Associated factors with early introduction of ultra-processed foods in feeding of children under two years old

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Abstract *Objective: To verify the association of maternal and anthropometric factors with consumption of ultra-processed foods in children between 4 to 24 months. Methods: cross-sectional study with 300 children hospitalized in a tertiary hospital and their mothers. The interview took place during the first 72 hours of hospitalization to avoid interference in the responses about the child's diet. Maternal factors investigated: age, schooling, income, parity, BMI and guidance on complementary feeding. Variables related to the child investigated: age, breastfeeding, infant school, BMI/age, height/age, weight/age and introduction of ultra-processed food. The association between the factors studied and introduction of ultra-processed food was tested by linear regression. The significance level considered was 0.05. Results:. It was verified that only 21% of the children had not yet received any type of ultra-processed food, and 56.5% received any of these foods before 6 months. In the multivariate analysis, maternal schooling, family income, maternal age and parity were associated with ultra-processed food supply. Conclusions: The feeding practices of children between 4 and 24 months are inadequate when compared to the recommendations for the age group.*

Key words *Food consumption, Fast foods, Snacks, Infant nutrition*

Introduction

Over the last decades there have been changes in the eating habits of the Brazilian population mainly characterized by the substitution of homemade food and *in natura* for processed and ultra-processed food (UPF)[1], being these introduced earlier in infant feeding[2-4].

Such foods are nutritionally unbalanced because they have a high energy density, a high amount of fat, sugar and/or sodium, low fiber, in addition to going through several processing stages and addition of many ingredients to increase durability and palatability[1].

This change in the Brazilian population's diet is one of the main causes of the current pandemic of obesity and chronic diseases[5]. In child population, obesity is also being related to early and inadequate introduction of complementary foods (CF) and with early weaning from breastfeeding (BF)[6]. The impact of the introduction of obesogenic diets during the early stages of development also has long-term effects on the health of infants, predisposing them to the development of chronic diseases in adult life[7].

The benefits of breastfeeding are already well established, regardless of income. The increase in this practice can play an important role in improving nutrition, education and health of the mother and the baby[8]. According to the recommendations of the Ministry of Health of Brazil, the child should receive breast milk (BM) exclusively until the six months of life and supplemented up to two years or more. From six months of life, the gradual and daily introduction of complementary foods should begin, which should be based on *in natura* foods, obtained directly from plants and animals, such as fruits, vegetables, greens, eggs, meat, tubers, grains and cereals. Before the two years of life one still must avoid consumption of UPF, such as sodas, processed juices, salty snacks, processed meat and sweets, once the consumption of these foods is associated with anemia, excess body weight and food allergies[9]. Due to the innate preference for the sweet taste, offering foods with added sugar or with large amounts of energy leads the child to be uninterested in cereals, fruits, vegetables and greens[10]. However, BF and the correct introduction of CF predict a better acceptance of these *in natura* foods[11].

The first two years of life are essential for encouraging and adopting healthy eating habits and for prevention of chronic diseases later in life, as the eating habits established at this stage of life tend to remain in adult life[10]. In this context, the strong influence of maternal and family characteristics on the formation of eating habits[12,13] is noted, since mothers with inadequate eating habits will hardly establish an adequate nutrition for their children[14]. Thus, the aim of this study was to verify the association of maternal and anthropometric factors with the consumption of ultra-processed foods in children from four months to two years old hospitalized in Porto Alegre, Rio Grande do Sul.

Methods

A cross-sectional study carried out in a tertiary hospital in the city of Porto Alegre, Rio Grande do Sul, from March 2012 to July 2013. This study is part of a research entitled "Maternal knowledge about feeding in the first years of life and its relation to the introduction of complementary foods to children aged 4-24 months hospitalized in Porto Alegre."

Included in the study were children of both sexes, aged between four to twenty-four months, accompanied by their mothers and admitted to the pediatric unit or pediatric emergency due to acute complications such as respiratory diseases, gastroenteritis, urinary tract infections and elective surgical situations such as hypospadias, herniorrhaphy, orchidopexy, among others. Children with enteral and parenteral nutrition and those who presented any chronic complication that might interfere with eating and growth, such as neurological and genetic diseases, allergies or food intolerances, were excluded from the study. Also excluded were children with mothers aged less than 18 years-old unaccompanied by an adult responsible and those to whom BF was contraindicated, such as seropositive mothers for the human immunodeficiency virus and under anti-neoplastic treatment.

