

ORIGINAL ARTICLE

EVALUATION OF THE DEGREE OF PROCESSING AND INGREDIENTS OF
FOODS OFFERED IN COMPLEMENTARY MEALS IN A HOSPITAL

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Highlights:

1. Of the foods offered, 27% of the items are ultra-processed - being 90% of the total in kg.
2. Ultra-processed foods: present in all complementary meals served.
3. Concentrations of sugar, fats and sodium are distributed in different types of foods.

PRE-PROOF

(as accepted)

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ABSTRACT

Introduction: Hospital food must ensure, in addition to hygienic-sanitary safety, the nutritional quality of the meals offered. **Objective:** to analyze the degree of processing and the amount of fat, sugar and sodium in foods offered in complementary meals at a university public hospital (UPH). **Methods:** retrospective study, with analysis of secondary data provided by the UPH. The foods used in the complementary meals breakfast, afternoon snack and night snack for four consecutive weeks at the end of 2022 were evaluated. The degree of processing was analyzed, as well as the amounts of total sugars, total fat, saturated fat and sodium of the most served foods, in kilograms (kg), according to the ABC curve criterion. The data was evaluated using descriptive statistics. **Results:** The foods were categorized into four groups: beverages, bread and derivatives, fillings and fruits. Of the 161 items used, 18 represented more than 90% of the total offer in kg. Of the foods offered, 27% were classified as ultra-processed. The supply of sugar was mainly due to yogurt, boxed juices and the group of breads and derivatives. More than 90% of the saturated fat found originated from foods containing whole milk powder in its composition. Sodium was found in greater amounts in the bread and derivatives group. Ultra-processed foods were present in all types of complementary meals served. **Conclusion:** The nutritional quality of hospital food requires attention, especially the amounts of sugar and sodium in food. Therefore, it is suggested to review the foods used, aiming at better quality complementary meals.

Keywords: ultra-processed foods; sugars; fats; sodium; hospital nutrition service.

INTRODUCTION

With population growth, especially since the 1950s, the main objective of agricultural development was to expand the production of cheap and energy-dense food¹. Processing allows the transformation of agricultural products into food for human consumption². In the twentieth century, the objective of food processing, in addition to providing safety and shelf life, was to offer food options with greater palatability and convenience³.

In the last decade, based on what was proposed by Monteiro et al.⁴, the Food Guide for the Brazilian Population (*Guia Alimentar para a População Brasileira*) provides a new classification of foods according to the degree of processing, with foods being separated into categories, including *in natura*, minimally processed, culinary ingredients, processed and ultra-

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processed^{5,6}. Among the ingredients that characterize foods in terms of their degree of processing are the amount of sugar, total, saturated and trans fats, and sodium.

Foods classified as ultra-processed are those that have several stages and processing techniques in their manufacturing process, containing, in addition to the ingredients already present in their composition, other additives and that are usually produced on a large scale by big industries^{5,6}. Due to globalization and the use of these foods and their consequences to human health, many countries are advancing efforts to regulate nutritional labeling, implementing strategies such as front-of-package labeling^{7, 8, 9}.

In Brazil, the National Health Surveillance Agency (ANVISA) has sanctioned legislation on front-of-package labeling. RDC No. 429/2020 provides instruction about front-of-package nutritional labeling for packaged foods, informing that "it is mandatory on the labels of foods packaged in the absence of the consumer, whose amounts of added sugars, saturated fats or sodium are equal to or greater than the established limits"¹⁰. This resolution entered into force on October 9, 2022 for new products and, for those already on the market, the deadline for adaptation was set to October 9, 2023.

Recent literature finds an association between the consumption of ultra-processed foods and their content of total sugars, fats, and sodium with negative health outcomes, especially chronic non-communicable diseases^{11, 12, 13}. Fats are usually associated with cardiovascular diseases¹⁴, sugar especially with cardiovascular diseases and cancer¹⁵, and sodium with hypertension and kidney diseases¹⁶. In context for the general population, these same attributes of food and its nutritional composition can be verified in collective food services, including hospital services.

Hospital feeding is part of the process of recovering patients' health. Sorensen et al.¹⁷ describe hospital feeding as a pillar of care, given that it impacts patients and outcomes in the health system. Hospital meals can be divided into main meals - lunch and dinner - and complementary meals such as breakfast, snacks and night snacks. Complementary meals are a part of nutritional therapy, as they are used to prevent and treat malnutrition and to improve the immune system of patients¹⁸. The public university hospital in question has a food service, in a self-managed system, which stands out for offering meals produced on site. Even so, there are many industrialized products purchased ready for consumption and offered in the hospital, especially in complementary meals.

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Thus, this study aims to analyze the degree of processing and the amount of saturated fats, sugar and sodium in the foods offered in complementary meals in a public university hospital.

MATERIALS AND METHODS

Methodology used

The present study is a retrospective study, with analysis of secondary data¹⁹. Data was obtained from reports provided by the Centralized Support Kitchen, which is part of the Nutrition and Dietetics Service (SND) at the study site. Information from four full weeks between October and November 2022 was evaluated.

Characterization of the study site

The investigated hospital is considered large and has the characteristics of the care of adult and pediatric patients, especially in the modality of the Unified Health System (SUS). The hospital's SND is responsible for preparing and providing all meals for patients. The main meals that can be made available to patients are classified as: lunch and dinner. Among the complementary meals there are four types: breakfast, collation, afternoon snack and night snack, which are prepared by the Centralized Support Kitchen.

