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ORIGINAL

Contribution of ultra-processed food to the nutritional dietary profile of young children school feeding

Contribuição de alimentos ultraprocessados para o perfil nutricional da alimentação escolar em creches

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ABSTRACT

Objective

To investigate the contribution of ultra-processed food to the nutritional dietary profile of school feeding in public child day-care centers.

Methods

Cross-sectional study carried out from June-November/2013. Samples from six daily meals were collected in twenty non-consecutive days. A total of 117 school meals (123 food items) were offered to children from 12-36 months of age. The served portions were determined by direct weighting. Physicochemical analyses were performed to establish the nutritional composition. School meals were classified according to the processing degree: (A) unprocessed/minimally processed/culinary preparations, (B) processed food, or (C) ultra-processed food. The contribution of each group to the quantity of energy, macronutrients and sodium was calculated. Student's *t* test was applied for comparison between groups.

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Results

Ultra-processed meals contributed to 45.8% of energy, 33.9% of lipids, 42.8% of proteins, 48.9% of carbohydrates, and 20.9% of sodium. All lunches and 90% of dinners were classified as unprocessed/minimally processed/culinary preparations. 39.0% of the meals were ultra-processed (mainly breakfast and snacks). Ultra-processed meals had a greater quantity of energy (p=0.026) and carbohydrates (p<0.001) per serving, while unprocessed/minimally processed/culinary preparations offered more sodium per serving (p<0.001).

Conclusion

Although most meals were classified as unprocessed/minimally processed/culinary preparations, ultra-processed food, which should be avoided at this stage of life, are offered daily, contributing with higher energy and carbohydrates offer per serving. The municipality need to improve the quality of the meals offered to children in these child day-care centers, observing the new Resolution nº 6/2020 that came into effect in 2021.

Keywords: Child day care centers. Food analysis. Food processing. School feeding. Ultra-processed foods.

RESUMO

Objetivo

Investigar a contribuição de alimentos ultraprocessados no perfil nutricional da alimentação escolar ofertada em Centros Municipais de Educação Infantil.

Métodos

Estudo seccional conduzido entre junho e novembro/2013. Amostras das seis refeições diárias foram coletadas durante 20 dias não consecutivos. Cento e dezessete refeições (123 itens alimentares) foram ofertadas a crianças de 12 a 36 meses. O tamanho das porções foi determinado por pesagem direta e a composição nutricional, por análises físico-químicas. As refeições escolares foram classificadas de acordo com o grau de processamento: (A) in natura/minimamente processados/preparações culinárias; (B) processados; (C) ultraprocessados. Foi calculada a contribuição de cada grupo para energia, macronutrientes e sódio. O Teste t foi utilizado para comparação entre os grupos.

Resultados

As refeições ultraprocessadas contribuíram com 45,8% de energia, 33,9% de lipídios, 42,8% de proteínas, 48,9% dos carboidratos e 20,9% do sódio ofertados. Todos os almoços e 90% dos jantares foram classificados como in natura/minimamente processados/preparações culinárias. 39,0% das refeições foram classificadas como ultraprocessadas (principalmente café da manhã e lanches). Refeições ultraprocessadas ofereceram maior quantidade de energia (p=0,026) e carboidratos (p<0,001) por porção, enquanto refeições in natura/minimamente processados/preparações culinárias forneceram mais sódio por porção (p<0,001).

Conclusão

Apesar da predominância de refeições in natura/minimamente processados/preparações culinárias, os alimentos ultraprocessados – que deveriam ser evitados nessa fase da vida, são ofertados diariamente, contribuindo com maior quantidade de energia e carboidratos por porção. É necessário que o município reavalie as refeições ofertadas às crianças nesses Centros de Educação Infantil, seguindo as recomendações atuais da Resolução nº 6/2020, que entrou em vigor em 2021.

