Parents' cooking skills confidence reduce children's consumption of ultra-processed foods

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A B S T R A C T

Ultra-processed foods are industrial formulations requiring little if any preparation before consumption. Their consumption is increasing in many countries and one of the possible determinants is the decrease in home cooking. As parents are key for family meals, we analysed the influence of parents' cooking skills confidence on children's consumption of ultra-processed foods at dinner. This is a cross-sectional study with 657 child-parent pairs from nine private schools in São Paulo, Brazil. Food consumption data were collected using two children's dinner dietary recalls while the Cooking Skills Index was used to collect parents' cooking skills, measuring their confidence in their own skills related to cooking 'from scratch', according to the Dietary Guidelines for the Brazilian Population. Food items were classified according to the NOVA classification system, considering the nature, extension and purpose of food processing. We used linear regression models to test associations between parents' cooking skills confidence and the contribution of ultra-processed foods to total energy intake at dinner, adjusting for socio-demographic variables. Parents' mean age was 38.3 and children's mean age was 7.8. These parents were mostly women, white, married, employed, with full secondary education and per capita household incomes up to ~ USD 320.00/month. They reached an average of 78.8 points (SD 14.8) in the Cooking Skills Index. Children's mean energy intake at dinner was 672.2 kcal (31.3% from ultra-processed foods). The increase in parents' cooking skills confidence was directly associated with decrease in consumption of ultra-processed foods ($\beta = -0.17$; $p = 0.007$), which remained after adjustment ($\beta = -0.15$; $p = 0.026$). These findings suggest that parents' cooking skills confidence potentially protect their children against ultra-processed foods, indicating the need for revaluing cooking to promote healthy eating.

1. Introduction

Eating plays an important role in building identity, reflects populations' cultures and encompasses diverse practices, including those related to preparing meals at home (Fischler, 2010; Maciel, 2001). However, given the changes in the current hegemonic food system, which end up reflecting in cooking practices and understanding, traditional food – composed of fresh foods and freshly cooked regular meals – is replaced with diet patterns that are strongly marked by consumption of ultra-processed foods (Garcia, 2003; Lang & Caraher, 2001; Monteiro, Moubarac, Cannon, Ng, & Popkin, 2013; Monteiro et al., 2018; , PAHO, 2015, p. 61; Popkin, 2006; Stuckler & Nestle, 2012; Willet et al., 2019).

Ultra-processed foods are industrial formulations of substances never – or rarely – used in cooking, which contain little or no whole food. They are designed to be convenient, and require little or no preparation before consumption (Monteiro et al., 2013, 2018, 2019). Their preparation involves a different set of skills, limited to assembling different ultra-processed products, customizing pre-packaged meals components or re-heating ready-to-consume full meals (Lang & Caraher, 2001; Short, 2006; Wolfson, Bleich, Smith, & Frattaroli, 2016). Because of that, ultra-processed foods are frequently time- and efforts-saving (Brunner, von der Horst, & Siegrist, 2010; Horning et al., 2017; Wolfson et al., 2016).

Ultra-processed foods are associated with low nutritional dietary quality, obesity and other chronic noncommunicable diseases, including in children (Monteiro et al., 2013; Louzada et al., 2015a; PAHO, 2015; Rauber, Campagnolo , Hoffman , & Vitolo, 2015; Steele, Popkin, Swinburn, & Monteiro, 2017; Mendonça et al., 2017; Cornwell et al., 2018; Fiolet et al., 2018; Melo et al., 2018; Rauber et al., 2018; Schnabel et al., 2019). Thus, the increasing consumption of such foods worldwide has become a target of public health nutrition policies (Brasil, 2014; Monteiro, Cannon, Lawrence, Costa Louzada, & Pereira Machado, 2019; PAHO, 2015, 2019).

The combination of the decreasing interest in home cooking and the deterioration in populations' cooking skills has been understood as possible mechanisms explaining the increase in consumption of ultra-processed foods (Beshara, Hutchinson, & Wilson, 2010; Brunner et al., 2010; Horning et al., 2017; Lam & Adams, 2017; Mills et al., 2017; Monteiro et al., 2015; Monteiro, Cannon, Levy, Moubarac, Louzada, & Rauber, 2019; PAHO, 2015), thus becoming an obstacle to be overcome in order to promote healthy eating among individuals and populations (Brasil, 2014; Castro et al., 2007; Hartmann, Dohle, & Siegrist, 2013; McGowan et al., 2017; Mills et al., 2017; Monteiro et al., 2015). However, studies about the skills involved in home cooking are still scarce and are mostly performed in high-income countries such as the United Kingdom (UK), the United States of America (USA) and Australia (McGowan et al., 2017; Mills et al., 2017; Trubek et al., 2017; Wolfson et al., 2016).