Data collection and inclusion criteria

The list of foods (and respective preparations) recorded and provided in the complementary meals was analyzed, which were grouped into four groups: beverages, breads and derivatives, fillings and fruits. The total amount of food used was calculated in kilograms (kg).

The classification criterion of the ABC curve was used to identify the percentage of utilization equal to or greater than 90% (A-B) for the most used items in kg in each of the groups, according to the requested requisitions. This type of evaluation is recommended by Strasburg and Jahno²⁰ and used in other studies in the collective feeding segment.

The data of the investigated foods were evaluated using the value of 100 grams of edible part as standard. Liquid products were converted in the ratio of 1 milliliter (ml) to one gram (g).

The nutritional information described on the packaging labels of the industrialized products used was also evaluated. The total energy value expressed in calories (kcal) and also

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the amount in grams for carbohydrates (sugars), total, saturated, and trans fats were considered. For sodium, the amount was evaluated in milligrams (mg). For *in natura* products, nutritional composition data were consulted in the Brazilian Table of Food Composition TACO²¹. When data collection was carried out at the UPH, the new legislation for nutritional labeling in Brazil, RDC No. 429/2020, had not yet come into force, so it was not yet mandatory to declare the amount of added sugar.

In the evaluation of the degree of processing, the information according to the Food Guide for the Brazilian Population was used⁵. The following grouping criteria were taken into account:

- i. *In natura* foods: those that have not undergone any processing, or simple processing, such as whole or peeled and chopped fruits.
- ii. Minimally processed foods: those that have undergone simple processing, for example, drying, pasteurization, grinding, and fermentation, such as pasteurized and powdered milk, and yogurt with no added sugar.
- iii. Processed foods: those that have undergone processing with the addition of culinary ingredients, for instance, salt, sugar, and fats, such as pickled vegetables, breads (only with flour, yeasts, water, and salt), cheeses, *requeijão* (a creamy cheese spread popular in Brazil), etc.
- iv. Ultra-processed foods: those that have gone through several stages and processing techniques, such as sweetened yogurts, cookies and crackers, boxed juices, breads with chemical additives, etc., and that contain many ingredients (including sugar, fats and salt) and ingredients for exclusively industrial use.

The following parameters were used as inclusion criteria: a) foods offered for oral diets; b) any type of diet, such as diabetes mellitus diet, bland diet, pasty diet, etc.; c) for the care of adult and pediatric patients. Thus, only formulas and supplements used for enteral or parenteral administration were not considered.

Use and analysis of data

The collected results were transcribed into the Microsoft Excel© 2010 software, and expressed as absolute, mean and percentage frequencies.

Ethical issues

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There was no type of direct intervention with patients or professionals from the university hospital, and thus, the use of a Free and Informed Consent Form is dispensed with. The information collected was made aware of the researched institution by means of a specific authorization term. This research was approved under No. 42886/2022 by the Ethics Committee of the Faculty of Medicine of the Federal University of Rio Grande do Sul.

FINDINGS

The menu patterns for complementary meals are as follows: breakfast and afternoon snack: a hot drink – which can be coffee, coffee with milk, chocolate milk and tea; a loaf of bread (or possibly biscuits) with filling; and sometimes fruit. The night snack usually has as a standard the offer of yogurt with salty biscuits, or coffee with milk with some bread, and eventually a fruit.

Different numbers of food categories were found in the four food groups. The percentage of the curve was higher than 90%, as shown in Table 1.

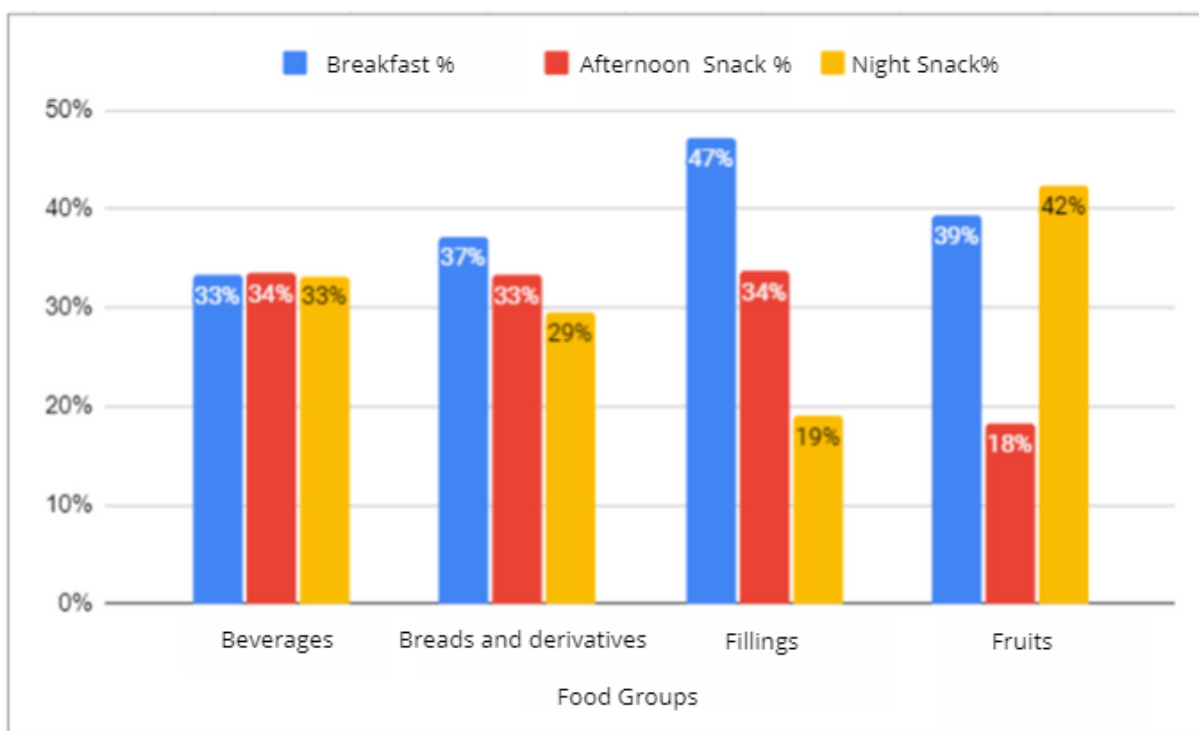
Table 1. Classification of the most used items in each food group according to the ABC curve.

