DOI: 10.1590/1413-81232022272.47072020

Consumption of ultra-processed foods during the first year of life and associated factors in Cruzeiro do Sul, Brazil

Mariana Bossi Nogueira (https://orcid.org/0000-0001-7017-8718) [1]
Lalucha Mazzucchetti (https://orcid.org/0000-0002-9649-5727) [1]
Paola Soledad Mosquera (https://orcid.org/0000-0001-8423-7344) [1]
Marly Augusto Cardoso (https://orcid.org/0000-0003-0973-3908) [1]
Maíra Barreto Malta (https://orcid.org/0000-0003-4993-1589) [2]

Abstract *This article aims to assess the consumption of ultra-processed foods (UPFs) during the first year of life and associated factors. We analyzed data from the one-year follow-up of the MINA-Brazil birth cohort. Socioeconomic, demographic and obstetric data were collected in the baseline study and at one-year follow-up (n = 774). Dietary intake during the previous day was assessed using a food frequency questionnaire to determine UPF consumption. Multiple Poisson regression with robust variance was performed to estimate prevalence ratios (PR) and confidence intervals (95%CI) for factors associated with the consumption of ≥ 3 UPFs. Prevalence of UPF consumption and consumption of ≥ 3 UPFs was 87.5% and 40.5%, respectively. Consumption of ≥ 3 UPFs was associated with lower maternal education (≤ 9 years of schooling [PR: 2.02 95%CI 1.42; 2.87] and between 10-12 years of schooling [PR: 1.55, 95%CI 1, 11; 2.14]), below-average wealth index (PR: 1.26, 95%CI 1.04; 1.53), and having a teenage mother (PR:1.19, 95%CI 1.00; 1.49). Lack of dietary diversity was inversely associated with the outcome (RP: 0,65, IC95% 0,51; 0,81). The consumption of ≥ 3 UPFs was associated with lower wealth index, education and maternal age. Dietary diversity was associated with higher levels of UPF consumption.*

Key words *Child nutrition, Industrialized foods, Complementary foods, Cohort study*

[1] Faculdade de Saúde Pública, Universidade de São Paulo. Av. Dr. Arnaldo 715, Cerqueira César. 01246-904 São Paulo SP Brasil. maaribnogueira@gmail.com
[2] Pós-Graduação em Saúde Coletiva, Universidade Católica de Santos. Santos SP Brasil.

Introduction

The first 1,000 days of life is an intensive period of growth and maturation, constituting an important window of opportunity for providing a healthy diet and nutrition. During this period, mother-infant food choices are determining factors for full neurocognitive growth and development and reducing the risk of various diseases and morbidities that affect health across the life span[1].

Given the importance of this period, the World Health Organization (WHO) recommends exclusive breastfeeding for six months and complementary foods up to two years of age[2]. It also recommends that complementary feeding, beginning at six months, should be adequate and safe, advising against ultra-processed foods (UPFs) in the first two years of life, as they are rich in harmful sodium, sugars and fats, and low in fibers, vitamins and minerals[3]. UPFs are defined as "industrial formulations that contain little or no whole foods"[4].

The importance of the first years of life for the formation of eating habits is well-known[4]. Studies show that dietary patterns during the first year of life are the same at six years, suggesting that unhealthy eating habits in early childhood persist throughout life[5]. Furthermore, the consumption of UPFs is associated with the rise in obesity, diabetes and other non-communicable chronic diseases[3]. In this regard, a systematic review including 26 studies concluded that there were positive associations between UPF consumption and body fat during childhood and adolescence[6]. Despite the evidence, high consumption of UPFs is a reality. A report published by the Pan American Health Organization[7] shows that UPF sales rose 48% between 2000 and 2013 in 13 Latin American countries, demonstrating shifts in eating habits and patterns towards high energy density diets[8].

While most studies on UPF consumption have been with adolescents and adults, a cross-sectional study in Brazil with pre-schoolers showed that mean age at the introduction of UPFs was six months[9]. In addition, the II Breastfeeding Prevalence Survey, conducted in Brazilian state capitals and the Federal District in 2009, showed that 11.6% and 71.7% of infants aged between nine and 12 months consumed sugary drinks and cookies and/or snack foods, respectively[10]. Another population-based study using data from Brazil's National Health Survey reported that 72.6% of children aged between six and 12 months consumed "unhealthy foods" (sodas, artificial fruit juices, cookies and candies), which were used in the study as a proxy for UPF consumption[11]. Few studies have investigated the factors associated with UPF consumption during early childhood in Brazil. A cross-sectional study carried out in Embu das Artes with 181 children aged between six and 12 months found an association between UPF consumption and maternal education and time between birth and the baby's first appointment at a health center[12].

Given the importance of healthy child feeding practices, the rise in UPF consumption during childhood, and lack of studies on UPF consumption during the first year of life, the present study aimed to assess UPF consumption and associated factors during the first year of life in a municipality in the western Amazon region, Brazil.