The calculation of the sample size was based on the II Maternal Breastfeeding Prevalence Survey of the Ministry of Health, 2009[15]. Using a 95% confidence interval, 5% margin of error, statistical power of 80% and considering that 21% of the children between three and six months had already been introduced CF, the minimum sample of 255 pairs of mothers and children was reached.

The data collection took place during the first 72 hours of hospitalization so that there was no interference of the hospital's diet during the questions about the child's eating habits. The

data collection was performed by resident nutritionists and nutrition scholars, who were enabled to apply the structured questionnaire related to the variables under study. The maternal variables studied were age, schooling, family income, parity, body mass index (BMI) and if they received orientation about CF. The variables related to the child were age, BF, attendance to nursery school, body mass index for age (BMI/A), height for age (H/A), weight for age (W/A) and introduction of UPF.

In relation to the UPF, the introduction of the following foods was analyzed: chocolate milk, yogurt, *petit suisse* cheese, biscuits, stuffed biscuits, salty snacks, processed juice and soda, sweets, jello and processed meat. The foods questioned were selected according to the definition of UPF present in the Dietary Guidelines for the Brazilian Population[1].

For the evaluation of the current nutritional status of the children the information used was weight and length, collected from the chart. For classification, the curves for H/A, BMI/A and W/A of the 2006 World Health Organization were used. The z-score standard was used, considering for BMI/A and W/A respectively: < -2.00 standard deviations (SD) as underweight for age, between −2.00 and +2.00 SD as eutrophy/adequate weight for the age, ≥ +2.00 SD as excess weight/high weight for age; and for H/A: <-2.00 SD as low height and ≥ -2.00 SD as adequate height for the age. For classification of preterm born children was used at corrected age.

Maternal age was divided into ≤19 years old, between 20 and 34, and ≥ 35 years old. Maternal educational level was categorized up to 8 years (low schooling), between 9 and 11 years and ≥12 years of schooling. The family income was defined according to the system of points of the Brazilian Economic Classification Criteria[16], being considered as high family income the classes A and B, average the class C and low the classes D and E.

The maternal BMI was calculated from weight and height measured on the day of the interview in a procedure room of the hospitalization unit. The mothers were invited to go to the room to gauge the data. The weight was measured in duplicate, in a digital scale with a capacity of 150kg, and the average value of the two measurements was used to calculate the BMI. Height was measured with a fixed anthropometer, and it was also performed in duplicate, being accepted values with a maximum of one centimeter of difference. For classification, we considered the cut-off

points proposed for adults of the World Health Organization[17], being those low weight the BMI <18.5 kg/m², eutrophic between 18.5 and 24.9 kg/m² and excess of weight above 25 kg/m². The cases in which the mother did not accept to perform the above measurements were disregarded for linear regression analysis.

The analyzes were carried out in the *Statistical Package for the Social Sciences Program* (SPSS) version 18.0. To characterize the sample, we used for the categorical variables absolute percentage and absolute number of individuals, and for the quantitative variables, average and standard deviation or median and interquartile range. The association between the factors studied and the consumption of UPF was tested using a linear regression model. The variables that presented p<0.20 in the univariate analysis were considered in the multivariate analysis .The assumptions of the model analyzed: normality, linearity and homoscedasticity. The assumption of normality was evaluated by the analysis of the adjusted residue; linearity and homoscedasticity were evaluated by graphical inspection; In addition, collinearity was assessed by VIF. All the assumptions were fulfilled to use the model. The significance level considered was 0.05.

The ethical issues of the present study follow the Directives and Norms Regulating of Research Involving Human Subjects (Resolution 466/2012) and submitted to evaluations of the Research and Graduate Group and the Research Ethics Committee of the Hospital de Clínicas de Porto Alegre (HCPA), approved under protocol number 12-0080 .Confidentiality was assured regarding identity, privacy and confidentiality of the data obtained.