Home cooking is important for healthy food consumption among populations (Mills et al., 2017) and parents play a crucial role in the dynamics of family meals, to promote and maintain children's health (Ohly et al., 2013; Pearson, Biddle, & Gorely, 2009; Scaglioni, Arrizza , Vecchi , & Tedeschi , 2011; Yee, Lwin, & Ho, 2017). Therefore, this study aims to analyze – in an unprecedented way in Brazil – the influence of parents' confidence in their own cooking skills on their children's consumption of ultra-processed foods at dinner.

2. Methods

2.1. Participants

This is a cross-sectional study conducted with child/parent pairs from a private school chain in Brazil. It included 6–9 years old children from the chain's nine full-time schools located in the Greater São Paulo Area – one of the most populous regions of Brazil. During their period at school (Monday to Friday, 8 am-5 pm), the children were provided with three meals/day (midmorning snack, lunch, and afternoon snack), while parents or caretakers were responsible for the other meals.

In Brazil, the three main daily meals are breakfast, lunch and dinner. The last two are usually considered 'warm meals' composed by a variety of traditional Brazilian dishes, such as rice and beans, meat and salad (Brasil, 2014; Louzada et al., 2015a; Maciel, 2004). We chose to analyze only dinner because, in this population, it is the main meal prepared by parents during most days of the week.

To test the association between parents' confidence in their cooking skills and children's food consumption, sample size was estimated by considering power of test (80%), level of significance (5%), sample losses (40%, based on pilot study losses) and coefficient of determination ($r^2 = 0.02$, corresponding to 'small effect'). Sample calculation was performed on the sample calculator of the WinPepi application version 11.65, module Etcetera version 3.26 (Abramson, 2011) and resulted in 654 parent-child pairs. The children's sample was obtained by random cluster sampling in two selection stages: the first stage included nine schools while the second stage included Elementary Education classes from the 1st to the 4th year in those nine schools. Each class had 30 students on average, thus totaling 1130 potential children. All parents or caretakers of the 1130 children enrolled in the randomly selected classes were invited to participate in the study; 755 of them agreed to participate (33.2% refused at recruitment) and 660 completed the two

telephone interviews for data collection (12.6% loss).

The pairs were recruited through the schools. All children enrolled in grades 1 to 4 who were selected from the nine schools and their parents or other adults responsible for feeding them at home were considered eligible for the study. Adults paid to feed the children – for instance, nannies or domestic workers – were not included. When siblings attended the same school, which occurred in 1.1% of the cases, only one of them was included in the study. One child with hearing impaired parents had to be excluded since their condition prevented them from participating in data collection.

Since this study involved children's family members responsible for feeding them, who in most cases (98%) were their mothers (91%) or their fathers (7%), the term 'children's parents' is used to refer to the adult responsible for feeding children at home.

2.2. Data collection

Data collection was carried out in 2015 and consisted of two telephone interviews conducted by trained interviewers with all parents who agreed to participate in the study. Data on socio-demographic characteristics were collected in the first interview while data on cooking skills confidence were collected in the second interview. Both interviews collected data on children's food consumption.

A minimum number of attempts at telephone contact (n = 5) was established before considering a participant as lost. The instruments used in the interviews were computerized and tested for telephone application. Tests (pre-test, pilot study, and test-retest) were carried out in a school belonging to the same educational chain, which did not take part in this study but had similar characteristics and public (Martins, Baraldi, Scagliusi, Villar, & Monteiro, 2019). Since data collection involved all children enrolled in the selected classes whose parents accepted to participate in the study, exclusion of 20 children who did not meet age specifications (6–9 years old) occurred only during data analysis.

2.2.1. Food consumption

Children's food consumption data were collected through two food recalls applied on non-consecutive days – one for weekdays and one for weekend days – where parents reported everything their children had eaten and drunk at dinner the day before.

The study used software developed to collect 24-h food recalls adapted to the specificities of the NOVA food classification system (Martins, 2017), a classification based on the nature, extent and purpose of the industrial processing the food undergoes before its consumption (Monteiro, Levy, Claro, Castro, & Cannon, 2010, Monteiro, Cannon, Levy, et al., 2019). The software was developed based on the Automated Multiple-Pass Method (Moshfegh et al., 2008), but including the question "Has the food consumed been prepared by someone at home or purchased ready?" and prompts provided by the program during the application of the recalls, which facilitated the classification of items consumed according to the NOVA system. The answers recorded during the interviews were automatically entered into an online database that eventually generated an individual food bank with food items already converted into grams, energy and nutrients, and then classified according to NOVA groups and subgroups. The amounts were converted into energy and nutrients based on the nutritional composition table for foods consumed in Brazil (IBGE, 2011).

