BREASTFEEDING, COMPLEMENTARY FEEDING AND HEALTH

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Milk preparations consumed in complementary feeding: characterization and nutritional composition according to participation of ultra-processed foods

Preparações lácteas consumidas na alimentação complementar: caracterização e composição nutricional segundo a participação de alimentos ultraprocessados

Abstract

Objective: To analyze the nutritional composition of milk preparations (MP) consumed by children aged 6-23 months. *Method:* We analyzed the list of MP (n = 183) reported by parents or guardians of children aged 6-23 months in a survey conducted with a representative sample of children using SUS in the city of Rio de Janeiro. The referred MP were typified according to their ingredients. The adequacy of reconstitution of powdered milk products was examined. The nutritional composition of the MP was compared to that of mature human milk and the Recommended Daily Intake, and analyzed as a function of the relative energy participation of ultra-processed foods (UPF) in 100 kcal of each MP. *Results:* Most MP was composed of cow's milk added with a thickener and / or sugar and / or fruit (86.9%). Of the total MP, 85% contained at least one UPF. Most MP with powdered milk products had lower product concentration than recommended by the manufacturer. As a whole, MP were hyperproteic, hypercaloric and had high levels of micronutrients when compared to human milk. In general, they extrapolated the daily nutrient recommendations for protein and micronutrients and, due to the relative participation of UPF, showed a positive correlation for carbohydrates and part of the analyzed micronutrients and a negative correlation for proteins and lipids. Regardless of this participation, their nutritional profile was very different from that of breast milk. *Conclusion:* The analyzed MP presented nutritional profile far from desirable, with high levels for some nutrients and low for others, in any level of participation of UPA in its composition.

Keywords: Human milk substitutes. Infant feeding. Industrialized foods

Resumo

Objetivo: Analisar a composição nutricional das preparações lácteas (PL) consumidas por crianças de 6-23 meses de idade. *Método*: Analisou-se o elenco de PL (n=183) referidas por responsáveis por crianças de 6-23 meses em inquérito conduzido com amostra representativa de crianças usuárias do SUS no município do Rio de Janeiro. As PL referidas foram tipificadas segundo seus ingredientes. Foi examinada a adequação da reconstituição dos produtos lácteos em pó. A composição nutricional das PL foi comparada à do leite humano maduro e à Ingestão Diária Recomendada, e analisada em função da participação relativa de energia de alimentos ultraprocessados (AUP) em 100 kcal de cada PL. *Resultados:* A maioria das PL era composta por leite de vaca acrescido de espessante e/ou açúcar e/ou fruta (86,9%). Do total de PL, 85% continham pelo menos um AUP. A maioria das PL com produtos lácteos em pó apresentou concentração do produto inferior à recomendada pelo fabricante. Em seu conjunto, as PL se mostraram hiperproteicas, hipercalóricas e apresentaram teores elevados de micronutrientes, quando comparadas ao leite humano. Em geral, extrapolaram as recomendações diárias de nutrientes para proteínas e micronutrientes e, em função da participação relativa de AUP, apresentaram correlação positiva para carboidratos e parte dos micronutrientes analisados e correlação negativa para proteínas e lipídios. Independentemente desta participação, apresentaram perfil nutricional muito distinto daquele do leite materno. *Conclusão:* As PL analisadas apresentaram perfil nutricional distante do desejável, com teores elevados para alguns nutrientes e baixos para outros, em qualquer nível de participação de AUP em sua composição.

Palavras-chave: Substitutos do leite humano. Alimentação infantil. Alimentos industrializados.

INTRODUCTION

In Brazil, in recent decades, researchers have found the recurring use of bottles and introduction of water, tea and milk in the first month of life; the early introduction of milks other than breast milk and other foods in the first year of life; and the expressive participation of industrialized products, monotony and low nutritional quality in diets of young children.[1-4] Up to now, there have been no studies that sought to examine, in-depth, the composition of milk preparations (MP) consumed by young children, the participation of UPF and their implications for the nutritional quality of these preparations.

