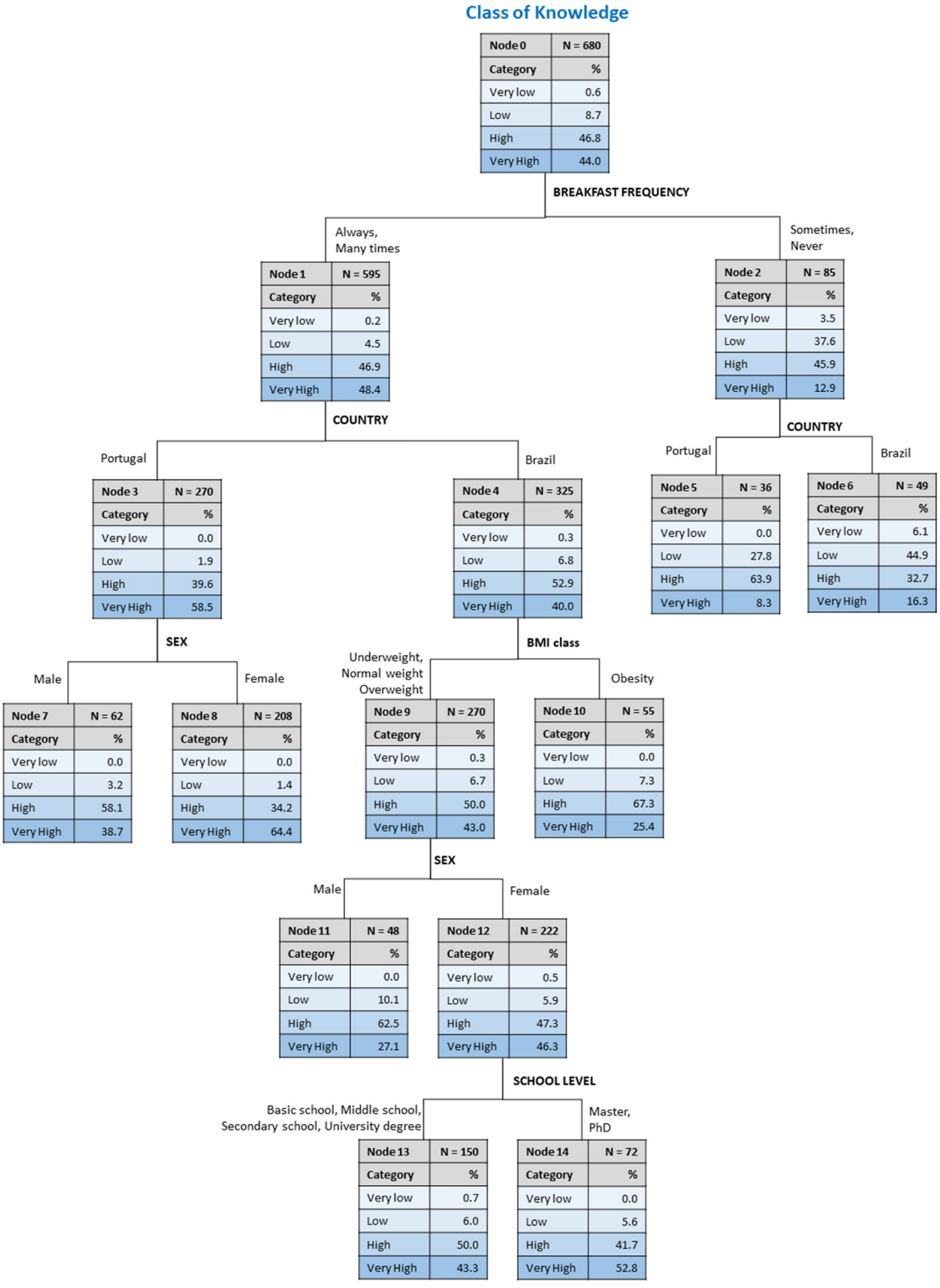

Figure 9: Classification tree for the level of knowledge.

Table 6: Model prediction capacity

Observed	Predicted				
	Very low knowledge	Low knowledge	High knowledge	Very high knowledge	Percent correct
Very low knowledge	0	0	2	2	0.0
Low knowledge	0	0	43	16	0.0
High knowledge	0	0	217	101	68.2
Very high knowledge	0	0	131	168	56.2
Overall percentage	0.0	0.0	57.8	42.2	56.6

intense). Therefore, it would be expected that those with knowledge on these subjects would show disagreement. The results indicated that in both countries, the participants, in fact, tend to "disagree" or "strongly disagree" with these two statements. Breakfast must attend to the needs of specific groups, and age is a relevant discriminator to this matter because the needs of children, for example, are quite different than those of adult individuals. Núñez et al. [82] reported differences in breakfast composition and habits among age groups (children, adolescents, and adults).