The NOVA system (•Monteiro, Cannon, Lawrence, et al., 2019) classifies food into four main groups: Group 1 – Unprocessed or minimally processed foods (ex. rice, beans, meat, fruit, vegetables, water, among others); Group 2 – Processed culinary ingredients (e.g. oils and fats, table sugar, honey, molasses, salt); Group 3 – Processed foods (e.g. canned vegetables, cereals, legumes or fish, with addition of salt, oil or sugar, salted and smoked meat, fruit in syrup, cheese and some types of bread); and Group 4 – Ultra-processed foods.

Ultra-processed foods (Monteiro et al., 2019) – the subject of this

study – are industrial formulations typically made with industrial ingredients not commonly used to prepare meals at home and which, due to their extensive degree of processing, keep virtually nothing from the whole foods (i.e. unprocessed or minimally processed foods) from which they originated. Examples of ultra-processed foods include soft drinks and artificial juices, ready-to-heat frozen products such as pre-prepared pies and pizzas, nuggets, sausages, hamburgers and other reconstituted meat products, instant noodles and soups, packaged snacks, packaged sandwich bread, mayonnaise and other ready-made sauces, infant formulas, sweet biscuits, cakes and cake mixes, breakfast cereals, chocolate-based powders, ice cream, chocolate, candies, sweets and instant desserts.

2.2.2. Cooking skills confidence

The Cooking Skills Index (Monteiro, Cannon, Levy, et al., 2019) was used to assess parents' confidence in their own skills. The index is based on the Social Cognitive Theory belief in self-efficacy (Bandura, 1977; Bandura, Azzi, & Polydoro, 2008) and the concept of cooking skills adopted by the Dietary Guidelines for the Brazilian Population (Brasil, 2014). It assesses people's confidence in performing ten cooking skills related to preparing meals 'from scratch', that is, from unprocessed or minimally processed foods and using natural seasonings or spices and culinary ingredients such as salt, sugar and fats. Each of the ten skills is ascribed scores according to respondents' confidence in their own skills, using the question "How confident do you feel about …" and a four-point scale with the following answer choices: 0-not confident, 1-little confident, 2-confident, and 3-very confident. The sum of the scores is transformed into a 0-100-point scale summarizing one's confidence about performing the skills included in the Cooking Skills Index, which considers that the higher the score, the greater one's confidence (Martins et al., 2019).

2.2.3. Sociodemographic variables

The sociodemographic variables collected included: sex and age of adults and children; adults' kinship to children, race/color, marital status, education and employment status; number of children at home, and per capita household income.

2.3. Data analysis

The analyses included the 657 parent-children pairs with complete data for the main variables of interest: parents' confidence in their cooking skills and children's food consumption.

Sociodemographic variables were used to describe the sample and as controlling variables in regression models. Adults were characterized according to the following variables: sex (male; female), kinship (mother, father, other), age/age group (years, continuous, categorical: 22–30, 31–41; ≥42 years old), race/color (white: yes/no), marital status (married/lives with partner: yes/no), education (elementary; secondary; higher); employment status (employed: yes/no); characterization of children: sex (male/female) and age/age group (years, continuous, categorical: 6–7, 8–9); and characterization of families: number of children in the household (1; 2 or more) and per capita household income (in Brazilian currency; continuous; categorical; in Brazilian minimum wages: < 0.5 minimum wage, 0.5–1 minimum wage; ≥ 1–3 minimum wages; ≥ 3 minimum wages).

Parents' confidence about performing each skill in the Cooking Skills Index was described as mean and standard deviation. The scores obtained in each skill and in the set of skills assessed by the index were transformed into a continuous variable and presented as mean scores with their respective 95% confidence intervals.

The core indicator used to describe the magnitude of consumption of ultra-processed foods was the mean relative (%) energy contribution of these foods and their subgroups to children's total energy intake at dinner. Estimates were based on intake informed for the two days on which the recalls were applied (a weekday and a weekend day). In

Table 1
Cooking Skills Index (CSI) according to sociodemographic characteristics. Parents of children living in the Greater São Paulo Area, SP, Brazil, 2015. (n = 657).