Food Group	No. of Categories	Category	No. of items	No. of items AB rating	% ABC Curve
Beverages	7	Smoothies, teas, coffees, yoghurts, porridge, milk mixes, juices.	64	4	90,5
Breads and derivatives	4	Biscuits, cakes, <i>cuca</i> (German crumb cake), breads	19	6	90,5
Fillings	4	Cheeses, hams, jams, creams	8	4	95,0
Fruits	1	<i>In natura</i>	7	4	90,8
Total	38		161 (100%)	18 (11,18%)	

It is highlighted in this table that of the total number of items/combinations, the 18 classified were represented as A-B.

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Of the four groups, bread and derivatives (twelve types of bread, four types of cakes and three types of biscuits) combined with the eight different types of fillings totaled a range of 82 possible combinations found in the data collection. In addition, the beverage group had the largest number of options available to offer.



Graph 1. Distribution of food groups according to the types of complementary meals at the Public University Hospital. Porto Alegre, 2022.

It is noted that the group of beverages and breads and derivatives presented the highest distribution balances between the three meals. On the other hand, the distribution of fruits and fillings between complementary meals presents a heterogeneous profile. The presence of fruit is higher at 9 p.m. night snack and breakfast, compared to the afternoon snack. Regarding the fillings, breakfast had 2.5 times more portions than the 9 p.m. night snack.

Tables 2 and 3 show the list of items used and the respective percentages for each complementary meal offered.

Table 2. Classification and total distribution of food groups used in UPH complementary meals according to the degree of processing.

Group	Kg	Distrib. %	MP kg	P kg	UP kg	IN kg
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Beverages	7139,27	66,96	741,4	5248,4	1149,4	0
Breads and derivatives	1609,4	15,10	0	0	1609,4	0
Fillings	413,49	3,88	0	210,3	203,2	0
Fruits	1499,2	14,06	0	0	0,00	1499,2
Total	10661,36		741,4	5458,7	2962,0	1499,2
% of Total	100	6,95	51,20	27,78	14,07	

* MP = minimally processed; P = processed; UP = ultra-processed; IN = *In natura*.

When evaluating the degree of processing of the most used products, according to the NOVA classification of the Food and Agriculture Organization and the Food Guide for the Brazilian Population, it was found that 12 of the 22 items evaluated and listed in table 3 can be classified as ultra-processed. Additionally, when considering the amount used in kg, this group represents 27.78%.

Table 3. Classification according to the degree of processing and total quantities and percentages of foods most used in complementary meals of the UPH

Food	Degree of processing	Quantity in kg or L	%BF	%AS	%NS
Coffee with sweetener	Processed	1493,3	43.39	33.68	22.93
Coffee with milk and sugar	Processed	2261,5	43,8	38,6	17,7
Unsweetened latte	Processed	1493,3	48,0	33,3	18,7
Milk	Minimally processed	741,4	45,3	38,3	16,4

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Strawberry Yogurt	Ultra-processed	541,2	8,4	10,9	80,6
Sweetened boxed juice	Ultra-processed	237,6	23,7	26,2	50,2
Sugar-free boxed juice	Ultra-processed	371,0	24,5	25,9	49,6
Light biscuit	Ultra-processed	228,1	12,1	26,5	61,5
Bolo inglês (Brazilian sweet muffin)	Ultra-processed	175,0	4,5	34,9	60,6
Chocolate Cake	Ultra-processed	45,2	0,0	100,0	0,0
<i>Cuca</i> (German crumb cake)	Ultra-processed	83,5	0,0	100,0	0,0
<i>Pão francês</i> (a typical Brazilian bread roll)	Ultra-processed	403,5	72,7	21,8	5,5
Loaf Bread	Ultra-processed	410,6	35,9	32,2	31,9
Whole wheat bread	Ultra-processed	263,7	50,8	28,3	20,9
Margarine	Ultra-processed	155,7	38,1	39,1	22,7
Cheese	Processed	107,8	40,2	34,5	25,2
<i>Requeijão</i>	Processed	102,5	86,8	11,7	1,5
Ham	Ultra-processed	47,5	48,0	33,2	18,8
Banana	<i>In natura</i>	731,6	34,9%	9,1%	56,0%
Papaya	<i>In natura</i>	417,0	56,9%	12,9%	30,2%
Apple	<i>In natura</i>	206,6	22,3%	23,7%	54,0%
Melon	<i>In natura</i>	144,0	43,5%	33,3%	23,2%
		7139,27			

Legend: % = percentage; BF= breakfast; AS = afternoon snack; NS = night snack.
Numbers in bold: emphasis added.