Palavras-chave: *Creches. Análise de alimentos. Manipulação de alimentos. Alimentos ultraprocessados.*

INTRODUCTION

A school feeding program may promote nutritional and food security in schools around the world. One of its aims is to oppose the triple burden of malnutrition, either undernutrition, overweight/obesity and diet-related chronic non-communicable diseases, and/or hidden hunger [1, 2].

The *Programa Nacional de Alimentação Escolar* (PNAE, Brazilian School Feeding Program) is one of the most relevant programs in the world providing school meals. PNAE's guidelines advise the offering of healthy meals, with varied and safe food items, promoting healthy eating habits and supporting students' growth and development. The PNAE regulates the types of food to be offered to children attending the public system, restricting the food energy content from added sugar, total fat, saturated and trans fat, and sodium [3-5].

The protective role of PNAE is necessary because food patterns are changing in Brazil, just like around the world. Ready-to-eat products are replacing traditional food choices, such as unprocessed foods and freshly prepared meals [6, 7]. For this purpose, Monteiro *et al.* [8] published the NOVA food classification, which assesses the magnitude and purpose of the processing of food items. NOVA classifies foods into the following four groups: unprocessed/minimally processed foods; processed culinary ingredients; processed foods; and Ultra-Processed Food (UPF) [8, 9]. NOVA based updated dietary guidelines to recommend low intake of UPF and high intake of unprocessed/minimally processed foods in order to reverse this trend and to prevent chronic non-communicable diseases [6, 10, 11].

Studies have suggested association between UPF consumption and an increase of overweight and obesity in Brazilian [12], French [13], Australian [14], British [15], and Canadian population [16]. A systematic review enrolling studies worldwide shows that ultra-processed exposure was associated with adverse health outcomes, such as cardiovascular disease, cancer, type-2 diabetes, and overweight/obesity [17].

The prevalence of overweight in pre-school aged children is increasing. In 2019, approximately 38 million children under the age 5 were overweight or obese worldwide [18]. Studies enrolling Brazilian children under 5 years investigated prevalence of overweight and obesity and found 8.1%, according to BMI/age (z-score >+2) in the Northwest semiarid [19]; 11.6%, according to Weight/Height (z-score >+2) in the five regions of Brazil [20]; and 26.2% according to BMI/age (z-score >+2) in the Southern [21]. Brazilian national data also have been shown an increase in the prevalence of overweight and obesity in children from 5-9 years old, since 1989 [22]. Considering that excessive weight in childhood is a risk factor for overweight/obesity in adulthood, it is necessary to prevent child exposure to an obesogenic environment to promote healthier later life [23]. In this way, school feeding try to combat childhood obesity, since PNAE aims to promote healthy and adequate feeding, to contribute to the student growth and development [3-5].

In this way, this study aimed to investigate the contribution of UPF to the nutritional dietary profile of school feeding meals served in public child day-care centers in a municipality in the South of Brazil.

METHODS

A cross-sectional and analytical study was carried out from June to November/2013 in public child day-care centers in *Colombo, Paraná* state (Southern Brazil), following the methodology described elsewhere [24]. *Colombo* had, in 2013, 38 public child day-care institutions serving 816 children younger than 3 years of age. For the purpose of this study, the municipality was stratified in three geographical areas: Central Area, serving 367 children; *Guaraituba*, serving 234 children; and *Maracanã*, serving 215 children. Four day-care centers were randomly selected within each stratum. The overall sample covered 10.7% of the children younger than 3 years of age attending public day-care centers in the municipality.

Daily, there were served six meals to children aged 12-36 months by the school feeding program: breakfast, morning snack, lunch, tea, afternoon snack, and dinner. At each child day-care center, all the meals served to the children were collected in five non-consecutive days, for a total of twenty (20) observed days. The complete menu offered is shown in Table 1. In six meals, there were served two food items together: porridge and bread twice (days 1 and 12), banana and bread (day 2), porridge and biscuit (day 11), biscuit and grape juice (day 17), and biscuit and chocolate milk (day 18). On the other hand, in three of the twenty days (days 1, 11, and 13), there were served not six, but five meals, totalizing 117 meals offering 123 food items. All of them were collected and analyzed by physicochemical procedures.