Variables	n*	CSI	
		Mean	Standard deviation
Sex of parents			
Male	42	77.0	14.5
Female	615	78.9	14.8
Age of parents			
22-30	64	76.9	14.4
31-41	401	79.4	14.9
42-82	189	78.0	14.5
Race/color of parents – white			
No	247	77.5	14.9
Yes	402	79.5	14.7
Marital status of parents – Married/With partner			
No	77	78.3	13.8
Yes	579	79.9	14.9
Educational level of parents			
Full elementary education	42	79.3	14.0
Full secondary education	356	78.0	14.9
Full higher education	258	79.8	14.7
Employment status of parents – Employed			
No	188	78.9	14.8
Yes	467	78.7	14.8
Number of children in the household			
1 child	419	78.7	14.9
2 children or more	233	78.3	14.6
Household income (R$/per capita)			
Up to minimum wage	131	75.5	14.4
1–3 minimum wages	336	78.9	15.0
Over 3 minimum wages	121	80.1	14.2

CSI: Cooking Skills Index (allows for 0-100-point variation). * For some variables the total number of observations is not 657 due to missing values.

order to consider the contribution of different days of the week to the usual intake, the children's average intake was estimate as following: recalls corresponding to weekdays were multiplied by five and those corresponding to weekend days were multiplied by two; the sum of the two results was divided by seven.

Linear regression models – both crude and adjusted for sociodemographic variables – were used to analyze the relationship between the Cooking Skills Index (explanatory, continuous variable) and the contribution of ultra-processed foods to children's food consumption at dinner (outcome, continuous variable). All statistical analyses were performed using Stata survey module (version 14) (Stata Corp., College Station, United States).

3. Results

Parents were predominantly women (93.6%), of whom 91.2% were mothers, aged 31–41 (61.3%), white (62.2%), married (88.3%), with educational level equivalent to full secondary education (54.3%) and formally employed (71.3%). Most households had only one child (64.3%) and per capita income between one and three minimum wages (57.1%) (Table 1), and more than 75% were composed by the mother, father and one or two children (data not shown). The children were predominantly female (51.5%) in the 5–7 age group (53.9%) (data not shown).

3.1. Parents' confidence in their cooking skills

Table 2 shows parents' level of confidence in their performance in each of the skills of the Cooking Skills Index as well as their mean scores in each skill and in the set of skills assessed. Overall, participants reported a high level of confidence about performing all cooking skills assessed, resulting in a high mean score for the Cooking Skills Index

Table 2

Confidence in cooking skills (%) and mean score (95% CI) obtained in each skill and in the set of ten skills assessed by the Cooking Skills Index (CSI). Parents of children living in the Greater São Paulo Area, SP, Brazil 2015. (n = 657).

Cooking skills	Confidence in cooking skills				Mean score	IC 95%
	Not confident	Little confident	Confident	Very confident		
	%	%	%	%		
1. Sauteing food	0.2	2.9	40.3	56.6	84.5	83.0; 85.9
2. Oven-baking/Roasting	0.3	9.1	46.3	44.3	78.2	76.4; 79.8
3. Seasoning meat using only natural seasonings	1.5	5.5	37.3	55.7	82.4	80.6; 84.1
4. Following a simple recipe	0.2	2.7	47.2	49.9	82.3	80.8; 83.7
5. Making a homemade tomato sauce using only tomatoes and natural seasonings	10.9	22.7	34.4	32.0	62.5	59.9; 65.0
6. Preparing a homemade soup	1.0	4.9	45.5	48.6	80.6	78.9; 82.1
7. Cooking beans in pressure cooker	0.2	4.2	43.7	51.9	82.4	81.0; 83.9
8. Grilling meat	3.9	9.0	45.2	41.9	75.0	73.0; 77.0
9. Preparing a simple homemade cake	2.3	5.6	47.0	45.1	78.3	76.5; 80.0
10. Preparing lunch or dinner by combining foods and spices already existing in the house without a recipe	1.2	4.5	41.6	52.7	81.9	80.3; 83.5
CSI (all skills)	-	-	-	-	**78.8**	**77.7; 80.0**

CSI: Cooking Skills Index (allows for 0–100 point-variation). 95% CI: 95% confidence interval.

(78.8 points) – corresponding to approximately 80% of the potential scoring. The exception was the cooking skill 'Making a homemade tomato sauce using only tomatoes and natural seasonings', which resulted in a mean score of 62.5 points.

3.2. Children's dinner

Children's mean energy intake at dinner was 672.2 kcal, approximately one third (31.3%) of which came from ultra-processed foods, especially sugary drinks and sweets (Table 3).

3.3. Parents' confidence in their cooking skills and children's consumption of ultra-processed foods at dinner

Fig. 1 shows the association between parents' confidence in their cooking skills as measured by the Cooking Skills Index and their children's consumption of ultra-processed foods at dinner. In this population, parents' confidence in their cooking skills was inversely related to the share of ultra-processed foods in children's dinner. The ten-point increase in the Cooking Skills Index determined the decrease of 1.5 percentage points in the share of ultra-processed foods in that meal (crude $\beta = -0.17$, p = 0.007, adjusted $\beta = -0.15$, p = 0.026) (data not shown).