It was found that the distribution of ultra-processed items over the three meals was heterogeneous. It was possible to identify the largest supply of ultra-processed beverages at the 9 p.m. night snack, such as juices and yogurt, which represented 81.5% of the total offered at this meal.

The group with the highest proportion of ultra-processed items was bread, considering that all items are purchased ready-to-eat, and in which the presence of food additives and, for the most part, the description of the item sugar as an added ingredient were verified on the packaging. Of particular note is the offer of *cucas* (German cake covered with crunchy sweet farofa based on margarine) and ready-made cakes in the afternoon snack, configured 100% of the offer only in this meal. In this group, it was interesting to notice the distribution of two of the most used foods: 70% of the consumption of French bread and 50% of the consumption of whole wheat bread was made at breakfast, while about 60% of the consumption of cakes and light biscuits occurred at the 9 pm night snack.

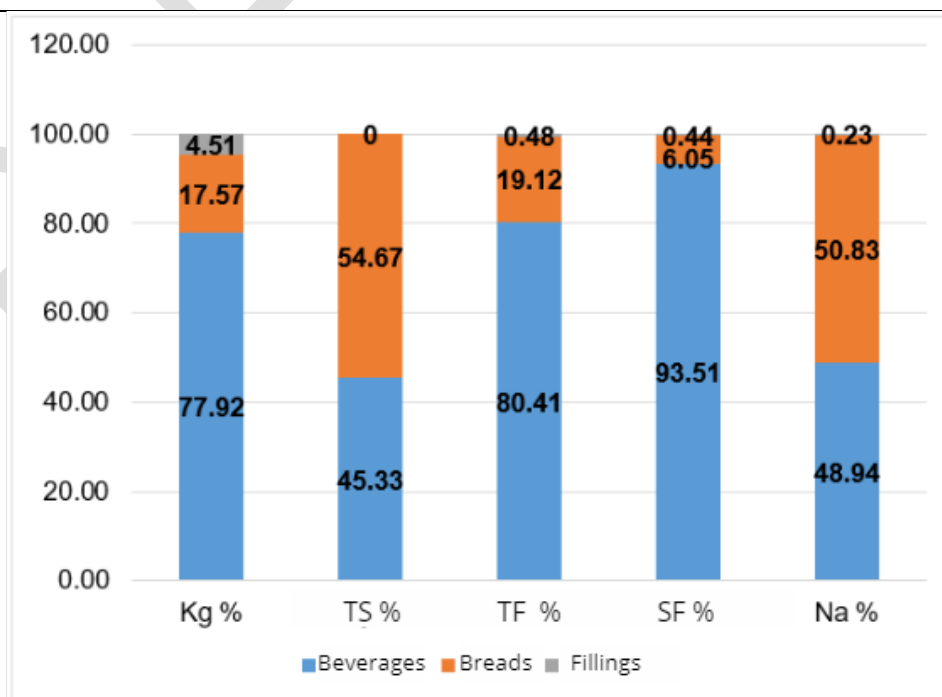
In the filling options, margarine, which was the most used item, is classified as an ultra-processed food and used in all meals. On the other hand, the ham item had the highest offer at breakfast.

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Table 4 and Graph 2 show the characterization of the most commonly used foods according to the degree of processing and amount of sugars (carbohydrates in general), total fats, saturated fats and sodium. None of the foods evaluated had any detectable amounts of trans fats in the indicated portion of consumption.

Table 4. Total sugars, total fat, saturated fat, and sodium contents of the foods most served in UPH complementary meals.

	Portion (g or ml)	Total Sugars Carbohydrates (g)	Total Fat (g)	Saturated Fat (g)	sodium (mg)
Coffee with sweetener	200	7,7	5,3	3,2	73,9
Coffee with milk with sugar	200	17,0	5,3	3,2	73,9
Unsweetened latte	200	7,7	5,3	3,2	73,9
Whole milk powder	20	7,7	5,3	3,2	73,9
Strawberry yogurt	90	12,0	1,4	1,0	131,0
Sweetened juice box	200	24,0	0,0	0,0	6,0
Sugar-free juice box	200	23,0	0,0	0,0	13,0
Light Biscuit	27	18,0	3,4	1,5	131,0
<i>Bolo inglês</i>	50	32,0	0,6	0,0	100,0
Chocolate Cake	50	15,0	2,8	0,9	124,0
<i>Cuca</i>	50	33,0	3,8	0,0	155,0
<i>Pão Francês</i>	50	28,0	1,4	-	120,0
Loaf Bread	50	26,0	2,4	-	220,0
Whole wheat bread	50	22,0	2,1	-	210,0
Margarine	10	0,0	5,0	1,3	0,0
Cheese	20	0,0	6,2	4,3	40,0
<i>Requeijão</i>	20	0,0	5,2	2,9	145,3
Ham	20	1,1	1,3	0,5	147,0



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* TS = total sugars (carbohydrates); TF = total fat; SF = saturated fat; Na = sodium.

Graph 2. Evaluation of the percentage amounts of the food groups and sugar, fat and sodium contents of the foods used in the complementary meals of the UPH.