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Table 1 – Menu offered by school feeding to children aged 12-36 months. *Colombo* (PR), Brazil, 2013.

Day	Breakfast	Morning snack	Lunch	Tea	Afternoon snack	Dinner
01	Corn porridge, Bread*	Banana	Rice and beans, ground beef with peas	–	Rice porridge	Noodle soup with potatoes
02	Corn porridge	Banana, Bread*	Noodle soup with potatoes, carrot and poultry	Fennel	Rice porridge	Chicken soup
03	Corn porridge	Handmade bread*	Noodle soup with potatoes, carrot and poultry	Fennel	Banana	Noodle soup with potatoes, carrot and poultry
04	Rice porridge	Peeled apple	Noodle soup with potatoes, carrot and poultry	Fennel	Multi-cereal pap	Ground corn soup with chicken
05	Corn porridge	Banana	Noodle soup with potatoes, carrot, poultry, parsley potato, zucchini, chayote, beetroot	Fennel	Milk	Noodle soup with parsley potatoes, carrot and poultry
06	Corn porridge	Bread* & margarine	Rice and beans, hard-boiled egg, potato, carrot, and ground beef	Mate	Sago	Noodle soup with potatoes and ground beef
07	Rice porridge	Handmade Carrot bread* & margarine	Rice and beans, chayote, cauliflower and ground beef	Mate	Passion fruit juice	Noodle soup with ground beef
08	Milk flour porridge	Salty cracker	Rice, beans, and mince	Mate	Sweet-rice	Cooked corn meal with meat
09	Corn porridge	Banana	Rice, beans, potato, cauliflower and fried chicken	Mate	Chocolate cake with blackberry jam	Chicken soup with corn meal
10	Corn porridge	Banana	Rice with carrot, beans, mashed potatoes, and mince with sauce	Mate	Strawberry jelly	Cooked corn meal with meat
11	Rice porridge	–	Rice and beans, chayote and ground beef	Fennel	Cereals porridge, Cornstarch cookie	Noodle soup, potatoes, poultry
12	Rice porridge Bread* & margarine	Melon	Rice and beans, chayote and ground beef	Fennel	Milk flour porridge	Noodle soup with potatoes, carrot and poultry
13	Rice porridge	–	Rice and beans, chayote and beef	Mint	Corn porridge	Instant noodles with carrot
14	Rice porridge	Strawberry yogurt	Rice, beans, potato, tomato, onion, chicken	Chamomile	Rice porridge	Instant noodles with carrot
15	Rice porridge	Banana	Rice, beans, noodles, cabbage and chicken	Fennel	Milk flour porridge	Noodle soup with potatoes, chayote and ground beef
16	Rice and corn mixed porridge	Cream cracker	Rice, beans, cooked corn meal and chicken	Mate	Cornstarch cookie	Chicken soup
17	Rice and corn mixed porridge	Family farming biscuit, Grape juice	Rice and beans, ground beef and crumb's egg	Fennel	Grape juice	Noodle soup with potatoes, carrot, chayote and ground beef
18	Cereals porridge	Banana	Noodle soup with potatoes, carrot, chayote, ground beef and bean soup	Chamomile and mint	Family farming biscuit, chocolate milk	Noodle soup with potatoes, carrot, chayote, ground beef and bean soup
19	Cereals porridge	Banana	Rice and beans, stewed chicken, corn crumbs with carrot and cabbage	Chamomile	Grape jelly	Noodle soup with poultry
20	Cereals porridge	Cornstarch cookie	Rice and beans, ground corn and meat	Mate	Strawberry porridge	Noodle soup with potatoes, carrot, chayote and ground beef

Note: *There were offered industrialized and homemade breads. The last ones are distinguished by name.

During sample collection, the average size of the whole portion of served meals were determined by direct weighing of served dishes [25]. At least six ready-for-consumption served dishes were weighed to compute the mean of portions served to the children.