4. Discussion

This is the first study assessing Brazilian parents' cooking skills and investigating the association between parents' confidence in those skills and consumption of ultra-processed foods by their children. The findings showed that parents – especially mothers – were responsible for feeding children at home in most cases. They had a high level of confidence in their cooking skills (nearly 80% of the potential score in the Cooking Skills Index). The higher the parents' confidence in their cooking skills, the lower their children's consumption of ultra-processed foods at dinner.

Studies on cooking skills confidence are incipient, especially those conducted in countries undergoing rapid nutrition and socioeconomic transitions but where fresh foods and freshly cooked regular meals are still common, such as Latin American countries (McGowan et al., 2017; Mills et al., 2017; Monteiro et al., 2018). The studies available – mostly from high-income countries and using instruments designed to measure cooking skills confidence in those contexts – found results similar to those of our research, with reports of high cooking skills confidence among the populations studied (McGowan et al., 2017; Mills et al., 2017). However, because there is no consensus in literature regarding

the definition of cooking skills (Caraher, Dixon, Lang, & Carr-Hill, 1999; Jomori et al., 2018; Lang & Caraher, 2001; McGowan et al., 2017), and considering that cooking practices are culturally influenced (Fischler, 2010; Maciel, 2001), comparisons have to be carefully made.

This research was developed in Brazil. Brazil is a middle-income country where traditional cuisine – composed of fresh foods and freshly cooked regular meals – is common (Brasil, 2014; Louzada et al., 2015a; Martins, Levy, Claro, Moubarac, & Monteiro, 2013) and where cooking those types of foods is still less expensive than buying ultra-processed foods (Claro, Maia, Costa, & Diniz, 2016). This study used an instrument developed to assess confidence in skills related to cooking 'from scratch' – type of cooking aligned with the healthy eating recommendations of the Dietary Guidelines for the Brazilian Population (Brasil, 2014). It found that parents' confidence in their skills was relatively high; only one of the ten questions in the index presented mean score close to 60 points: 'Making a homemade tomato sauce using only tomatoes and natural seasonings'. A study conducted in Switzerland - a high-income country - with 4436 adults also found that subjects had high confidence in their own cooking skills, but one of the skills in which they had the highest confidence was 'preparing sauce' (Hartmann et al., 2013). In addition to the sociocultural differences between the two contexts, it is important to point out that the Swiss study did not specify the type of sauce that was being assessed – whether it was prepared 'from scratch' or from ultra-processed ingredients – which makes it difficult to compare with our study.

Also in the UK, which is a reference in nationwide studies on cooking skills, the two populational studies assessing adult confidence about these skills – one from the early 1990s (Caraher, Dixon, Lang, & Carr-Hill, 1999) and the other from 2008 to 2009 (Adams et al., 2015) – found high levels of confidence in performing the skills assessed (using eight cooking techniques and preparing ten types of food). However, in the most recent study (Adams et al., 2015; Lam & Adams, 2017), only half of the 509 adults interviewed felt confident in using all techniques and preparing all foods assessed; and the skill they felt the lowest confidence to perform was preparing pulses (60.4%). The opposite was observed in our study, where preparing beans was one of the skills adults felt most confident to perform (82.4 points in the Cooking Skills Index). This is not surprising since culinary preparations based on rice and beans are the basis of traditional Brazilian meals (Doria, 2014; Louzada et al., 2015a), while beans consumed in the UK are usually canned – regardless of being processed or ultra-processed (Rauber et al., 2018).

In spite of being in line with international findings, our results differ from another study conducted with university students from a state capital in southern Brazil (n = 767), where less than a third of the

Table 3

Mean absolute and relative energy intake at dinner according to NOVA groups and subgroups. Children aged 6–9 living in the Greater São Paulo Area, SP, 2015 (n = 657).