Results

Enrolled in the study were 300 pairs of mothers and children. In relation to the variables that did not reach full sample (n = 80, 26.6%), this is due to the mothers' refusal to temporarily leave their children because the anthropometric measures were performed in the unit's procedure room. As for the other variables, the losses are due to the negative response of the mother.

The average age of the children was of eight months (5-12). Table 1 presents the characteristics of mothers and children, presenting 59.3% (n=178) of male children. More than half of the children younger than six months of age were in BF (57.1%); however, only 25% of those (n=11)

Table 1. Characterization of the sample of mothers and children between 4 and 24 months old admitted in a tertiary hospital in Porto Alegre, RS.

Variables	n	%
Maternal age		
≤ 19 years old	48	16,0
20 – 34 years old	221	73,7
≥ 35 years old	31	10,3
Total	300	100
Maternal schooling		
≤ 8 years	118	39,3
9 – 11 years	155	51,7
≥ 12 years	27	9,0
Total	300	100
Marital status		
No partner	131	43,8
With partner	168	56,1
Total	299	100
Parity		
Primiparous	112	37,3
Multiparous	188	62,7
Total	300	100
Maternal BMI		
Underweight	5	2,3
Eutrophy	101	45,9
Excess of weight	114	51,8
Total	220	100
Family income		
High income	60	21,1
Average income	186	65,5
Low income	38	13,4
Total	284	100
Complementary feeding orientation		
No	112	37,4
Yes	188	62,6
Total	300	100

it continues

Table 1. Characterization of the sample of mothers and children between 4 and 24 months old admitted in a tertiary hospital in Porto Alegre, RS.

Variables	n	%
Sex		
Male	178	59,3
Total	300	100
Age		
< 6 months	77	25,7
≥ 6 months	223	74,3
Total	300	100
Breastfeeding		
Still breastfeeds	154	51,3
Stopped before 6 months	118	39,3
Stopped after 6 months	28	9,3
Total	300	100
Attends nursery school		
No	233	77,7
Yes	67	22,3
Total	300	100
Weight for age		
Low weight	23	7,7
Adequate weight	255	85,0
High weight	22	3,3
Total	300	100
Height for age		
Low height	58	19,3
Adequate height	242	80,7
Total	300	100
BMI for age		
Thinness/Underweight	13	4,3
Eutrophy	237	79,0
Excess of weight	50	16,7
Total	300	100

were exclusively breastfed. Among the children older than six months, approximately half (49.3%) were BF, but only 5.4% (n= 6) of these children received exclusively breastfed until the sixth month of life.

Regarding maternal characteristics, the average age was 26.29 (SD 6.09) years, 39.3% (n=118) had low schooling (≤ 8 years), 51.8% (n=114) had excess of body weight and 62.7% (n=188) were multiparous. In addition, most families had average income (class C) (65.5%), which is equivalent to the average family income of 1.6 minimum wages. More than half of the mothers (62.6%) had received some kind of orientation regarding complementary feeding, however, only 19.6% (n=37) were oriented by a nutritionist, being most of them by a pediatrician and/or other health professional, and more than half (53.7%) performed in a basic health unit.

The foods most offered to children before the age of two were biscuits (65.7%), jello (62.3%) and *petit suisse* cheese (58.3%). Regarding the early introduction of ultra-processed food (UPF), it was verified that only 21% (n = 63) of the children had not yet received this type of product. The average UPF that had already been introduced in the children's feeding was five (3-7) ultra-processed foods. Among the children

who had consumed these foods in the first years of life, 56.5% (n = 134) received any of these foods before six months of age.

Figure 1 shows the UPF according to its moment of introduction into the child's diet (not introduced, before or after six months of age). The foods most introduced before the six months were jello (27.0%), *petit suisse* cheese (23.7%) and biscuits with no filling (19.7%) .After six months of age these same foods remain the most presented to the children, but in larger proportions: 46% of children received biscuits with no filling in this age group, 35.3% jello and 34.7% received *petit suisse* cheese. The foods least introduced by mothers before six months of age were chocolate milk (2%), processed meats (1%) and salty snacks (1%).