The results in Table 4 show the values of the indices calculated for each item as the mean values of the scores for the global sample and for each of the countries after reversing the scores of the two false statements. These indices vary between a minimum of 1 (the lowest knowledge) and a maximum of 5 (the highest knowledge). When comparing the values of both countries, it is observed that the values for all eight items are always slightly higher for Portuguese than for Brazilian participants, revealing that the Portuguese are more informed about the issues related to breakfast than the Brazilians. When looking at the indices for the global sample, it is possible to identify which items have the highest scores, corresponding to facts that are more easily recognisable by the participants, and those items about which the participants are not so well informed (those with the lowest indices). The indices were highest for items 2 and 3, revealing that people are aware of the health benefits of regularly having breakfast and its effect on cognitive performance during the rest of the day. The indices were lowest for items 4, 7, and 8. Considering that two of these were presented to the participants as false statements, that might have confused some of them, making it more difficult to give a correct answer, which would have been a disagreement.

Results in Table 5 correspond to the frequencies of the participants according to the class of knowledge. They reveal that a high fraction of the participants has a high (45.8%) or very high (43.1%) knowledge about facts related to breakfast. However, there are some differences between the countries, with more Portuguese in the very high knowledge class (52.6%) and more Brazilians in the high knowledge class (50.3%).

The level of knowledge was submitted to a tree classification using the sociodemographic (country, sex, age class, professional status, and school level), anthropometric variables (BMI class), and frequency of having breakfast. The tree obtained (Figure 9) is five levels deep, with 15 nodes, from which 8 are terminal. Of the seven independent variables included in the analysis, two of them were not explicative, i.e. they were not found to influence the level of knowledge (age, class, and professional status), while all others were discriminating (country, sex, school level, BMI class, and breakfast frequency). The risk estimate was 0.419 with a standard error of 0.019 for re-substitution and 0.468 with a standard error of 0.019 for cross-validation. The model prediction capacity is shown in Table 6, demonstrating overall 58.1% chance of correctly predicting the cases according to the class of knowledge.

The tree presented in Figure 9 shows that the first predictor variable was the frequency of having breakfast, differentiating the participants that always or most of the time have breakfast from those who never have breakfast or do it only sometimes. The participants that frequently have breakfast have a higher level of knowledge (48.4% with very high knowledge). In level two, regardless of the frequency of having breakfast, the second discriminating variable was country. For those who usually consume breakfast, the incidence of the very high knowledge category is higher in Portugal than in Brazil (58.5 and 40.0%, respectively). For the participants who tend to skip breakfast, there is a higher prevalence of low knowledge in Brazil (44.9%) or high knowledge (32.7%), but a higher incidence of very high knowledge (16.3%). The discriminating variables in level three were sex (higher incidence of very high knowledge for female participants, 64.4%) and BMI class (lower incidence of very high knowledge for obese participants, 25.4%). In level four, sex is again the predicting variable, with female participants having

higher knowledge (46.3% of very high knowledge). In the last level, the school level was the discriminating variable, separating the participants with a master's degree or PhD as having better knowledge (52.8% of very high knowledge).

4 Conclusion

This study revealed very similar breakfast habits between the Portuguese and Brazilian participants, with a clear tendency to have breakfast every day and to have it at home. For those who skip this meal, the reasons pointed out were essentially lack of time or not wanting to eat in the morning. For those who always have breakfast, they do it for energy, for satiety, for being a habit, or just because they like it.

The foods that are typically included in the breakfast of the participants in both countries were also similar, including milk and coffee as the main beverages, cheese and butter, bread (mostly from refined flour), eggs, fruits (especially banana and apple), and a relatively low prevalence of sweets and pastry.

The participant's level of knowledge was slightly higher for Portuguese than for Brazilian participants, and it varied depending on whether they tended to have breakfast or skip it, and also on their country, sex, BMI class, and school level.

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Appendix

In this section, the questions used in the survey are listed in the format as they were presented to the participants.