NOVA food groups	Kcal at dinner	% of total energy intake at dinner (CI 95%)
Unprocessed and/or minimally processed foods and their culinary preparations	**427.5**	**65.5 (63.6; 67.4)**
Rice	83.6	13.4 (12.7; 14.1)
Beef or pork	65.7	10.0 (9.0; 11.1)
Beans	55.2	8.2 (7.5; 8.8)
Poultry	49.6	7.6 (6.5; 8.6)
Fruit juices	25.2	3.9 (3.3; 4.4)
Bread, sandwiches and other snacks[a]	21.5	3.0 (2.3; 3.8)
Fruit	19.7	3.0 (2.6; 3.5)
Spaghetthi and other pastas[b]	14.4	2.4 (1.8; 3.1)
Potatoes	14.6	2.1 (1.7; 2.5)
Milk and natural yogurt	14.0	2.1 (1.6; 2.6)
Vegetables	13.0	2.1 (1.8; 2.3)
Soups	11.1	2.0 (1.4; 2.6)
Cakes	12.8	1.8 (1.3; 2.2)
Eggs and egg-dishes	6.2	1.0 (0.7; 1.2)
Others[c]	21.0	2.9 (2.3; 3.5)
Processed foods	**22.1**	**3.2 (2.6; 3.8)**
Fresh bread	11.6	1.8 (1.3; 2.2)
Cakes and pies	5.1	0.6 (0.3; 0.9)
Cheese	1.6	0.3 (0.1; 0.4)
Others[d]	3.8	0.5 (0.3; 0.7)
Ultra-processed foods	**222.6**	**31.3 (29.5; 33.1)**
Sugary drinks[e]	74.7	11.0 (10.1; 11.8)
Sweets[f]	61.6	7.6 (6.6; 8.7)
Sausages, nuggets and other reconstituted meats	27.2	3.9 (3.2; 4.6)
Sandwiches and other snacks[g]	25.1	3.9 (3.0; 4.8)
Instant noodles and other ready dishes[h]	22.8	3.3 (2.5; 4.0)
Others[i]	11.2	1.6 (1.3; 2.0)
Total	**672.2**	**100.0**

95% CI: 95% confidence interval.

[a] Includes pizza, homemade filled snacks, and sandwiches made with homemade bread.

[b] Includes spaghetti and/or other pasta – homemade or made from wheat flour, with or without eggs, such as lasagna, pancakes, gnocchi, cannelloni.

[c] Includes preparations based on cassava, corn, fish or mixed preparations without identifying the main food, chicken and bovine viscera, nuts/seeds, other cereals (e.g. oat), honey/molasses and other homemade sweets.

[d] Includes *paçoca* (peanut-based sweet), sweet and salty biscuits, chocolate with more than 50% of cocoa.

[e] Includes artificial juices, soft drinks and other beverages such as chocolate milk in carton, dairy drinks and yogurts with colors, flavorings, thickeners and other ingredients for industrial use only.

[f] Includes chocolates, ice creams, jellies, candies and other sweets, sweet biscuits and cakes produced with colors, flavorings, thickeners and other ingredients exclusively for industrial use.

[g] Includes hot dog, cheeseburger and other similar sandwiches, including those made with industrial packaged breads, pizzas, bread and filled salty snacks, whether fried or oven-baked, produced with colors, flavorings, thickeners and other ingredients for industrial use only.

[h] Includes cereal-based dishes (e.g. corn, wheat, oat), ready-to-eat *farofas* (toasted cassava flour) and potato chips produced with colors, flavorings, thickeners and other ingredients for industrial use only.

[i] Includes packaged snacks, salty biscuits, breakfast cereals, margarine, cream cheese and other industrialized sauces such as mayonnaise, ketchup and shoyu.

sample – also made up mostly of women (59.6%) but in their twenties – reported high confidence in all cooking skills assessed (confidence in cooking and using different cooking techniques) (Jomori et al., 2017). As cooking skills are developed within sociocultural contexts, rather than solely individual characteristics and intentions (Fischler, 2010; Maciel, 2004; Trubek et al., 2017), such disparity is a warning sign about possible generational changes in the understanding and practice
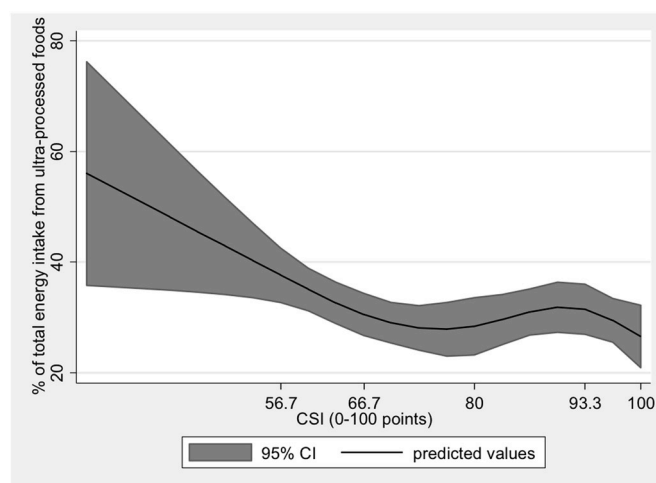
Fig. 1. Analysis of the association between the share of ultra-processed foods in children's energy intake at dinner and their parents Cooking Skills Index (CSI), adjusted for socio-demographic variables. Parent/child pairs living in the Greater São Paulo Area, SP, 2015. (n = 585)

CSI: Cooking Skills Index (allows for 0-100-point variation). 95% CI: 95% confidence interval.