Food samples were collected by the first author. For each served meal, a sample of approximately 300g was collected from ready-for-consumption served dishes. All the foods present in a meal were mixed in the collection bag. Samples were stored in labelled polypropylene packages, kept at 7-10°C and transported to the Food Analysis Laboratory. Solid and pasty samples were dehydrated until reaching humidity levels <10% for posterior analysis. Liquid samples such as milk, porridges and teas were analyzed from the humid base.

To determine the nutritional composition of the meals, analyses of humidity, ashes, proteins, and lipids were carried out in triplicate, in compliance with the Association of Official Analytical Chemists methods [26]. Sodium content was determined following the *Instituto Adolfo Lutz* methods [27]. Carbohydrates were determined by difference [27], and the total energy value was calculated according to the energy coming from macronutrients [28].

All the 123 food items offered to the children were classified by the authors according to their extent and purpose of food processing, based on the items composing the meal [8, 9]. Any disagreement or remaining doubt was clarified with the help of an expert. In this study, the sample unity was the meal as a whole, and not the food items and/or ingredients. The recipes' ingredients were evaluated to classify the meal according to the processing degree. Because of that, an adapted NOVA food classification was employed as explained below [29].

We analyzed the list of ingredients of each recipe/culinary preparation offered in the meals. We classified the meals into three groups, based on their food items or ingredients: (A) unprocessed foods, minimally processed foods, and culinary preparations, (B) processed foods, and (C) UPF.

Meals were classified into Group A if they were unprocessed foods, minimally processed foods, or culinary preparations made mainly with unprocessed or minimally processed foods (more than 50%). It includes all the ingredients added in recipes, including oil and salt. According to the NOVA classification, unprocessed foods are those derived directly from animals, plants, fungi, and algae in which no processing method was applied. Minimally processed foods, in turn, are unprocessed foods altered by minimal industrial processes, such as drying, crushing, boiling, and others processes that do not comprise substance addition [8, 9].

Examples of the culinary preparations from Group A in our study were rice, beans, soups, and meat, even if small quantities of UPF (such as powder industrialized ready-seasonings and industrialized tomato sauce) or processed foods (such as pickled peas and corn) were present in its composition. This author's choice was based on the number and quantity of ingredients that comprised those culinary preparations, which were mainly unprocessed or minimally processed foods. In this way, we concluded that we could not include a dish of rice and beans in the UPF group just because a small amount of industrialized ready-seasoning powder was added.

Meals would be classified into Group B if they were industrial products made by adding salt, sugar, oils, or fats to unprocessed or minimally processed foods. However, Group B ingredients (pickled peas and corn) were used only in small quantity in culinary preparations that were classified in Group A. In this way, after the meals classification process, we identified no meals to compose Group B.

Meals composed mainly of UPF were classified into Group C (more than 50% or which the main ingredient was ultra-processed, as industrialized porridge). According to the NOVA classification, UPF are industrial formulations resulting from a series of industrial processes, generally composed of a long list of ingredients, mostly of exclusive industrial use, such as casein, lactose, maltodextrin, high fructose corn syrup, and cosmetic additives to make products more palatable or hyper-palatable [8, 9]. Examples of this group in our study were industrialized bread, porridges, biscuits, concentrated juices, gelatin, instant noodles, milk flavored with chocolate, and yogurt. A spreadsheet with the complete data about meals and meals' ingredients, and the final NOVA classification is available in PDF at <https://encurtador.com.br/alzRT>.

The percentages of energy, macronutrients and sodium content from each meal group was determined according to the following equation:

$$\text{\% of Energy, macronutrient or sodium in the meal group} = \frac{\text{Energy, macronutrient or sodium in the group x 100)}}{\text{(Total Energy, macronutrient or sodium)}}$$

Where: "group" corresponds to Groups A and C, according to the degree of food processing; "energy, macronutrient, or sodium" corresponds to the calories (kcal), quantity of macronutrients (g) or sodium (mg) provided by school feeding from all food groups.