Methods

We conducted a longitudinal population-based study using data from the MINA-Brazil Birth Cohort: Maternal and Infant Health and Nutrition in Cruzeiro do Sul, Acre. In the baseline study, mothers and babies were recruited from a maternity unit between July 2015 and June 2016, as described in a previous study[13]. All mothers admitted for delivery living in Cruzeiro do Sul in the state of Acre were invited to participate in the study.

After agreeing in writing to participate in the study, the mothers responded a structured questionnaire devised to collect information on socioeconomic, demographic and health characteristics. There were 1,881 childbirth admissions during the recruitment period, 128 of which (6.9%) were ineligible (112 abortions and 16 stillbirths), resulting in 1,753 live births. One hundred and eighty-four mothers refused to participate in the study and 18 were not contacted by the research team. Of the 1,551 contacted mothers, 305 were excluded because they lived in rural areas. At the one-year follow-up, 25 of the 1,246 eligible mothers (2.0%) refused to participate, there were 10 twins, four children had died, 38 had moved to rural areas or outside the municipality, 110 mothers did not turn up to the assessment after three scheduling attempts, and 285 were not located, resulting in the follow-up of 774 children (63.2% of the eligible infants)[13].

The mothers were interviewed in the maternity unit by a previously trained team of researchers, collecting the following maternal data:

date of birth, to calculate maternal age (categorized as < 19 years, 19-34 years, ≥ 35 years, and adolescent yes/no[14]); self-declared skin color (white/brown, black, yellow, indigenous); education level (0-4, 5-8, 9-11, and ≥ 12 completed years of study); receiving benefits from the *Bolsa Família* program (yes, no); in paid employment (yes, no); living with partner (yes, no); mother declared herself head of the family (yes, no); first pregnancy (yes, no); and wealth index (below-average, above-average).

The wealth index was used as a proxy for family socioeconomic status[15], based on the assessment of principal components from the following household assets: television, stereo system, computer, DVD, internet, cable TV, fridge, gas cooker, blender, microwave, electric iron, couch, landline telephone, cellphone, bicycle, motorbike, car, land and cattle. The index was categorized as above-average or below-average based on the overall scores. Further details on this method can be found in previous studies[13].

Information on number of antenatal appointments was obtained from the respondent's antenatal record and categorized according to Ministry of Health recommendations[16] (< 6, ≥ 6 appointments). The following information was collected from the respondent's health records: baby's sex (female, male), birthweight in grams (low < 2,500g, normal 2,500-3,999g, macrosomic 4,000g), and gestational age in weeks. For 34% of the mothers, gestational age was estimated by the MINA-Brasil team using ultrasound, showing acceptable difference in means when compared to the hospital records, as described in a previous study[17].

When the children turned one, a member of the research team contacted the mother by telephone to schedule a face-to-face assessment in the health center. The child's anthropometric measurements were taken and the mother answered a questionnaire on general feeding practices in early childhood[18], use of feeding bottles (yes, no), use of pacifiers (yes, no), breastfeeding at one-year follow-up (yes, no), and exclusive or predominant breastfeeding at six months of life (yes, no).

The anthropometric measurements were taken twice by previously trained members of the research team, following standardized procedures and using properly calibrated equipment[19]. The infants were weighed using a portable 150kg 0.1kg digital Tanita scale and length was measured using a portable infantometer. A Z-score cut-off value of < -2 was used to indicate short length-for-age[14]. Nutritional status at one year was assessed using BMI-for-age, adopting the WHO reference value for overweight (Z-score of > -2[14]).

Pre-pregnancy weight was self-reported. For mothers aged 19 years and over, nutritional status was assessed using BMI, based on the following WHO criteria (1995)[19]: underweight (BMI < 18.5 kg/m²); normal weight (BMI 18.5-24.9 kg/m²); overweight (BMI 25.0-29.9 kg/m²); obese (≥ 30 kg/m²). For mothers aged under 19 years, pre-pregnancy nutritional status was determined using WHO AnthroPlus (2009), which calculates adolescent BMI in Z-score-for-age, considering the following cut-off points: underweight (Z-score < -2); normal weight (Z-score -2 to < 1); overweight (Z-score ≥ +1); and obese (Z-score ≥ +2).

The infants' dietary intake was assessed using a structured food frequency questionnaire on the intake of foods and drinks during the previous day when this intake represented the child's usual diet. Each of the 23 foods/food groups and the option "other foods" had nine possible responses (not consumed, upon waking, mid-morning, lunch, mid-afternoon, dinner, before sleeping, during the night, don't know). More than one of the responses could be chosen. The food list was adapted from a questionnaire devised by Oliveira *et al.* (2015)[18], adding regional foods selected based on a questionnaire used by Castro *et al.* (2009) in a study in the Amazon region[20]. For cases where the previous day did not represent the infant's usual diet, the mother or carer was asked to respond the questions based on the last typical day. To this end, the following question was asked: "Was what your child ate yesterday similar to what he/she usually eats?"