The values shown on the x axis correspond to the lower (33.3) and upper (100) limits of CSI variation in the sample and to the following CSI percentiles: 5, 25, 50, 75 and 95 – p95 corresponds to 100 points. Adjusted for sociodemographic variables: adults' sex, age, race/color, marital status, education, and employment status; and per capita household income and number of children per household.

of cooking in Brazil, such as the cooking transition process seen in British reality (Lang & Caraher, 2001).

In Brazil, ultra-processed foods are being incorporated into daily meals to replace traditional foods (Louzada et al., 2015a; Martins, Levy, Claro, Moubarac, & Monteiro, 2013). In our study, 31% of the calories consumed by children at dinner already came from ultra-processed foods. Also, we observed that parents' high confidence in their cooking skills potentially protects their children against consumption of ultra-processed foods. Such finding supports the recommendations of the Dietary Guidelines for the Brazilian Population (Brasil, 2014), which encourages the development of cooking skills as tools for protection and promotion of adequate and healthy eating in Brazil.

Evidence from international studies support our findings. A review conducted on 11 cross-sectional studies addressing home cooking skills (McGowan et al., 2017) found association between cooking skills and healthier food choices in seven of them, including decreased consumption of convenience and take-away food. Another study conducted with adults in the UK (Lam & Adams, 2017) found that individuals who were confident preparing some foods, including red meat, pulses, pasta and vegetables, used to consume significantly fewer calories from ultra-processed foods. Furthermore, among working mothers of Australian children (Beshara et al., 2010), confidence in preparing certain types of unprocessed and minimally processed foods was related to decrease in consumption of food from fast-food restaurants. It seems that feeling confident in their own skills can facilitate the transformation of the intention to cook into effectively cooking (McGowan et al., 2017; Mills et al., 2017; Trubek et al., 2017). On the other hand, a lower level of confidence in their cooking skills does not mitigate the capacity of a person to be fed (or to feed others), although this may reflect on the lower healthiness of their meals. American parents with low confidence for preparing meals at home argued that this was one of the main reasons for buying pre-packaged, processed meals and offering them to their children (Horning et al., 2017).

Although cooking from scratch is often considered the healthier type of cooking, in some cuisines the preparation of meals by

assembling ultra-processed foods with non-ultra-processed foods (natural, minimally processed, processed foods and culinary ingredients) is considered as a kind of cooking named 'semi-scratch cooking' (Brunner et al., 2010; Wolfson et al., 2016). The Brazilian Dietary Guidelines encourages home cooking as an emancipatory competence to promote healthy eating (Brasil, 2014), but the preparation of ultra-processed foods is not considered part of those health-promoting cooking skills. Furthermore, in the Latin America region, the consumption of ultra-processed foods has been discouraged (Brasil, 2014; PAHO, 2015, 2019, pp. 1–57), given the growing evidence on the harms of these foods to populations' health (Wang & Lim, 2012; Monteiro, Moubarac, Cannon, Ng, & Popkin, 2013, 2018; Louzada et al., 2015b; Rauber et al., 2015; Steele et al., 2017; Mendonça et al., 2017; Fiolet et al., 2018; Melo, Rezende, Machado, Gouveia, & Levy, 2018; Kim, Hu, & Rebholz, 2019; Cornwell et al., 2018; Schnabel et al., 2018; Monteiro, Cannon, Levy, et al., 2019; Schnabel et al., 2018).

Therefore, our study bridges knowledge gaps by generating evidence that strengthens the positive role of cooking skills confidence related to cooking 'from scratch' against consumption of ultra-processed foods. It also contributes to scientific knowledge by presenting results from a context outside the axis of high-income countries, where most of the studies on the subject have been conducted. Other strengths of the study were the use of a food recall adapted to the NOVA system – which minimized errors in food classification during data collection – and the Cooking Skills Index – which assesses cooking skills that help implementing recommendations of the Dietary Guidelines for the Brazilian Population and synthesizes skills in a 0-100-point scale, thus making interpretation of the results easier.