Data were organized using Microsoft Excel® spreadsheets (Microsoft Corporation, Washington, USA). Statistical analysis were performed using Stata® statistical software 14.0 (StataCorp, Texas, USA). Descriptive statistics were run to describe absolute and relative proportion according to the NOVA classification and contribution of groups to the total offer of energy, macronutrients, and sodium. Student's t-test with equal or unequal variances were applied for comparison between Groups A and C, based on the variables behavior. Group B was not included because we found no meals to be classified in it. Differences were considered statistically significant if $p<0.05$.

The project was approved by the Committee on Ethics in Research in Human Beings of the Health Science Sector of the Federal University of Paraná (UFPR, *Universidade Federal do Paraná*), CAAE n° 11460612.8.0000.0102, and authorized by the Department of Education, Culture and Sport of the municipality.

RESULTS

A summary classification of the food offered by the school feeding system is presented in Table 2. From the 123 samples, 61.0% (n=75) were classified into group of unprocessed/minimally processed/culinary preparations, and 39.0% (n=48) were classified into UPF group. Homemade meals were the most frequently food item offered from group of unprocessed/minimally processed/culinary preparations and were present every day (100%) at lunch and in eighteen out of twenty days (90%) at dinner. Furthermore, the most frequently offered product from UPF group was porridge, which was served every day for breakfast (100%) and in nine days as an afternoon snack (45%) (Tables 1 and 2).

In Figure 1, we can see an overview of the groups' contributions to the total energy and nutrients. Group of unprocessed/minimally processed/culinary preparations contributed more than 50% to energy, macronutrients, and sodium. The largest contributions from UPF group were energy (45.76%) and carbohydrates (48.93%).

Comparison of portion size, energy, and macronutrients and sodium content per serving, in total sample and by food group is presented in Table 3. The average served portion size were statistically equal between groups (p=0.404). Ultra-Processed Food group's food provided 112.84±59.59 kcal/serving, statistically higher than the unprocessed/minimally processed/culinary preparations group (p=0.026), and 20.87±11.72g of carbohydrates per serving, also statistically higher than the group of unprocessed/minimally processed/culinary preparations (p<0.001). On the other hand, group of unprocessed/minimally processed/culinary preparations meals were a larger source of sodium per serving (266.26±282.54mg per serving, p<0.001). There were no differences in protein and lipid offer per serving between groups (p=0.329 and p=0.325, respectively).

Table 2 – Foods offered by school feeding to children aged 12-36 months, according to the degree of processing. *Colombo* (PR) Brazil, 2013.

Meal description	Frequency		
	n	%	n/day
Group A (Unprocessed foods, minimally processed foods and culinary preparations)			
Handmade meals (rice and beans, vegetables, chicken, beef, and soup with or without meat)	38	30.9	1.90
Teas (fennel, mate, chamomile, mint, and chamomile with mint)	19	15.5	0.95
Fruits (banana, peeled apple and watermelon)	11	9.0	0.55
Handmade desserts (*sago*, chocolate cake with blackberry jam, and sweet rice)	3	2.4	0.15
Whole grape juice	2	1.6	0.10
Reconstituted milk formula	1	0.8	0.05
Handmade bread	1	0.8	0.05
Total Group A	75	61.0	3.75
Group C (Ultra-processed foods)			
Porridges (powdered milk, water, starches and refined sugar)	29	23.6	1.45
Industrialised biscuits	7	5.7	0.35
Industrialised bread with or without margarine	5	4.1	0.25
Jelly	2	1.6	0.10
Instant noodle soup	2	1.6	0.10
Reconstituted concentrated juice	1	0.8	0.05
Industrialised strawberry yogurt	1	0.8	0.05
Industrialised chocolate milk	1	0.8	0.05
Total Group C	48	39.0	2.40
Total	123	100	6.15