The following UPFs were included in the questionnaire: industrialized yogurt, artificial fruit juice, soda, candies, cookies, packaged savory snacks, hotdogs and instant noodles. Other UPFs mentioned during the interview in response to an open question about eating "other foods" were also considered (chocolate drinks, ice cream, jelly, cake and industrialized soup). Prevalence of UPF consumption was estimated based on the intake of at least one food in the category during the previous day. In view of the high prevalence of UPF consumption during the previous day – going against the recommendations of Brazil's Dietary Guidelines for Children Aged under Two Years[4] (UPFs should be avoided for children in this age group) – we chose to investigate the factors associated with the consumption of three or more UPFs.

Dietary diversity was classified using the WHO (2008)[21] indicator based on a cut-off of at least four out of seven recommended food groups (grains, roots and tubers; legumes, nuts and seeds; dairy products; meats; eggs; fruits and vegetables rich in vitamin A; and other fruits and vegetables).

The socioeconomic, demographic, obstetric and perinatal characteristics of the children assessed in the follow-up study were compared to those of the follow-up losses using the chi-squared test. The discrete variables were presented as measures of central tendency and dispersion (means and standard deviation - SD) and the categorical variables were presented as total frequencies and according to the number of UPFs consumed during the previous day (not consumed; between one and two; three or more). The categories were also compared using the chi-squared test.

Prevalence ratios (PR) and confidence intervals (95% CI) for the consumption of one and three or more UPFs at one-year follow-up were estimated using Poisson regression with robust variance. The multiple regression models were based on a conceptual framework for describing hierarchical relationships[22], considering associations with exposures at the distal (socioeconomic and demographic factors), intermediate (obstetric and perinatal factors), and proximate (feeding practices and nutritional status at one-year follow-up) levels. The crude analysis of each independent variable was performed retaining variables with a cut-off p-value of < 0.20 for association with the outcome. The variables associated with the outcome with a cut-off p-value of $p < 0.10$ in each level of the model were included in the final multiple model. Data analysis was performed using Stata 14.0, adopting a significance level of $p < 0.05$.

The respondents signed an informed consent form after explaining the study objectives and that the confidentiality of information would be guaranteed. Consent for the participation of adolescent mothers was granted by the parent/guardian. The research protocol was approved by the research ethics committee at the Faculty of Public Health, University of São Paulo (FSP/USP, approval No. 872.613, 13/11/2014).

Results

The comparison between the participants assessed at one-year follow-up and those who did not participate in the follow-up (n = 450) showed that there was no difference in relation to self-reported maternal skin color, living with a partner and the mother being the head of the family. There were statistically significant differences in the following variables, with participants at one-year follow-up showing lower rates: maternal age < 19 years (16.0% versus 23.3%; $p = 0.002$); ≤ 9 years of schooling (29.7% versus 45.7%; $p < 0.0001$); and below-average wealth index (45.5% versus 58.7%; $p < 0.0001$). With regard to obstetric and perinatal characteristics, there were no statistically significant differences in primiparity, sex and birthweight.

Mean maternal age at delivery was 25.5 years (SD ± 6.6), varying between 14 and 43 years. Sixteen percent of the sample were adolescents and only 19.7% had completed at least 12 years of schooling. A large proportion of the mothers (36.9%) received benefits from the *Bolsa Família* program (Table 1).

With regard to the children, 96% were breastfed on the first day of life and approximately 6% had low birthweight and were macrosomic. Mean age at follow-up was 12.7 months (SD ± 0.7). The frequencies of short length-for-age and overweight (BMI-for-age) were 2.2% and 6.6%, respectively.

The large majority of the children (87.5%; 95%CI 0.85; 0.90) consumed at least one UPF during the previous day, 47% (95%CI 0.44;0.51) consumed one or two, and 40.5% (95%CI 0.37;0.44) consumed three or more. The most commonly consumed foods were cookies, industrialized yogurt, candies, packaged savory snacks and artificial fruit juice (66.4%, 53.2%, 18.1%, 17.9% and 14.7%, respectively) (data shown in Figure 1). Only 5% of the mothers (n=39) said that the food eaten on the previous day did not represent the child's usual diet.

Table 2 shows the results of the crude analyses of the association between the exposures and UPF consumption during the previous day. The factors associated with consumption of three or more UPFs in the crude analysis were: having an adolescent mother; lower maternal education; below-average wealth index; receiving benefits from the Bolsa Família Program; and mother not in paid employment. Lack of dietary diversity was inversely associated with the outcome (Table 3). The characteristics associated with greater UPF consumption after adjusting for sex and child's age were: lower maternal education (≤ 9 years of schooling [PR: 1.97 95%CI 1.38; 2.80] and between 10 and 12 years of schooling [PR:

1.58, 95%CI 1.13; 2.20]); below-average wealth index (PR: 1.26, 95%CI 1.04; 1.53); and having an adolescent mother (PR: 1.28, 95%CI 1.06; 1.55). Lack of dietary diversity was inversely associated with excessive consumption of UPFs (PR: 0.65, 95%CI 0.51; 0.81).