This study sought to characterize the nutritional composition of MP consumed by children aged 6-23 months who use the Sistema Único de Saúde (Unified Health System - SUS) in the city of Rio de Janeiro; to determine the adequacy of the reconstitution of powdered milk products (ARPMP) in MP; to estimate the nutritional adequacy of MP with regard to daily nutritional recommendations and to evaluate the nutritional composition of MP according to UPF participation

METHODS

The larger project of which this study is part, titled "Diets and Nutrition of Pre-Schoolers who Use SUS", carried out by the Instituto de Nutrição (Institute of Nutrition) at UERJ in partnership with several academic institutions, is a cross-sectional study with a probabilistic representative sample of children aged six to 59 months who use the primary health network of the Rio de Janeiro municipality (and also representative of the age groups <24 and >=24 months). The sample design is described in detail in Furtado.[5]

Of the total number of children included in the larger project (n=536), we included in this study only those who were aged between six and 23 months (n=190). We chose this age range because MP represent a highly expressive share of diets in this group. We considered the milk preparations (n-183) reported by the participants responsible for those children.

Data collection took place between the months of June and December, 2014, in a private environment. At a previously-scheduled date, participants filled out a 24-hour diet recall (24HR). They were asked to describe the foods and beverages (and amounts) that the child consumed on the eve of the interview (including over night, if applicable). The types of foods, amounts, manner of preparation, time and place of consumption were recorded. In order to help participants to recall the food portions they offered to the children, we used utensils and food replicas to quantify them in household measurements.

For the purposes of this analysis, MP include all animal-milk-based preparations offered to children, including bottles, porridges and milk served in a glass, whether or not other ingredients were added. We identified 301 different MP. Since not all records had complete information regarding MP composition, they were classified according to the completeness of the information, namely: complete recipe (with a detailed description of the amounts of liquids and solids added to the milk preparation and the volume of the preparation [based on the sum of all ingredients]) (n=112); incomplete recipe due to lack of information regarding the volume of the liquid ingredient in the preparation, but including the preparation's total volume (n=71); incomplete recipe due to lack of information regarding the amount of some ingredient in the preparation (n=53); and no recipe (n=65).

We discarded preparations classified as having "no recipe" or as " incomplete due to lack of information regarding the amount of some ingredient". For those classified as "incomplete due to lack of information regarding the volume of the liquid ingredient in the preparation, but including the preparation's total volume", we imputed the volume of the liquid ingredient (milk or water) based on the difference between the total preparation volume reported by the interviewee and the sum of grams of the solid ingredients. For example: for a preparation made with water with a total volume of 240 ml and composed of 30g of powdered milk + 15 g of corn starch (45), the imputed volume of water was of 195 ml. We included 183 MP in the study.

The MP were typified as: milk, porridge, formula and milk beverage, according to their main ingredient and consistency. They were also categorized based on whether or not they contained sugar, chocolate mixtures or strawberry beverage mixtures with cereals and artificial aromas, cereal flours and/or fruit. The MP types and subtypes and respective number of preparations are presented in table 1.

The household measurements reported for these preparations in the 24HR were converted into units of mass and volume based on the Tabela de Medidas Referidas para os Alimentos Consumidos no Brasil (Table of Reported Measurements for Foods Consumed in Brazil).[6] When participants reported household measurements that are not found in the available literature on the subject, or when they reported consumption based on fractions of food replicas used to fill out the 24HR, we converted these household measurements into units of mass. To do so, we purchased foods similar to the replicas and weighed them using a digital scale with 1g precision and capacity of up to 5kg at the Laboratório de Técnica Dietética (Laboratory of Dietetic Technique) of the Instituto de Nutrição at UERJ and the Instituto de Nutrição Annes Dias (Annes Dias Nutrition Institute).