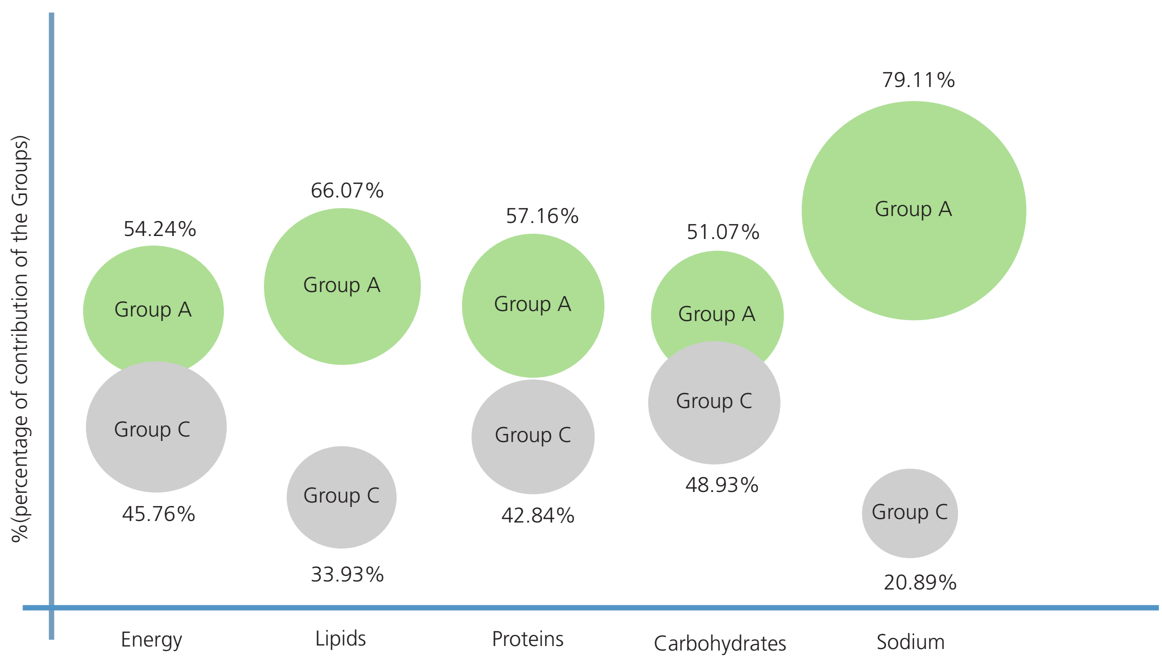

Figure 1 – Contribution of Groups A and C to the total offer of energy, macronutrients, and sodium by school feeding to children aged 12-36 months in child day-care centers. *Colombo* (PR) Brazil, 2013.
Note: Group A: unprocessed foods, minimally processed foods, or culinary preparations; Group C: ultra-processed foods.

Table 3 – Portion size, energetic density and portion's nutritional composition total mean and according to the degree of processing in school feeding. *Colombo* (PR), Brazil, 2013.

School feeding characteristics	Overview	Group A	Group C	*p*-value
	Mean±SD	Mean±SD	Mean±SD	
Portion size (g)	127.96±71.20	123.65±63.92	134.69±81.54	0.404*
Energy (kcal/ serving)	96.23±66.27	85.60±68.49	112.84±59.59	0.026*
Carbohydrates (g/serving)	16.64±10.65	13.94±8.99	20.87±11.72	<0.001†
Proteins (g/serving)	3.92±3.75	3.67±4.21	4.30±2.90	0.329†
Lipids (g/serving)	1.55±2.20	1.68±2.74	1.35±0.77	0.325†
Na (mg/serving)	205.22±247.13	266.26±282.54	109.85±132.69	<0.001†

Note: *student's t-test with equal variances between Groups A and C; †student's t-test with unequal variances between Groups A and C. Group A: unprocessed foods, minimally processed foods, or culinary preparations; Group C: ultra-processed foods; SD: Standard Deviation.