It was decided to evaluate separately some items of the same category in the beverage group, by the addition or not of ingredients such as sugar, as is the case of boxed juices and coffee with milk. Coffee with milk is machine-made by mixing hot water and dry ingredients. Therefore, a 200 ml serving of coffee with milk and sugar contains 20g of powdered milk, 2g of instant coffee and 10g of sugar. The group of breads, cakes and biscuits also stood out in terms of the amount of total sugars, but in this case it is not possible to make a separation between carbohydrates in general and sugar (sucrose) added to the list of ingredients.

The items with the highest saturated fat content were those that use whole milk powder and dairy products such as *requeijão* and cheese. However, they are preparations that vary in terms of the degree of processing, with some being minimally processed, processed and others ultra-processed.

It was observed that in the group of breads and derivatives, the percentages of sodium were the highest, and that they are also usually the items most offered in meals. High values were also found in the fillings of *requeijão* and ham, which are usually more offered in the breakfast meal. The combination of *pão francês* and *requeijão* offers 265 mg of sodium, about 13% of the daily value.

DISCUSSION

The present study evaluated a hospital food service that includes, in addition to the main meals such as lunch and dinner, also complementary meals, such as breakfast, afternoon snack and night snack. The types of meals and quantities offered to patients is a factor that differs between hospitals.

At the research site of this study, patients are entitled to at least four meals a day, and can even reach six if a morning snack and night snack are added. A study on food waste in an outsourced food service in Italian hospitals reported that the standard of care is the provision of three meals a day: breakfast, lunch and dinner²².

The food groups and their respective items are described in Table 1. It was possible to identify the particularity of the use of the items according to the type of meal offered. The foods that make up hospital menus can vary not only according to dietary prescriptions, but also

according to the food culture of different regions and countries. In a study carried out in a public hospital in Greece, it was described that the standard breakfast offered milk or tea, a sachet of sugar, a slice of cheese and toast to patients²³. On the other hand, the standard of the public university hospital (UPH) evaluated in the present study offers breakfast, among other options, coffee with milk and some type of bread with fillings to hospitalized patients. As it is a large hospital, the use of this type of food ends up being necessary, due to the demands of care and the financial resources that are provided by the government. In Brazil, it is a habit to consume coffee and *pão francês*, foods that are among those most frequently consumed by Brazilians, as specified in the Household Budget Survey (*Pesquisa de Orçamento Familiar*)²⁴.

In other studies that evaluated the use of food in complementary meals for adults and children in a hospital in Porto Alegre, Rio Grande do Sul, the presence of yogurts, fruit juices, soy-based beverages and cookies was also identified^{18,25}. In the same hospital in Porto Alegre, in an investigation on the degree of processing of foods offered in diets for pediatrics, the presence of chocolate powder, margarine and loaf bread in pediatric diets was verified²⁶. The *requeijão* product was later used in the preparations offered to children.

Degree of processing

It is noteworthy that in the group of breads and derivatives, the items evaluated were classified in their entirety as ultra-processed foods, while half of the fillings received this classification. As for the beverage group, yogurts and juices were classified as ultra-processed.

Ultra-processed foods receive this classification because they contain ingredients such as salt, sugar, oils, and fats in their composition. Furthermore, they receive the addition of substances for exclusively industrial use, such as thickeners, emulsifiers, dyes, flavor enhancers, flavorings, among others. They also usually go through several processing techniques and stages⁵.

In the investigation in a Greek hospital, the degree of processing according to the FAO NOVA classification of the products offered for breakfast, lunch and dinner was verified. The results showed a correlation between minimally processed foods and a higher intake of energy,

protein and micronutrients²³. In our study, the percentage of ultra-processed foods was 27.78% of the total. This value can be considered high when considering the quality of the food offered to a hospital population.

Excessive consumption of ultra-processed foods is often associated with a higher risk of pathological outcomes, especially chronic non-communicable diseases, as cited in the following studies. The main findings establish an association between increased consumption of ultra-processed foods and a higher risk of all-cause mortality, coronary heart disease, cerebrovascular diseases, hypertension, metabolic syndrome, overweight and obesity, depression, irritable bowel syndrome, cancers, among others^{11, 12, 13}.

In the cohort study conducted by Srour et al.²⁷, the researchers concluded that there was an association between high consumption of ultra-processed foods and a higher risk of type 2 diabetes mellitus (T2DM). Research by Duan et al.²⁸ in the Netherlands, where the health-related eating behavior of individuals was analyzed, found a positive association of the analyzed dietary pattern, especially between the consumption of hot and cold salty snack patterns, and a higher risk for DM2.

Further research corroborates these findings. Studies by Carvalho et al.²⁹ and Mendonça et al.³⁰ found an association between high consumption of ultra-processed foods and the impact on the individual's weight, being associated with a higher Body Mass Index and a higher risk of developing overweight and obesity. Just as the impact of the higher consumption of ultra-processed foods and the nutritional status of the general population, this consumption by hospitalized patients should also be contextualized.

Many foods go through some processing, if only to be preserved. Therefore, the addition of sugar, salt, oils and fats in excess in food, as well as ingredients for industrial use, are determining factors in the impact of ultra-processed foods on human health.

Total sugars, total fat, saturated fat, and sodium contents of foods

In this study, the association between the degree of processing and the presence of sugar in beverages can be perceived, especially boxed juices and strawberry yogurt (Table 4). Unsweetened carton juice is made up of 100% fruit juice, while sugar-bound carton juice is classified as nectar since it is made up of 50% fruit juice. Therefore, both have fairly similar amounts of total sugars, since fruit juice already has a natural amount of sugar. In a study carried out in supermarket chains in the capitals of Colombia, Peru and Ecuador, the highest concentrations of sugars were found, especially in fruit juices and fermented dairy products, of

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which about 70% of the products had sugar levels above the safe limit to avoid the risk of dental caries³¹. Also, according to Ramne et al.¹⁵ and Debras et al.³², high sugar consumption may contribute to the development and prevalence of cancer and cardiovascular disease, as well as to higher mortality risk.