Table 2 presents the linear regression analysis, considering as an outcome the number of UPF introduced in the child's diet. In the univariate analysis, we observed a statistically significant association of the introduction of UPFs with maternal schooling, family income, maternal age, parity, weight for age and BMI for age. In the multivariate analysis, maternal schooling, family income, maternal age and parity remained statistically significant. It was verified that the lower the schooling the greater the number of ultra-processed products introduced. As for the family income, the higher it was the less of these foods were presented to the children. On the other hand, a more advanced maternal age was associated with greater introduction of these foods, as well as multiparity.
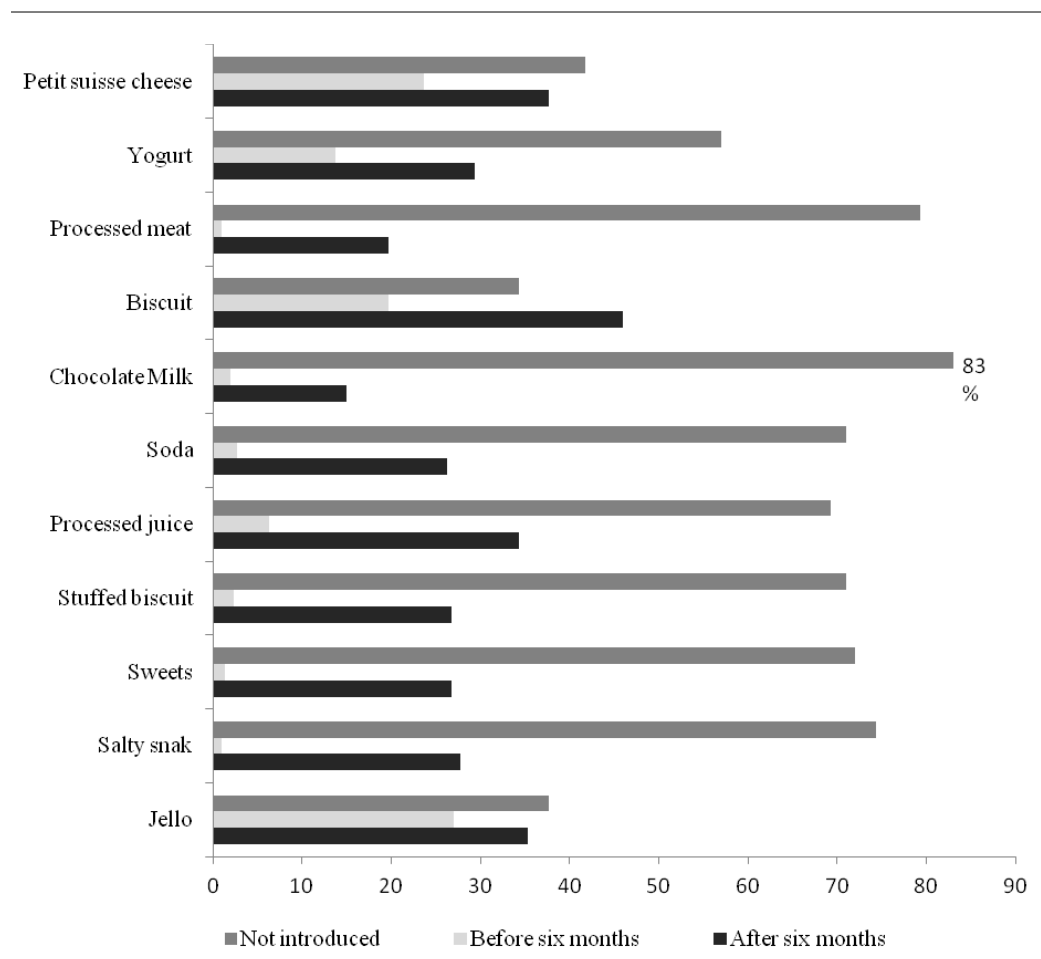
Figure 1. Introduction of ultra-processed foods in children with less than two years of age admitted to a tertiary hospital in Porto Alegre, RS (n = 300).

Table 2. Univariate and multivariate regression, having as dependent variable the number of ultra-processed foods introduced.