Discussion

The present study is the first to investigate UPF consumption and associated factors among children at a follow-up after one year of life from a cohort in the western Amazon region. The findings show that the prevalence of the consumption of this type of food is high, with 87.5% of children having consumed one or more UPFs and 40.5% three or more UPFs during the previous day. These results are especially alarming considering Brazil's Dietary Guidelines for Children Aged under Two Years[4] (2019), which recommends that UPFs should be avoided for this age group, highlighting their contribution to the increasing prevalence of childhood overweight and obesity. In addition, this period is critical for child development, with various physiological changes taking place, such as the formation of taste buds, which play a determining role in food preferences[23].

With regard to the proportion of children with minimum dietary diversity (76.6%), it is important to highlight that this aspect of complementary feeding was estimated using the indicator proposed by the WHO consisting of seven food groups (grains, roots e tubers; legumes, nuts and seeds; dairy products; meats; eggs; fruits and vegetables rich in vitamin A, and other fruits and vegetables). Intake is considered varied when at least four of these groups are consumed[21]. This means that children who only consumed foods from the food groups meats, eggs, grains and dairy products, for example, may have been inappropriately classified as having a varied diet[18].

In addition, it is important to note that, despite the evidence of the adverse effects of UPF consumption on children's health[4], the WHO indicator does not differentiate between extent of processing of foods and therefore does not penalize UPF consumption[21]. For example, hamburgers are included in the food group meats, despite being an UPF. Thus, the frequency of minimum dietary diversity in the present study may have been overestimated, contributing to the positive association between dietary diversity and excessive consumption of UPF. Our findings point to the need to establish indicators of complementary feeding that take into account the recommendations of the Dietary Guidelines for Children Aged under Two Years[4], including the assessment of UPF consumption, to ensure the adequate monitoring of infant feeding practices.

In a cross-sectional study investigating UPF consumption among 181 children aged under one year in Embu das Artes, São Paulo, Relvas *et al.*[12] (2019) found that the frequency of consumption of one or more UPF was 43.1%, which is almost half the rate observed in the current study. This may be due to the more limited scope of the food list included in the questionnaire used by Relvas *et al.* (potentially leading to an underestimation of UPF consumption), when compared to the present study, which encompassed all the UPFs consumed during the previous day using the open question regarding "other foods".

Our findings show that frequency of UPF consumption was higher in children from families with a below-average wealth index. In the same direction, Martins *et al.*[24] (2013) showed that the share of UPFs in the Brazilian diet has increased, especially in low income groups. In addition, in a study with children in a municipal school in Itajaí in the state of Santa Catarina (n = 523) using a questionnaire based on the Dietary Guidelines for the Brazilian Population, Momm & Hofelmann[25] (2014) reported that 52.6% of the sample had an inadequate diet. The authors concluded that better diet quality was directly associated with higher family income and education levels. In the same vein, studies in high-income countries conducted by Keane *et al.*[26] (2012) and Kendzor *et al.*[27] (2012) showed that low socioeconomic status and education levels are factors that can contribute to childhood overweight and obesity. These findings corroborate the results of a systematic literature review showing a positive association between UPF consumption and body fat during childhood and adolescence[6].

The association between higher UPF consumption and low maternal education identified by the present study confirm the findings of a study conducted by Saldiva *et al.*[28] (2014) using data from the II Breastfeeding Prevalence Survey. These authors reported an almost two-fold increase in frequency of UPF consumption in children with mothers with low education levels compared to those with mothers with higher education levels in the crude analyses. Likewise, Relvas *et al.*[12] (2019) found that UPF consumption was higher in girls with mothers with low education levels.

Table 1. Frequency (%) of the consumption of ultra-processed foods (UPFs) during the first year of life by socioeconomic, demographic and obstetric characteristics. MINA-Brazil Cohort, Cruzeiro do Sul, Acre, 2016-2017.