DISCUSSION

The aim of this study was to determine the contribution of UPF to the nutritional dietary profile of the meals served by the school feeding in public child day-care centers in *Colombo, Paraná*, Southern Brazil. 39% of the meals were classified as UPF. Meals classified as unprocessed, minimally processed, or culinary preparations contributed with more than 50% to energy, macronutrients and sodium. Meals from UPF group offered the largest content of energy and carbohydrates per serving, while the group of unprocessed/ minimally processed/culinary preparations provided the largest sodium content per serving.

Meals were classified predominantly as unprocessed/minimally processed/culinary preparations (61.0%), composing 100% of lunches and 90% of dinners. According to the Dietary Guidelines for the Brazilian Population [30], Brazilian feeding should be based on foods from this group, while food from UPF group should be avoided. The dietary guidelines for children younger than 2 years of age [31, 32] also state that industrialized foods should not be offered to children from this age group. Therefore, our results showed that the school feeding provided by the public child day-care centers offered mainly unprocessed/minimally processed meals/culinary preparations, which were served, on average, 3.75 times a day. Nonetheless, meals composed mainly of UPF, which should be avoided in this age group's feeding [31], were offered everyday (on average, 2.4 times a day).

Offering meals mainly from group of unprocessed/minimally processed/culinary preparations in school feeding is essential. This group has a lower degree of processing [8, 9], a higher amount of vitamins and minerals [29, 30], and a better nutritional profile [33]. However, the daily offering of UPF group meals impairs the school feeding quality.

Ultra-Processed Food usually have a higher energy density and glycemic load and large amounts of fat, sugars, and sodium [9, 33]. However, our findings do not endorse the amounts of fat and sodium expected. Our sample unity was the meal, including all the ingredients of the recipes. In this way, oil, butter, salt, industrialized ready-seasonings, and other fatty and salty ingredients were embedded in the culinary preparations group, increasing the amount of fat and sodium in this group.

School feeding programs must provide adequate and healthy meals, which use varied and safe ingredients that respect students' traditions [3-5]. In the light of the recent researches and the actual PNAE's rules, we understand that the daily offering of UPF by the school feeding contradicts the PNAE's aims, which support that the offering of healthy meals should promote the development of healthy food habits [3, 5].

When analysing the total energy and nutrient amounts offered to children, meals from group of unprocessed/minimally processed/culinary preparations were responsible for more than half of all parameters investigated, reaching almost 80% of sodium amount. Since culinary preparations were classified into this group, salt and industrialized ready-seasonings added during preparation were also included in the average nutritional composition. These are highly sodium-dense ingredients. In the studied child day-care centers, the cooks, in general, did not follow standardized recipes. Therefore, there were no control about how much ingredients (including salt and industrialized ready-seasonings) were being added. This demonstrates the need for training and supervision in the school feeding production.

Meals from UPF group, even though were only 39% of the meals, contributed to 45.8% of energy. The Family Budget Survey 2017-2018 (POF 2017-2018), which analyzed the daily food consumption of Brazilians older than ten years of age, found that UFP contributed to 19.7% of the calories consumed [34]. Children's energy requirements are lower than those of adolescents, adults, and the elderly. It is important to highlight that the POF 2017-2018 presents data about the daily food consumption, while our study investigates the school feeding offer. Nonetheless, we can note that UPF consumption is a common eating habit in Brazil. When we observe the data by age, the POF results indicate that UPF contributes to a higher percentage of calories among adolescents (26.7%) when compared to adults (19.5%) and the elderly (15.1%). UPF generally contains a high supply of fat, sugar, and consequently energy. In this way, we can conclude that UPF in childhood are even more aggressive to health than later in life.

Meals from UPF group contributed to 48.9% of carbohydrates content. In addition to carbohydrates found naturally in foods, sugar added to juices and porridges was also included here. Sugar addition contradicts the guidelines for feeding children younger than 2 [31,32], and could be avoided by offering fruits and drinks unsweetened, not offering UPF, and with strategies as using fruits and dry fruits to sweeten culinary preparations to children. Excessive consumption of UPF with high carbohydrate content during childhood may lead to obesity [35], a risk factor for obesity in adulthood. The percentage of calories found in this food group is larger than the percentage found in a population-based study, developed in Southern Brazil. In the referred study, with children younger than 2, 19.7% of the consumed energy were provided by UPF [36]. Furthermore, our findings are similar to a study developed in a basic health Unit, also in Southern Brazil. The authors found that 43.7% of energy consumed by children from two to 6 years old came from UPF [37]. This suggests that children have been routinely consuming UPF, which highlights the importance of schools offering better feeding to improve healthy eating habits in childhood.