Independent Variable	Univariate Analysis		Multivariate Analysis	
	Alimentos Ultraprocessados		Alimentos Ultraprocessados	
	β (CI 95%)	P	β (CI 95%)	P
Maternal schooling				
≥ 12 years	1		1	
9-11 years	1,93 (0,57 a 3,30)	**0,006**	1,58 (0,23 a 2,954)	**0,022**
≤ 8 years	2,59 (1,2 a 3,99)	**<0,001**	1,82 (0,38 a 3,25)	**0,013**
Maternal age				
≥ 35 years old	1		1	
20 – 34 years old	-1,5 (-2,77 a -0,24)	**0,020**	-1,47 (-2,74 a -0,19)	**0,025**
≤ 19 years old	-0,56 (-2,08 a 0,96)	0,469	-,019 (-1,64 a 1,61)	0,982
Attends nursery school				
Yes	1			
No	-0,25 (-1,17 a 0,68)	0,603	-	-
Maternal BMI				
Eutrophy	1		-	-
Underweight	-1,32 (-4,48 a 1,84)	0,411	-	-
Excess of weight	-0,88 (-1,82 a 0,06)	0,067	-	-
Family income				
Low	1		1	
Average	-1,98 (-3,14 a -0,82)	**0,001**	-1,85 (-3,00 a -0,71)	**0,002**
High	-2,66 (-4,01 a -1,31)	**<0,001**	-2,30 (-3,66 a -0,93)	**0,001**
Parity				
Primiparous	1			
Multiparous	1,05 (0,26 a 1,83)	**0,009**	1,11 (0,26 a 1,97)	**0,010**
Marital status				
With partner	1			
No partner	0,41 (-0,36 a 1,18)	0,300	-	-
Height for age				
Adequate	1			
Low height	-0,33 (-1,30 a 0,65)	0,507	-	-
Weight for age				
Adequate	1		1	
Low weight	-0,99 (-2,42 a 0,45)	0,176	1,50 (-0,81 a 3,09)	0,063
High weight	1,88 (0,41 a 3,34)	**0,012**	-0,52 (-2,16 a 1,12)	0,532
BMI for age				
Eutrophy	1		1	
Thinness/Underweight	-0,32 (-2,21 a 1,57)	0,742	0,12 (-1,02 a 1,26)	0,833
Excess of weight	1,05 (0,01 a 2,08)	**0,047**	-0,64 (-2,71 a 1,42)	0,540

Results in bold point statistical significance. Coefficient of determination of the adjusted model ($R^2_{adjusted}$) = 0,121.

Discussion

Our findings point to inadequate food practices in the first two years of life, with a low prevalence of exclusively breastfed and inadequate complementary food introduction, given the high prevalence of early introduction of UPF, especially before six months of life, despite 62.6% of the mothers having received some kind of orientation about CF from health professionals.

In relation to the factors investigated associated to the introduction of UPFs, it was observed a greater introduction of these foods among mothers with lower family income, lower education, older age and multiparous. These results are in agreement with the findings presented by

several authors who affirm that mothers with low schooling, lower family income, older or multiparous tend to introduce CF earlier[18-20], including UPF[3,21], and consequently, have shorter duration of BF[12]. Pries et al. report that a minimally acceptable diet, according to dietary diversity and meal frequency, is directly related to a higher level of maternal schooling and higher family income[21]. Opposed to the results found in this study, Simon et al. observed in private schools that mothers over the age of 35 introduced treats belatedly, in the first two years of life. However, it is noted that these presented a high socioeconomic level[22]. Greater access to information on healthy eating practices possibly explains the association of maternal schooling and social class with less introduction of UPF.

Over the last decades, there has been an increase in the consumption of UPF in the Brazilian diet of adolescents and adults, from 18.7% in 1987 to 29.6% in 2009, the participation of processed meats, ready meals, sweets, soft drinks and sugary drinks doubling. This increase occurred in all economic strata; however, it tended to be higher among the lower income classes[5]. This increase is related to the greater practicality and durability of these foods, since these products are usually sold in large portions, in the form of snacks ready for consumption, facilitating the habit of eating between meals. Often, they have a wide commercial advantage when compared to in natura or minimally processed foods, also presenting lower costs[23]. Moreover, they are considered hyperpalatable due to their composition and processing, therefore, they are likely to cause "nonsense eating" and impairing the processes that control satiety and appetite[23-26]. All these characteristics combined with aggressive marketing make these foods attractive and desired, especially by the children's audience[5,26].