Variables	UPF consumption during the previous day				
	Total (n = 774)	Not consumed (n = 97)	1 to 2 UPFs (n = 364)	3 or more UPFs (n = 313)	p[e]
Maternal age (n=774)					<0.001
< 19 years	16.0	6.2	13.2	22.4	
19-35 years	73.4	75.3	75.3	70.6	
≥ 35 years	10.6	18.6	11.5	7.0	
Maternal education (n=761)				<0.001	
0-4 years of schooling	7.2	6.2	5.1	10.1	
5-8 years of schooling	13.0	12.4	9.8	16.9	
9-11 years of schooling	51.7	45.4	50.0	55.5	
≥ 12 years of schooling	28.1	36.1	35.1	17.5	
Wealth index (n=762)				<0.001	
Below-average	50.0	38.1	44.8	59.7	
Above-average	50.0	61.9	55.2	40.3	
Receives Bolsa Família (n=762)	36.9	32.0	33.6	42.2	0.041
Maternal skin color (n=762)					0.292
White	12.2	8.3	14.0	11.4	
Black/Indigenous/Brown	87.8	91.8	86.0	88.6	
Living with partner (n=762)	78.7	77.3	81.2	76.3	0.281
Mother head of household (n=762)	13.7	14.4	15.4	11.4	0.309
First pregnancy (n=762)	42.3	39.2	40.1	45.8	0.265
Number of antenatal appointments (n=770)				0.463	
< 6 appointments	18.2	15.6	17.1	20.2	
≥ 6 appointments	81.8	84.4	82.9	79.8	
Pre-pregnancy nutritional status (n=757)					0.147
Normal weight	50.7	44.1	48.7	55.1	
Underweight	4.2	2.2	3.6	5.5	
Overweight	30.9	38.7	31.9	27.4	
Obese	14.1	15.1	15.7	12.1	
Child sex (n=774)					0.390
Female	52.2	46.4	51.9	54.3	
Male	47.8	53.6	48.1	45.7	
Birthweight (grams) (n=773)					0.153
Underweight (< 2,500 g)	6.3	12.4	5.2	5.8	
Normal weight (2,500-3,999 g)	87.6	82.5	87.9	88.8	
Macrosomic (≥ 4,000 g)	6.1	5.2	6.9	5.4	
Breastfeeding on 1st day (n=774)	96.0	95.9	95.6	96.5	0.843
Use of feeding bottle[a] (n=774)	62.7	69.1	62.6	60.7	0.330
Use of pacifiera (n=774)	22.0	30.9	20.6	20.8	0.074
Exclusive or predominant breastfeeding in first six months (n=628)	7.8	9.9	5.4	10.0	0.097
Breastfeeding at 12 months (n=774)	69.4	58.8	72.3	69.3	0.038
Short length-for-age[a,b] (n=772)	2.2	2.1	1.4	3.2	0.271
Overweight[a,c] (n=772)	6.6	7.2	8.3	4.5	0.127
Dietary diversity[a,d] (n=774)	76.6	66.0	74.3	82.1	0.002

Totals for each variable may differ due to lack of information. [a] During the first year of life; [b] Length-for-age Z-score according to the WHO[18]; [c] BMI-for-age Z-score according to the WHO[18]; [d] Calculated based on the dietary diversity criteria proposed by the WHO (2008)[22]. [e] Chi Square for Trend.

Source: Authors.

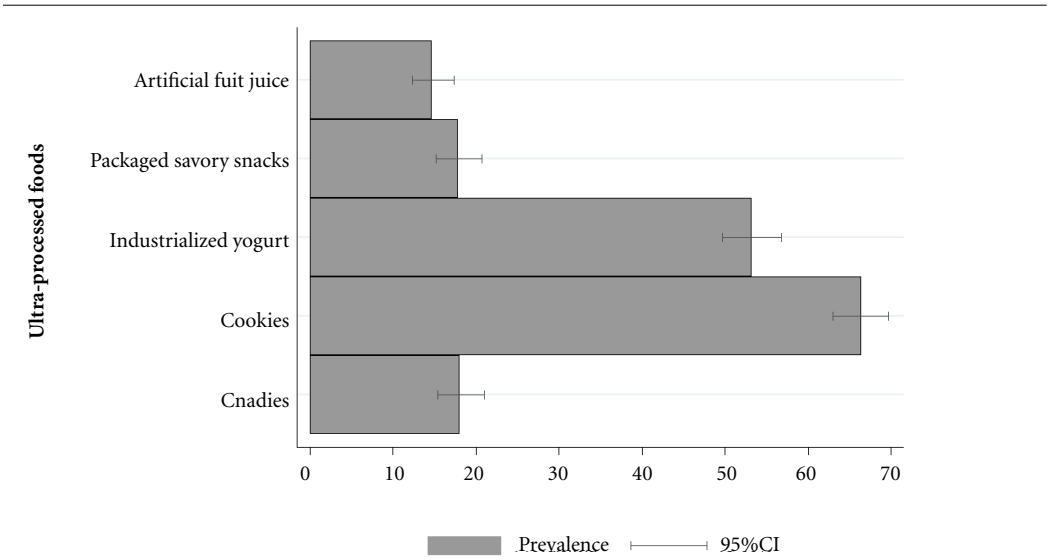

Figure 1. Prevalence and 95% confidence intervals (95%CI) for the most commonly consumed ultra-processed foods during the first year of life. MINA-Brazil Cohort, Cruzeiro do Sul, Acre.

Source: Authors.

The present study found that prevalence of UPF consumption was higher in boys with adolescent mothers than in those with adult mothers. Similarly, a cross-sectional study (n = 112) in Recife assessing maternal diet and complementary feeding practices for children aged between nine and 24 months found that consumption of foods that are high in sugar, oils and fats was higher in boys with adolescent mothers than in boys with adult mothers[29]. This may be related to the fact that young people's eating habits are resulting in diets that are increasingly rich in sodium, fats and sugars, and lacking vegetables[30]. A cross-sectional study in Teresina in the state of Piauí assessed the dietary intake of 80 young people using the NOVA food classification, which categorizes foods based on the extent and purpose of processing. The findings showed that 94% of the adolescents consumed UPFs at least once a day[31].