The high quantity of energy and carbohydrates in food portions from UPF group corroborates with previous studies, confirming that UPF have this nutritional profile [6, 8, 33]. The contribution of UPF to total energy intake could be a risk of overweight and excess adiposity in adults [38]. The PNAE's restriction to UPF is a protective health regulation [3-5].

The high quantity of sodium per serving from the group of unprocessed/minimally processed/culinary preparations contradicts the expected for unprocessed/minimally processed foods. However, we highlight that culinary preparations are included in this food group and were made with a non-standardized addition of salt and industrialized seasonings. This indicates the need for standardization of recipes and training of cookers so as to offer an adequate amount of salt (and sodium) to the children. Another alternative approach could be creating school garden programs to produce locally natural seasonings. This could lead to a reduction in the industrialized seasoning use and give the opportunity to improve children's knowledge and attitudes related to the environment [39].

PNAE's laws restrict sugar, fat and sodium offer in school feeding. On the other hand, it obliges local governments to purchase part of offered foods from local family farmers [3, 5]. In this way, increasing family farming products offer and strengthening relationships with family farmers could improve school

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feeding nutritional profile, leading to healthier meals [40]. Considering Brazilian children are exposed to an UPF pattern at home [41], it is important that school feeding make meals healthier, to reach PNAE's aims to promote food security and to oppose the double burden of malnutrition, either undernutrition or overweight, obesity and diet-related chronic diseases [1].

Aiming to improve school feeding in public schools, the Brazilian government published, in 2020, a stricter resolution [4], which takes into account the magnitude and purpose of the processing food items. The Resolution FNDE n° 6/2020 [4] has to be enforced since January 2021 and states that school feeding should be based on *in natura* and minimally processed foods. In this way, the acquisition and use of industrialized ready-seasonings should reduce. To enable adherence to the rules, the Federal government should empower the municipalities and supervise the PNAE's execution.

This study has a few limitations. The NOVA classification was adapted to consider meal rather than food ingredients as the sample unity. Another point is that is not possible to extrapolate the findings, because data collection was conducted in just one municipality.

As a strength, we highlight the measurement methods for portion sizes, which were performed through direct weighting of ready-to-eat dishes, the determination of the nutritional composition through physicochemical food analysis, and the evaluation of twenty working days of menu, totalizing four weeks – which represents a month menu.

CONCLUSION

Ultra-Processed Food contributes to 45.8% of energy, 33.9% of lipids, 42.8% of proteins, 48.9% of carbohydrates, and 20.9% of sodium content from all sampled meals. Unprocessed foods, minimally processed foods, and culinary preparations are more prevalent in school feeding. However, UPF are offered daily in child day-care centers, contradicting PNAE's laws and Brazilian dietary guidelines (which ones we highlight that were published after data collection). Therefore, the local School Feeding Program executors need to improve the quality of the meals offered to children in these day-care centers, especially food choices at breakfast and snack, as UPF were served mainly in these meals (powder for porridge preparation, biscuits/cookies, industrialized bread, margarine, flavored gelatin, and industrialized chocolate milk).

It is necessary that the municipality reassess the composition of meals offered to children, following the current recommendations, considering that a new Resolution came into effect in 2021. Further researches should be conducted to follow up this matter.

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CONTRIBUTORS

A RETONDARIO worked in all stages of the research, such as project design, data collection, laboratory analysis and writing of the manuscript; MAO ALVES and SMR FERREIRA guided all steps of the research and the manuscript idealization. All the authors read, revised and approved the final version of the manuscript.

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