The group of breads and derivatives, the only group composed entirely of items classified as ultra-processed (Table 2), represented 17.6% of the food supply in kg, but was responsible for 54.7% of the total sugar offered among all groups (Graph 2).

In this sense, based on data collected in the Canadian Community Health Survey, food consumption was evaluated using the FAO NOVA classification, and it was identified that with the increase in the consumption of ultra-processed foods in the diet, there was a higher intake of refined sugar, total fats and saturated fat. However, the content of protein, fiber, and all minerals and vitamins decrease significantly³³. The results of this study at UPH corroborated the data of the Canadian study, especially for the group of breads and derivatives in relation to the amounts of sugars and sodium.

Regarding saturated fats, a study conducted in the mountainous region of Rio Grande do Sul on the frequency of consumption of ultra-processed foods identified that this ingredient and industrialized products were a significant part of the participants' diet. Among the foods listed in the survey were the consumption of sweets in general, processed meats and sausages, white and whole wheat bread, yogurt (fruit milk drink), sugary drinks, among others³⁴.

In the UPH of this study, the beverage group was responsible for 93.5% of the total offered, especially due to the use of whole milk powder. However, in the evaluation of the quantity in grams, the value is not considered high. This is because the main sources of animal fat are from the meat preparations offered in the so-called main meals (lunch and dinner). Reducing saturated fat consumption can have health benefits, such as a 17% reduction in the risk of cardiovascular events, as pointed out in the study by Hooper et al.¹⁴.

In addition, when assessing the consumption profile of Brazilians, Louzada et al.³⁵ found that the portion of ultra-processed foods consumed contributed to a higher content of total fat, saturated fat, trans fat, free sugar and energy density, but with lower potassium and sodium content. These results are in agreement with the findings of the present study in relation to sugars and fats, but in contrast to what was found in relation to sodium.

The group of breads and derivatives, such as ready-to-eat cakes, crumb cakes and biscuits, had the highest amounts of sodium in their nutritional composition, and this group was responsible for approximately half of the total amount of sodium offered to patients. It is worth

noting that, among the most consumed types of bread, the amount of sodium is equivalent to 10% of the total daily value allowed. According to Aguiar et al.¹⁶, the impact of sodium on the health of Brazilians is mainly linked to the triggering of diseases such as hypertension, kidney diseases, stomach cancer, among others.

Sugars, fats and sodium, in addition to being inherent to some foods, are also ingredients added to food in the food industry. In recent decades, interest in sodium reduction strategies in food products has been increasing, such as reducing the total amount of salt, and replacing it with substitutes such as acid salts and phosphate³⁶. The reformulation of food products is currently part of some European legislation, which establishes limits to reduce the content of salt, sugar and fat, and presents a challenge for the food industry, which also seeks to meet technological, sensory and safety aspects³⁷. A review of the literature concluded that nutritional labeling influences the practices of food industries, which end up reducing, for example, the sodium and trans-fat content of products³⁸.

Considering the fact that it is a public service, and also due to the size of the hospital, the changes require adjustments that involve the purchasing and bidding policy. Even so, alternatives can be verified, especially for items classified as ultra-processed. As the UPH has been making purchases from family farming suppliers, it is possible to search for items such as non-industrialized breads and cakes. For yogurt, a study is suggested regarding their acceptance and consumption, given that the flavor used is always strawberry. And, in the case of beverages, look for healthier alternatives with companies in the market.

Additionally, it is advisable to replace margarine, often used as a filling for bread, with *requeijão*, a less processed food. A similar change has already been applied to the pediatric diets of the UPH, and can be extended to the diets offered to adults. On the other hand, ham, another ultra-processed filling, should be replaced by other options, such as jams and cheeses, or used in smaller quantities in the hospital, only in exceptional cases. It is worth noting that an average of two to three servings of fruit per day are offered to UPH patients, as well as food and vegetables. *In natura* after and minimally processed foods that contribute to the nutritional quality of hospital meals.

The limitation of the present study was the impossibility of verifying the amount of sugar added to foods, in contrast to total sugars, due to the absence of this information in nutritional labeling. The consumption of each food by the patients was also not verified, only the amount and types of food offered were recorded. That said, despite the previous knowledge

from the scientific literature about the negative impact of ultra-processed foods on health, it was not possible to verify the impact of these foods on the health of patients.

FINAL THOUGHTS

Hospital feeding aims to provide meals that promote the health and recovery process of patients, among which we highlight complementary meals. The advance of industrialization has boosted the supply of ultra-processed products, which stand out for the presence of components such as sugar, saturated fat and sodium, which cause harm to health when consumed in excess.

The present study found higher amounts of total sugars in some ultra-processed products, such as boxed juices, yogurts, breads, cakes and cookies, which are offered in complementary meals at the public university hospital. We identified that the sodium and fat profile among ultra-processed foods was not homogeneous. The group of breads and derivatives stood out for its higher sodium content and was fully classified as ultra-processed due to its multiple ingredients and chemical additives. Saturated fat was found mainly in foods that contained whole milk powder in their composition, an ingredient rich in this type of fat. On the other hand, ultra-processed items in the beverage group have a higher profile of total sugars.