This study has some limitations. First, due to difficulties in locating respondents and accessing rural areas, the sample was restricted to individuals living in urban and peri-urban areas in Cruzeiro do Sul, meaning that the data should not be generalized to the overall population of the municipality. Second, a number of participants were lost to follow-up, with losses being greater among younger poor mothers with low education levels. However, it is important to highlight that we used prospectively collected data from a little studied region and constant checks were performed to verify data consistency, together with the ongoing training of the research team.

With regard to UPF consumption, we used a questionnaire on intake during the previous day, minimizing the chances of maternal recall bias and thus improving the quality of the data presented. Another limitation was that we only assessed one day of dietary intake, which may not necessarily represent usual diet. To minimize the effects of this limitation, the examiners asked whether the food eaten during the previous day represented the child's usual diet. For children where the food eaten during the previous day did not represent their usual diet (5% of the sample), we recorded intake on the last typical day.

The current study reveals high levels of UPF consumption during the first year of life among children in Cruzeiro do Sul, reinforcing the need for actions to promote appropriate feeding practices in this stage of life. It falls on health professionals, managers and policy makers to address this major challenge. We propose the following recommendations: increased dissemination of the Dietary Guidelines for Children Aged under Two Years among families and health professionals; promotion of food and nutrition education in primary care settings, aimed at improving

Table 2. Prevalence ratios and 95% confidences intervals (95%CI) for factors associated with consumption of three or more ultra-processed foods (UPFs) during the first year of life (n=774). MINA-Brazil Cohort, Cruzeiro do Sul, Acre. 2016-2017.

Variables	Consumption of 3 or more UPFs during the previous day (n = 774)					
	Crude model		Model 1[a]		Model 2[b]	
	PR (95% CI)	p	PR (95% CI)	p	PR (95% CI)	p
Maternal age						
≥ 19 years	Ref.		Ref.		Ref.	
<19 years	1.51 (1.26; 1.82)	<0.001	1.21 (0.98; 1.48)	0.073	1.28 (1.06; 1.55)	0.010
Maternal education						
> 12 years	Ref.		Ref.		Ref.	
10 - 12 years	1.74 (1.26; 2.40)	0.001	1.51 (1.07; 2.12)	0.020	1.58 (1.13; 2.20)	0.007
≤ 9 years	2.38 (1.73; 3.28)	<0.001	1.89 (1.31; 2.74)	<0.001	1.97 (1.38; 2.80)	<0.001
Wealth index						
Above-average	Ref.		Ref.		Ref.	
Below-average	1.48 (1.24; 1.77)	<0.001	1.20 (0.99; 1.46)	0.068	1.26 (1.04;1.53)	0.018
Bolsa Família						
Not received	Ref.		Ref.			
Received	1.25 (1.05; 1.49)	0.011	0.97 (0.81; 1.16)	0.743		
Mother head of household						
No	Ref.		Ref.			
Yes	0.81 (0.61; 1.08)	0.150	0.84 (0.63; 1.11)	0.217		
Mother in paid employment						
Yes	Ref.		Ref.			
No	1.49 (1.22; 1.84)	<0.001	1.11 (0.88; 1.39)	0.377		
Living with partner						
Yes	Ref.		Ref.			
No	1.15 (0.95; 1.40)	0.164	1.07 (0.87; 1.31)	0.551		
Pre-pregnancy nutritional status						
Normal weight	Ref.		Ref.		Ref.	
Underweight	1.21 (0.86; 1.70)	0.284	1.15 (0.81;1.63)	0.452	1.16 (0.82;1.65)	0.401
Overweight	0.82 (0.66; 1.00)	0.052	0.85 (0.70;1.05)	0.128	0.85 (0.69;1.04)	0.104
Obesity	0.79 (0.59; 1.04)	0.096	0.81 (0.61;1.07)	0.138	0.80 (0.60;1.06)	0.117
First pregnancy						
Yes	Ref.		Ref.			
No	0.87 (0.73; 1.03)	0.103	0.91 (0.74; 1.11)	0.357		
Exclusive or predominant breastfeeding in first six months						
Yes	Ref.		Ref.		Ref.	
No	0.76 (0.57; 1.02)	0.064	0.78 (0.58;1.03)	0.082	0.78 (0.59;1.04)	0.095
Short length-for-age[c]						
No	Ref.		Ref.			
Yes	1.47 (0.98; 2.21)	0.064	1.20 (0.74; 1.94)	0.457		
Overweight[c]						
No	Ref.		Ref.			
Yes	0.67 (0.42; 1.05)	0.078	0.73 (0.46; 1.16)	0.184		
Dietary diversity[cd]						
Yes	Ref.		Ref.		Ref.	
No	0.71 (0.56; 0.90)	0.005	0.65 (0.52;0.81)	<0.001	0.65 (0.51; 0.81)	<0.001