Parallel to the increase in UPF consumption, obesity rates worldwide have also increased, particularly in middle-income countries[5,27] possibly due to the unfavorable nutritional profile of UPFs, since they have 2.5 times more energy, twice as much free sugar, 1.5 times more fats in general and eight times more trans fats, as well as three times less fiber, two times less protein and 2.5 times less potassium[26]. Consequently, these products are associated with a significant increase in BMI (0.94 kg/m2; 95% CI 0.42-1.47) and higher chances of excess weight (OR = 1.26; 95% CI 0.95-1.69) and obesity (OR = 1.98; 95% CI: 1.26-3.12)[27]. In addition to the low nutritional value of these foods, recent evidence suggests that children of lower income families between the ages of two and three years old are at risk for excessive intake of micronutrients such as calcium, iron, zinc, vitamin A, C and folate due to high intakes (88.1 %) of UPFs aimed at children, who are generally enriched with these nutrients[29]. Although our findings have not found a relation between the consumption of UPF and childhood obesity, it is worth noting that this reflex can also be found in the long term, with weight gain being a frequent consequence of poor feeding of in natura foods and rich in processed and ultra-processed products.

UPF has been increasingly introduced earlier in the feeding of children under two years of age[2-4], corroborating to our findings. Pries et al. found similar results, since approximately 70% of the mothers who reported avoiding the UPF offer because they believed it to harm the health of their children, had offered this type of food to the child the day before the interview[21]. Recent Ministry of Health data found lower values among children aged six to 23 months of age, where 56% had already consumed some type of UPF[30]. Heitor et al. associate the tendency of increasing the offer of processed foods with the deceleration in the child's growth during the second year of life, since there is a decrease in appetite and often the mother, concerned about this aspect, will begin to offer the preferred and requested foods by the child[2].

The results found are worrying, considering that the first thousand days of life, intrauterine period and the first two years of life, are sensitive to metabolic and nutritional factors which may predispose to short-term and long-term consequences on the individual's health, extending up to adulthood[2,7]. Thus, inadequate feeding in the first years of life may be one of the determinants of the growth of childhood obesity and chronic diseases in adult life, since the consumption of these UPFs has a negative impact on health in the first years of life. It is known that a 10% increase in the consumption of UPF at 3-4 years of age can increase the levels of total and LDL cholesterol at 7-8 years of age, up to 3 mg/dL, regardless of the energy intake and the nutritional state[31]. In addition, data from the Family Budget Survey 2008-2009[32] indicate that consumption of UPF (pizza, processed meats, salty snacks, biscuits with filling and soft drinks) was associated with a higher sodium intake[31], which may result in altered blood pressure at preschool age[33].

A study with Mexican children aged between five and 24 months old and their mothers found

a significant association between the consumption of high-energy foods and sweetened beverages and excess weight (11%) and obesity (8%)[34]. Similar results were observed in the present study, although the association with UPF consumption in the multivariate analysis was not maintained, which may be related to the fact that our children are young and not yet have the reflex of feeding in the nutritional state.

The foods most offered to children before the age of two were biscuits, jello and petit suisse cheese. The II Maternal Breastfeeding Prevalence Survey performed in Brazilian capitals and in the Federal District found high consumption of biscuits/salty snacks among children of six and nine months of age, being the highest values found in the South region, reaching 61.1% in Porto Alegre[15]. These findings corroborate with the national data, since these foods were part of the feeding of 70.7% of children over six months old, with biscuits being the most offered food in this age group[15]. Regarding petit suisse cheese, national studies also found high prevalence of consumption of this type of ultra-processed, ranging from 62.2 to 73.6%, being the most consumed food between children under one year of age and offered until the end of the sixth month of life in approximately half the children[2,35]. This high consumption is justified by the accelerated growth in the marketing of petit suisse cheese over the last years, being considered a healthy food by the families due to the wide publicity campaigns directed strategically to children, besides factors such as palatability and practicality, that inserted and kept them in the food habit of the population, mainly in the homes of class C[35]. Regarding the composition of this UPF, when compared to BM, the percentages of adequacy for proteins and carbohydrates were higher, exceeding by more than 400% the amount of protein[35], which may lead to the development of obesity in school and adult age[36]. For calcium and sodium, the adequacy percentages were more than 20 times higher, exceeding 300% of the daily needs in the age group from zero to six months old, being well beyond the levels present in BM[35], which could lead to the increase of renal calcium excretion with a negative impact on the child's bone health[37].