It is important to realize that these ultra-processed foods made up almost 30% of the total offered in complementary meals, and contain important amounts of ingredients that can be harmful to human health when consumed in excess. However, it is worth mentioning that the highlighted products, even if ultra-processed, offer the advantage of convenience for the hospital's food service: because they are ready-made products, they save the demand for time, resources and labor.

Further studies are needed on the use and impact of ultra-processed foods on the health of hospitalized patients in order to better understand the impact of these foods on the recovery of patients assisted. It is suggested that, with the application of the new front-of-package nutrition labeling in Brazil, studies such as this one should be replicated to verify the proportion of added sugar, and not only the total sugars of the foods served in hospital meals.

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REFERENCES

1. Poole N, Donovan J, Erenstein O. Viewpoint: Agri-nutrition research: Revisiting the contribution of maize and wheat to human nutrition and health. Food Policy [Internet]. 2021;100:101976. Available from: <https://doi.org/10.1016/j.foodpol.2020.101976>
2. Panahi S, Jones W, Duncan AM, Ferland G, Keller H, Grantham A, et al. Guidance and perspectives on highly processed foods. Appl Physiol Nutr Metab = Physiol Appl Nutr Metab. 2022 Oct;47(10):1038–44.
3. Huebbe P, Rimbach G. Historical reflection of food processing and the role of legumes as part of a healthy balanced diet. Foods. 2020;9(8):1–16.
4. Monteiro CA, Levy RB, Claro RM, Castro IRR de, Cannon G. A new classification of foods based on the extent and purpose of their processing. Cad Saude Publica. 2010;26(11):2039–49.
5. Brasil. Ministério da saúde. Guia Alimentar para a População Brasileira Guia Alimentar para a População Brasileira. Ministério da Saúde, Secretaria de Atenção Primária à Saúde Departamento de Atenção Básica, Secretaria de Atenção Primária à Saúde Departamento de Atenção Básica,. 2014. 156 p.
6. Monteiro CA, Cannon G, Lawrence M, Costa Louzada ML, Machado PP. The NOVA food classification system and its four food groups [Internet]. Ultra-processed foods, diet quality, and health using the NOVA classification system. 2019. 6–9 p. Available from: <http://www.wipo.int/amc/en/mediation/rules>
7. Taillie LS, Bercholz M, Popkin B, Reyes M, Colchero MA, Corvalán C. Changes in food purchases after the Chilean policies on food labelling, marketing, and sales in schools: a before and after study. Lancet Planet Heal. 2021;5(8):e526–33.
8. Chantal J, Hercberg S. Development of a new front-of-pack nutrition label in France: the five-colour Nutri-Score. Public Heal Panor. 2017;03(04):712–25.
9. Scarborough P, Matthews A, Eyles H, Kaur A, Hodgkins C, Raats MM, et al. Reds are more important than greens: How UK supermarket shoppers use the different information on a traffic light nutrition label in a choice experiment. Int J Behav Nutr Phys Act [Internet]. 2015;12(1):1–9. Available from: <http://dx.doi.org/10.1186/s12966-015-0319-9>
10. Agência Nacional de Vigilância Sanitária. Resolução da Diretoria Colegiada No 429, de 8 de outubro de 2020. Dispõe sobre a rotulagem nutricional dos alimentos embalados. Diário da União [Internet]. 2020a. Available from: http://antigo.anvisa.gov.br/documents/10181/3882585/RDC_429_2020_.pdf
11. Schnabel L, Kesse-Guyot E, Allès B, Touvier M, Srouf B, Hercberg S, et al. Association Between Ultraprocessed Food Consumption and Risk of Mortality Among Middle-aged Adults in France. JAMA Intern Med. 2019 Apr;179(4):490–8.