[a] Model 1:maternal age (<19 years, ≥19 years), education (≤9 years, 10 to 12 years, >12 years), wealth index (below-average, above-average), receives Bolsa Família (yes, no), mother head of household (yes, no), mother in paid employment (yes, no), living with partner (yes, no), pre-pregnancy nutritional status (underweight, normal weight, overweight e obesity), first pregnancy (yes, no), exclusive or predominant breastfeeding at six months of life (yes, no), short length-for-age at one-year follow-up (yes, no), overweight at one-year follow-up (yes, no) and dietary diversity at one-year follow-up (yes, no), adjusted for age and child's sex. [b] Model 2: model 1 without adjustment for Bolsa Família, mother head of household, mother in paid employment, living with partner, first pregnancy, short length-for-age, overweight. [c] One-year follow-up of cohort. [d] Calculated based on the dietary diversity indicator proposed by the WHO (2008)[22].

Source: Authors.

young child feeding practices; and continuous monitoring of young child feeding practices based on the recommendations of the Dietary Guidelines for Children Aged under Two Years. Understanding complementary feeding practices in a given location is essential for the effective implementation of current initiatives, defining early intervention policies and programs aimed at promoting children's health, and improving and increasing the dissemination of the laws and regulations governing the marketing and sale of foods for children, such as the NBCAL, which regulates the sale of foods for infants and toddlers, pacifiers and nipple protectors. The findings of this study provide evidence that reinforces the importance of promoting policies to discourage the consumption of UPFs, especially among socially vulnerable groups.

Conclusion

The present study revealed high levels of UPF consumption at one-year follow-up, which is worrying considering that Brazil's Dietary Guidelines for Children Aged under Two Years recommend that these foods should be avoided in the first two years of life. The consumption of three or more UPFs during the previous day was associated with low maternal education, wealth index and maternal age. Dietary diversity was associated with higher UPF consumption, underlining the need to include the assessment of UPF consumption in indicators of complementary feeding, in accordance with the recommendations of the Dietary Guidelines for Children Aged under Two Years, thus enabling the adequate monitoring of child feeding practices and development and implementation of concrete strategies to promote healthy eating from pregnancy and avoid UPFs in the first two years of life.

Collaborations

MB Nogueira: analysis and interpretation of data, preparation and revision of the manuscript. L Mazzucchetti: data analysis and critical review of the manuscript. PS Mosquera: data collection, interpretation and critical review of the manuscript. MA Cardoso: conception and design of the study, data collection and critical review of the manuscript. MB Malta: study planning, data collection, analysis and interpretation and critical review of the manuscript.