It is also worth noting that the present study found high rates of maternal excess weight. Although no association of maternal BMI with the introduction of UPF has been found, this relationship has been extensively explored in the literature. Maternal obesity is associated with de-creased intention to breastfeed, decreased initiation and duration of BF[38], and also with weaning before six months of age. The reduced duration of BF is also a risk factor for the consumption of snacks and sweetened beverages[34].

Corroborating with our findings, Alves et al. also found early introduction of CF and high consumption of UPF even after the mothers' orientation on BF and CF during routine follow-up of their children at the basic health unit[3]. The reasons related to this non-adherence to the orientation may be related to the lack of knowledge on the subject by professionals in general[39,40], difficulties in communication between the professional and the mother[41], the personal divergence of the mother in relation to dietary guidelines received[42] and the maternal belief that eating practices have little influence on the child's development[43]. Broiloa et al. suggest that the transmission of information is not sufficient to motivate the mothers' actions regarding their children's eating practices, since 47% of the mothers reported not following the orientation received in the basic health unit, of which 45.7% did not recognize the importance of food for the health of the child[44]. In addition, the main reasons why mothers provide CF early are based on their own experiences or beliefs, that is, they believe that the time is ripe or that BM alone is not enough, in information provided by the pediatrician and by the influence of media[13,14,45].

In order to qualify the work process of health professionals in relation to this theme, the federal government instituted the Brazilian Breastfeeding Strategy, which reinforces and encourages the promotion of healthy BF and CF in the Unified Health System through training and continuing education of professionals on the topic[46]. This way, it is up to the professionals, especially nutritionists, to encourage and disseminate information about the importance of healthy eating at this stage of life for the formation of healthy eating habits and prevention of chronic diseases in adult life. This need is reinforced by evidence that nutritional interventions over time are effective in reducing UPF consumption (biscuits, petit suisse cheese and soda), regardless of maternal age and schooling, when performed with nursing infants in the first year of life, through nutritional consultations or home visits and based on the "Ten steps of healthy eating for Brazilian children of less than two years of age"[13,47]. In addition, the maternal perception of adhesion to the orientation provided by health professionals is associated with higher prevalence of exclusively

breastfed, introduction of solid foods after four months of age and introduction of foods not recommended after six months, as well as higher family income[44].

The present study contributes to a better understanding of the factors associated with the early introduction of ultra-processed foods in children feeding. Regarding the limitations, there is a lack of a validated document for the analysis of the consumption of UPFs at the time of research and a lack of knowledge about the frequency and quality of the feeding orientation provided by health professionals to mothers. It also refers to the smaller sample size of the maternal BMI variable, since 220 mothers were evaluated.

It is concluded that the feeding practices of children between four and 24 months are inadequate in relation to the current recommendations of the World Health Organization and the Ministry of Health. In this sense, health professionals should be aware of these practices in order to be able to adapt the actions of promotion to the sociodemographic and cultural contexts of the assisted population, in order to provide mothers with opportunities to acquire knowledge and skills about infant feeding. It is further stressed the importance of training and continuous updating of health professionals on the subject in accordance with current recommendations, so that the orientation is given in an adequate and continuous way for mothers and their families.

It is hoped, therefore, that this study may contribute to the reorientation of food and nutritional education actions in health services, especially in tertiary care, where health professionals, primarily nutritionists, have daily contact with patients and their relatives. carrying out actions to promote healthy breastfeeding and complementary foods to prevent nutritional disorders in early childhood.

Collaborations

JM Giesta, E Zoche, RS Corrêa and VL Bosa participated in the work of conception, elaboration, data extraction, interpretation and analysis and in the writing and revision of the article, the current version being read and approved by all.

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