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OFFERED IN COMPLEMENTARY MEALS IN A HOSPITAL

12. Chen X, Zhang Z, Yang H, Qiu P, Wang H, Wang F, et al. Consumption of ultra-processed foods and health outcomes: A systematic review of epidemiological studies. *Nutr J*. 2020;19(1):1–10.
13. Elizabeth L, Machado P, Zinöcker M, Baker P, Lawrence M. Ultra-processed foods and health outcomes: A narrative review. *Nutrients*. 2020;12(7):1–36.
14. Hooper L, Martin N, Jimoh OF, Kirk C, Foster E, Abdelhamid AS. Reduction in Saturated Fat Intake for Cardiovascular Disease. *Cochrane Database Syst Rev*. 2020;(8).
15. Ramne S, Alves Dias J, González-Padilla E, Olsson K, Lindahl B, Engström G, et al. Association between added sugar intake and mortality is nonlinear and dependent on sugar source in 2 swedish population-based prospective cohorts. *Am J Clin Nutr*. 2019;109(2):411–
16. Aguiar M dos S, Bernardo ED de S, Costa FN. Alto consumo de sódio: impacto na saúde da população brasileira adulta. *Res Soc Dev*. 2021;10(14):e440101422132.
17. Sorensen J, Fletcher H, Macdonald B, Whittington-Carter L, Nasser R, Gramlich L. Canadian Hospital Food Service Practices to Prevent Malnutrition. *Can J Diet Pract Res a Publ Dietitians Canada = Rev Can la Prat la Rech en Diet une Publ des Diet du Canada*. 2021 Dec;82(4):167–75.
18. Ribeiro KRR, Rolim PM, Seabra LMJ, Strasburg VJ. Evaluation of the ecoefficiency of greenhouse gases generation in the provision of complementary meals in a public hospital. *Res Soc Dev*. 2021;10(4):e10110413995.
19. Prodanov CC, Freitas EC. Metodologia do trabalho científico: métodos e técnicas da pesquisa e do trabalho acadêmico. [Internet]. Novo Hamburgo: Feevale; 2013. 277 p. Disponível em: < <http://www.feevale.br/Comum/midias/8807f05a-14d0-4d5b-b1ad1538f3aef538/E-book%20Metodologia%20do%20Trabalho%20Cientifico.pdf>>.
20. Strasburg VJ, Jahno VD. Application of eco-efficiency in the assessment of raw materials consumed by university restaurants in Brazil: A case study. *J Clean Prod*. 2017;161:178–87.
21. Núcleo de Estudos e Pesquisas em Alimentação. Tabela Brasileira de Composição de Alimentos. 4th ed. Campinas; 2011.
22. Schiavone S, Pelullo CP, Attena F. Patient evaluation of food waste in three hospitals in southern Italy. *Int J Environ Res Public Health*. 2019;16(22).
23. Detopoulou P, Panoutsopoulos GI. How processed is the hospital menu? An analysis based on NOVA food scoring system. Vol. 53, *Clinical Nutrition ESPEN*. 2023. p. 277–81.
24. IBGE. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2017-2018 – POF. Rio de Janeiro, 2020.
25. Strasburg VJ. Avaliação da Ecoeficiência de Refeição Fornecida por Unidade de Internação Pediátrica de um Hospital Público do Sul do Brasil: Um Estudo de Caso. *Saúde e Ambient*. 2022;9(1):274–88.

26. Zarth K, Zoche E, Hammes TO, Bosa VL. Oferta de alimentos ultraprocessados nas dietas pediátricas hospitalares para crianças maiores de dois anos em um hospital universitário. *DEMETRA Aliment Nutr Saúde*. 2022;17(August 2020):e62378.
27. Srour B, Fezeu LK, Kesse-Guyot E, Allès B, Debras C, Druet-Pecollo N, et al. Ultraprocessed Food Consumption and Risk of Type 2 Diabetes Among Participants of the NutriNet-Santé Prospective Cohort. *JAMA Intern Med*. 2020 Feb;180(2):283–91.
28. Duan MJ, Vinke PC, Navis G, Corpeleijn E, Dekker LH. Ultra-processed food and incident type 2 diabetes: studying the underlying consumption patterns to unravel the health effects of this heterogeneous food category in the prospective Lifelines cohort. *BMC Med*. 2022;20(1):1–11.
29. Carvalho VN de, Couto AN, Vitiello IP, Severgnini C, Pohl HH. Consumo de Alimentos Processados/Ultraprocessados e In Natura por Adultos e sua Relação com o Estado Nutricional. *Rev Bras Obesidade, Nutr e Emagrecimento*. 2009;3:337–46.
30. Mendonça R de D, Pimenta AM, Gea A, de la Fuente-Arrillaga C, Martinez-Gonzalez MA, Lopes ACS, et al. Ultraprocessed food consumption and risk of overweight and obesity: the University of Navarra Follow-Up (SUN) cohort study. *Am J Clin Nutr*. 2016 Nov;104(5):1433–40.
31. Angarita-díaz P, Lopez-ramos RP, Tipan-asimbaya L, Gonzalez-bernal MA, Antonio L. Sugar in ultraprocessed foods in Latin American capitals: From dentistry perspective. 2023;30(February):21–31.
32. Debras C, Chazelas E, Srour B, Kesse-Guyot E, Julia C, Zelek L, et al. Total and added sugar intakes, sugar types, and cancer risk: Results from the prospective NutriNet-Santé cohort. *Am J Clin Nutr* [Internet]. 2020;112(5):1267–79. Available from: <https://doi.org/10.1093/ajcn/nqaa246>
33. Moubarac JC, Batal M, Louzada ML, Martinez Steele E, Monteiro CA. Consumption of ultra-processed foods predicts diet quality in Canada. *Appetite*. 2017;108.
34. Morandi T, Bonatto S, Silva ACP da. Avaliação do Consumo de Gorduras Saturadas e de Alimentos Ultraprocessados em uma População Adulta de uma UBS em uma Cidade da Serra Gaúcha. *Rev Bras Obesidade, Nutr e Emagrecimento*. 2019;13(82):922–33.
35. Louzada ML da C, Martins APB, Canella DS, Baraldi LG, Levy RB, Claro RM, et al. Ultra-processed foods and the nutritional dietary profile in Brazil. *Rev Saude Publica*. 2015;49:1–11.
36. Duntzman AN, McKenzie EN, Yang Y, Lee Y, Lee SY. Compendium of sodium reduction strategies in foods: A scoping review. *Compr Rev Food Sci Food Saf*. 2022;21(2):1300–35.
37. Belc N, Smeu I, Macri A, Vallauri D, Flynn K. Reformulating foods to meet current scientific knowledge about salt, sugar and fats. *Trends Food Sci Technol* [Internet]. 2019;84:25–8. Available from: <https://www.sciencedirect.com/science/article/pii/S0924224417303588>

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38. Shanguan S, Afshin A, Shulkin M, Ma W, Marsden D, Smith J, et al. A Meta-Analysis of Food Labeling Effects on Consumer Diet Behaviors and Industry Practices. Am J Prev Med. 2019 Feb;56(2):300–14.

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