References

1. Mizuno K. The first 1,000 days of life. *Pediatr Int* 2019; 61(1):3.
2. Kramer S, Kakuma R. *The optimal duration of exlusive breastfeeding: a systematic review*. Geneva: WHO; 2002.
3. Monteiro CA, Cannon G, Levy R, Moubarac J-C, Jaime P, Martins AP, Canella D, Louzada M, Parra D, Ricardo C, Calixto G, Machado P, Martins C, Martinzes E, Baraldi L, Garzillo J, Santtamini I. NOVA The Food System. *World Nutr* 2016; 7(7):28-38.
4. Brasil. Ministério da Saúde (MS). *Guia alimentar para crianças brasileiras menores de 2 anos*. Brasília: MS; 2019.
5. Rose CM, Birch LL, Savage JS. Dietary patterns in infancy are associated with child diet and weight outcomes at 6 years. *Int J Obes* 2017; 41(5):783-788.
6. Costa CS, Del-Ponte B, Assunção MCF, Santos IS. Consumption of ultra-processed foods and body fat during childhood and adolescence: a systematic review. *Public Health Nutr* 2018; 21(1):148-159.
7. Pan American Health Organization (PAHO). Ultra -processed food and drink products in Latin America: trends, impact on obesity, policy implications. Washington, DC: PAHO; 2015.
8. Levy RB, Claro RM, Mondini L, Sichieri R, Monteiro CA. Distribuição regional e socioeconômica da disponibilidade domiciliar de alimentos no Brasil em 2008-2009. *Rev Saude Publica*. 2012; 46(1):6-15.
9. Longo-Silva G, Silveira JAC, Menezes RCE, Toloni MHA. Age at introduction of ultra-processed food among preschool children attending day-care centers. *J Pediatr* 2017; 93(5):508-516.
10. Brasil. Ministério da Saúde (MS). Secretaria de Atenção à Saúde. Departamento de ações Programáticas e Estratégicas. *II Pesquisa de Prevalência de Aleitamento materno nas Capitais Brasileiras e Distrito Federal*. Brasilia: MS; 2009.
11. Flores TR, Nunes BP, Neves RG, Wendt AT, Costa CS, Wehrmeister FC, Bertoldi AD. Consumo de leite materno e fatores associados em crianças menores de dois anos: Pesquisa nacional de saúde, 2013. *Cad Saude Publica* 2017; 33(11):e00068816.
12. Relvas GRB, Buccini GS, Venancio SI. Ultra-processed food consumption among infants in primary health care in a city of the metropolitan region of Sao Paulo, Brazil. *J Pediatr (Rio J)* 2019; 95(5)584-589.
13. Cardoso M, Matijasevich A, Malta MB, Lourenco BH, Gimeno SGA, Ferreira MU, Castro MC. Cohort profile: The Maternal and Child Health and Nutrition in Acre, Brazil, birth cohort study (MINA-Brazil). *BMJ Open* 2020; 10(2):e034513.
14. De Onis M. WHO Child Growth Standards based on length/height, weight and age. *Acta Paediatr* 2006; 95:76-85.
15. Filmer D, Pritchett LH. Estimating wealth effects without expenditure data – or tears: an application to educational enrollments in states of India. *Demography* 2001; 38(1):115-132.
16. Brasil. Ministério da Saúde (MS). Portaria n° 569. Programa de Humanização no Pré-natal e Nascimento. *Diário Oficial da União* 2000; 1 jun.
17. Dal Bom JP, Mazzucchetti L, Malta MB, Ladeia-Andrade S, De Castro MC, Cardoso MA, Lourenço BA. Early determinants of linear growth and weight attained in the first year of life in a malaria endemic region. *PLoS One* 2019; 14(8):e0220513.
18. Oliveira JM, Castro IRR, Silva GB, Venancio SI, Saldiva SRDM. Avaliação da alimentação complementar nos dois primeiros anos de vida: proposta de indicadores e de instrumento. *Cad Saude Publica* 2015; 31(2):377-394.
19. World Health Organization (WHO). *Physical status: the use and interpretation of report anthropometry. Report of a WHO Expert Committee*. Geneva: WHO; 1995.
20. Castro TG, Baraldi LG, Muniz PT, Cardoso MA. Dietary practices and nutritional status of 0-24-month -old children from Brazilian Amazonia. *Public Health Nutr* 2009; 12(12):2335-2342.
21. World Health Organization (WHO). Indicators for assessing infant and young child feeding practices. Part 1: definitions. Washington DC: WHO; 2008.
22. Victora CG, Huttly SR, Fuchs SC, Olinto MTA. The role of conceptual frameworks in epidemiological analysis : a hierarchical approach. *Int J Epidemiol* 1997; 26(1):224-227.
23. Victora CG, Horta BL, Loret de Mola C, Quevedo L, Pinheiro RT, Gigante DP, Gonçalves H, Barros FC. Association between breastfeeding and intelligence, educational attainment, and income at 30 years of age: a prospective birth cohort study from Brazil. *Lancet Glob Health* 2015; 3(4):e199-205.
24. Martins APB, Levy RB, Claro RM, Moubarac JC, Monteiro CA. Increased contribution of ultra-processed food products in the Brazilian diet (1987-2009). *Rev Saude Publica* 2013; 47(4):656-665.
25. Momm N, Höfelmann DA. Qualidade da dieta e fatores associados em crianças matriculadas em uma escola municipal de Itajaí, Santa Catarina. *Cad Saude Colet* 2014; 22(1):32-39.
26. Keane E, Layte R, Harrington J, Kearney PM, Perry IJ. Measured parental weight status and familial socio-economic status correlates with childhood overweight and obesity at age 9. *PLoS One* 2012; 7(8):e43503.

27. Kendzor DE, Caughy MO, Owen MT. Family income trajectory during childhood is associated with adiposity in adolescence: a latent class growth analysis. *BMC Public Health* 2012; 12:611.
28. Saldiva SR, Venancio SI, Santana AC, Silva Castro AL, Escuder MM, Giugliani ER. The consumption of unhealthy foods by Brazilian children is influenced by their mother's educational level. *Nutr J* 2014. 13:33.
29. Costa KAO, Antunes MMC, Cabral PC, Silva GAP. Feeding style of adolescent mothers and complementary feeding practice of their infants. *Rev Nutr* 2018; 31(1):49-58.
30. Toral N, Conti MA, Slater E. A alimentação saudável na ótica dos adolescentes : percepções e barreiras à sua implementação e características esperadas em materiais educativos. *Cad Saude Publica* 2009; 25(11):2386-2394.
31. Coelho BMS, Macedo MAD, Pereira TG. Avaliação do consumo alimentar de adolescentes segundo a nova classificação de alimentos – NOVA. *Revista Interdisciplinar* 2017; 10(2):32-39

Article submitted 24/09/2020
Approved 26/01/2021
Final version submitted 28/01/2021

Chief editors: Romeu Gomes, Antônio Augusto Moura da Silva

This is an Open Access article distributed under the terms of the Creative Commons Attribution License