However, some limitations should be considered when interpreting its results. This is a cross-sectional study and thus causation cannot be determined. These results refer to a specific population (child-parent pairs from private schools from one Brazilian Metropolitan Area), and therefore is not representative of the Brazilian population as well as cannot be widely generalized given the diversity and specifics of cooking in different sociocultural contexts. Despite of this, there is no apparent reasons to expect that the direction of the association between parents' cooking skills confidence and consumption of ultra-processed foods found in our study would be different in samples including children with different socioeconomic characteristics in Brazil (e.g. from public schools).

By stressing the importance of home cooking skills as tools for protection and promotion of healthy eating, our findings also highlight the crucial role played by the home environment in improving and sharing those skills. Therefore, for populations that still cook at home often – as is the case in this study – we recommend that actions and interventions encourage cooking practices that promotes health and protect against consumption of ultra-processed foods. Yet, promoting cooking skills in Brazilian households should also consider that women are still responsible for all the housework, including planning and preparing meals (Sousa & Guedes, 2016). The uneven division of tasks is not limited to Brazil (Beshara et al., 2010; Thofholz et al., 2018). Thus, we also advocate that preparing meals at home should be a family activity, stressing the importance of equitable division of tasks and the inclusion of children in the process, as also recommended in the Brazilian Dietary Guidelines (Brasil, 2014).

However, we are aware that cooking skills confidence is only one factor determining ultra-processed food consumption (Almeida, Scagliusi, Duran, & Jaime, 2018; Mills et al., 2017; Moran, Khandpur, Polacsek, & Rimm, 2019; Wolfson, Ramsing, Richardson, & Palmer, 2019). Frequently, ultra-processed foods are accessible (Borges, Cabral-Miranda, & Jaime, 2018), affordable (Moubarac et al., 2013) and aggressively marketed (; Kelly et al., 2019; Ni Mhurchu et al., 2016; Zorbas et al., 2019). In some cases, people buy ultra-processed foods due to their familiarity and long shelf-life (Moran et al., 2019). These characteristics may also induce the displacement of freshly prepared meals (Monteiro, Cannon, Levy, et al., 2019; Pan American Health Organization PAHO, 2015).

Given the challenges posed by the current hegemonic food system (Lang & Caraher, 2001; Monteiro et al., 2013, 2018; Popkin, 2006; Stuckler & Nestle, 2012; Willet et al., 2019), we agree with international call for of policies to guarantee accessibility and affordability to healthier foods, as unprocessed and minimally processed foods (Mills et al., 2017; Willet et al., 2019; Wolfson et al., 2019, Monteiro, Cannon, Lawrence, et al., 2019, pp. 1–44). Equally important are actions aimed at warning families against misperception about healthiness of ultra-processed foods and the potentially harmful impact of replacing homemade preparations with such foods (Ares et al., 2016; Munsell, Harris, Sarda, & Schwartz, 2016; Vartanian, Schwartz, & Brownell, 2007), and advocating the maintenance and rescue of home cooking.

Finally, considering that the scarcity of national studies about cooking and its impact on the population's health restricts real possibilities of acting and directing the agendas for food and nutrition policies (McGowan et al., 2017; Mills et al., 2017), we recommend expanding the body of evidence on home cooking as a proposal for the continuity of this study, highlighting the importance of generating nationwide evidence not only in Brazil but also in other contexts, especially in Latin America.

5. Conclusion

For the first time in Brazil, this study examined the relationship between parents' confidence in their cooking skills and children's consumption of ultra-processed foods. In the population studied, children whose parents were more confident in their cooking skills consumed less ultra-processed foods. Such findings reinforce the need to revalue home cooking and encourage the development of cooking skills related to preparing meals from unprocessed or minimally processed foods and culinary ingredients as relevant measures to promote and protect adequate and healthy eating among children.

Ethics approval and consent to participate

This research was approved by the Committee for Ethics in Research of the School of Public Health, University of São Paulo (CAAE: 25962213.9.0000.5421). Written informed consent was obtained from all parents who accepted to participate. These protocols are in accordance with the Declaration of Helsinki (2013) and ensure subjects' right to quit the study at any point in time.

Consent for publication

Not applicable.

Availability of data and material

The manuscript was developed as part of the principal author's PhD thesis. The datasets generated and analysed during the current study are not available, but the materials can be accessed at: http://www.teses.usp.br/teses/disponiveis/6/6138/tde-04092017-152620/pt-br.php.

Conflicts of interest

The authors declare that they have no competing interests.

Authors' contributions

CAMartins and CAMonteiro were responsible for the conception and design of the study as well as data analysis and interpretation; CAMartins wrote the first draft of the manuscript; PPM, MLCL and RBL contributed in writing the manuscript, analysis and interpretation of data; PPM, MLCL, RBL and CAMonteiro revised each draft for important intellectual content. All authors approved this version for publication.

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