A1 Sociodemographic and anthropometric characterisation of the sample

Country: ☐ Brazil ☐ Portugal
Age: _____ years
Sex: ☐ Female ☐ Male ☐ Other
Weight: _____ kg **Height**: _____ m

Professional status:
☐ Student ☐ Part-time job ☐ Full-time job ☐ Unemployed ☐ Retired

School level:
☐ Basic school – 1st cycle ☐ Middle school – 3rd cycle ☐ Secondary school – 12th year
☐ University degree ☐ Master degree ☐ PhD
Number of people in the household: _____

A2 Breakfast consumption habits

How many times per week do you take breakfast?
☐ Always ☐ Many times (4–5 times/week) ☐ Sometimes (2–3 times/week) ☐ Never

If you did not answer "Always" in the previous question, indicate the reason(s) for not having breakfast (You can choose more than one option).
☐ Lack of time
☐ I do not want to eat in the morning
☐ I want to lose weight
☐ Hangover
☐ I smoke a cigarette
☐ I don't have food at home
☐ I don't have enough money for breakfast
☐ Other reasons

If you do not take breakfast, do you feel any difference?
☐ Yes ☐ No ☐ Sometimes ☐ I don´t know

If you answered "Yes" or "sometimes" to the previous question, indicate which difference(s) you feel (You can choose more than one option).
☐ Difference in energy level
☐ Difference in cognitive performance
☐ Difference in weight
☐ Difference in my mood
☐ I feel hungrier at lunch

If you always eat breakfast, indicate the reason or reasons (You can choose more than one option).
☐ Because it gives me energy
☐ Because I want to lose weight

☐ It helps me to prevent feeling hungry until lunch
☐ Because I like it
☐ For being a habit
☐ Because I feel hungry in the morning
☐ Having breakfast makes it easier to control my weight
☐ Other reasons

Where do you usually eat breakfast?
☐ House ☐ Work ☐ School/University ☐ Coffee shop
☐ Gymnasium ☐ Other

A3 Breakfast composition

Indicate which food(s) you usually consume for breakfast (You can select more than one option in each food group.)

Group 1 - Drinks

☐ Water	☐ Aromatised milk	☐ Natural fruit juice	☐ Tea
☐ Skimmed milk	☐ Milk with coffee	☐ Industrial fruit juice	☐ Others
☐ Semi skimmed milk	☐ Milk with chocolate	☐ Liquid yogurt	
☐ Soya drink	☐ Milk and fruit shake	☐ Coffee	

Group 2 – Other dairy products

☐ Natural yogurt	☐ Yogurt with fruit pieces	☐ Whey cheese
☐ Aromatised yogurt	☐ Cheese	☐ Others

Group 3 – Bread and cereals

☐ White bread	☐ Sliced bread with multi cereals	☐ Corn Flakes cereals	☐ Granola
☐ Whole bread	☐ Toast with ham and cheese	☐ Sugary cereals	☐ All-Bran fibres
☐ White sliced bread	☐ Toast with butter	☐ Cereals with chocolate	☐ Others
☐ Whole sliced bread	☐ Porridge	☐ Muesli	

Group 4 – Charcuterie and eggs

☐ Pig ham	☐ Smoked loin	☐ Sausage	☐ Others
☐ Turkey ham	☐ Salami	☐ Eggs	

Group 5 – Fats

☐ Butter with salt	☐ Vegetal cream/Margarine (ex: Becel)	☐ Others
☐ Butter without salt	☐ Olive oil	

Group 6 – Fruits and nuts

☐ Apple	☐ Orange	☐ Mango	☐ Red fruits
☐ Pear	☐ Tangerine/grapefruit	☐ Papaya	☐ Nuts
☐ Banana	☐ Kiwi	☐ Avocado	☐ Other fruits

Group 7 – Sweets and pastry

☐ Whole cereal cookies	☐ Puff pastry croissant	☐ Crepes	☐ Others
☐ Chocolate cookies	☐ Brioche croissant/Brioche bread	☐ Waffles	
☐ Maria type cookies	☐ Ham and cheese brioche	☐ Cakes/pastry	
☐ Water and salt cookies	☐ Pancakes	☐ Jams	

A4 Knowledge about breakfast

On a scale of 1 to 5, say whether you agree or not with the following statements

	Strongly disagree (1)	Disagree (2)	Indifferent (3)	Agree (4)	Strongly agree (5)
Breakfast is considered by many as the most important meal of the day					
I have several benefits if I eat breakfast every day					
Having breakfast improves intellectual performance, memory, and concentration during the day					
By eating breakfast, I am reducing the risk of obesity by 30–50%					
Eating breakfast provides my body with about 20–25% of its daily energy needs					
It is important to have breakfast at home					
Breakfast characteristics should be the same for all age groups*					
As a rule, when breakfast is skipped, the feeling of hunger at lunch will be much less intense*					

*Items in reverse scale.