We also weighed foods in the utensils presented during the interviews. For each utensil, we carried out at least three independent weighings. We measured spoons and ladles that were full, shallow and leveled (using the plane side of a table knife). In addition, we used the measurement spoon (leveled and full) included in formula packages.

For UPF reported as ingredients in MP, we carried out a market research in order to collect the following information from their labels: nutritional composition and ingredients (foods, additives or any other components present in this section). Trained field researchers visited establishments that sell food and photographed the packaging (front, back and side, when present).

Data regarding each MP's ingredients and respective amounts were entered into an Excel spreadsheet. Ingredients were categorized according to the food classification based on the extent and nature of processing.[7] Ingredients, energy totals and percentage of energy participation from UPF are presented in detail in Furtado (2018).[5]

In order to obtain the nutritional composition of each MP, we used the table from the 2008-2009 POF (Family Budget Survey),[8] which presents the composition of whole fat cow's milk in grams. However, many interviewees reported offering liquid cow's milk. To convert milliliters into grams, we adopted the equivalence of 1 ml of fluid cow's milk to 1 g of powdered cow's milk, since the density of milk is, on average, 1.032 g/ml, and is therefore very close to one.[9] For the analysis of the nutritional composition of UPF, we used the information available on product labels or on their manufacturers' websites, following the brands and flavors mentioned in the 24HR. When we could not find a specific brand or flavor, we used the nutritional composition of similar foods most often consumed by the study population.

In order to describe the nutritional composition of the MP, we obtained the mean values of macronutrients (carbohydrates, proteins, fats) and micronutrients (calcium, iron, zinc, vitamin A, vitamin C) in 100 ml of the preparations that comprise each of the 25 types included in the study. We included iron and zinc in the study because they were considered limited in diets of several populations; and calcium, vitamin A and vitamin C were included because they have been found to be deficient in many developing countries.[10-12] In Brazil, controlling iron and vitamin A deficiencies is a public health priority.[13-15]

Another aspect we considered was the reconstitution of powdered milk products (cow's milk, formula and milk beverages) because it is crucial to the nutritional density of MP. We examined the ARPMP of the 131 MP that contained powdered milk products using the dilution recommended by the manufacturer for 100 ml of water for each product type as the adequacy standard (100%). We carried out the following descriptions and analyses: distribution of the adequacy of MP reconstitution; adequacy of milk product reconstitution according to MP type (milk, porridge, formula and milk beverage); and analysis of the association between reconstitution adequacy and energy amount in 100 ml of MP.

For the analysis of the MP's nutritional composition, we compared the mean values of energy, macro and micronutrients found in 100 ml of each of the four MP types (milk, porridge, formula and milk beverage) with the values present in 100 ml of mature human milk (MHM), which is considered the gold standard for the age group included in the study.[16] We also calculated the percentage of the daily amounts of energy, macronutrients and micronutrients present in the four MP types in terms of what is recommended by the IOM according to age group.[17-21] To do so, we considered the observed means of each nutrient in the set of MP in each type (milk, n=143; porridge, n=19; formula, n =10; and milk beverage, n=11) in 500 ml of preparation.

We chose the 500 ml volume of MP because this is considered the maximum amount to be consumed in a day, if the child is not breastfed, in order to avoid potential loss of micronutrients and enable a healthy and adequate supplementary diet.[15-22] The estimated energy requirement (EER) was calculated following IOM recommendations,[17] using the 50th percentile of the distribution of the weight/age index according to sex[23] (average of boys and girls) for each age group.

To calculate protein amounts, we used the estimated average requirements (EAR) of 1.0g/kg/day for children aged between 6-12 (incomplete) months and of 0.87 g/kg/day for children aged 12-36 months.[18] For the other macro and micronutrients, we used the DRI.[18-21] Since there is no EAR, RDA or AI for lipids for children aged between 13-36 months, we used the AMDR[18] (acceptable macronutrient distribution ranges), using the midpoint (35%) of the range defined for this age group (30 to 40% of total calories).

In order to assess excessive values of micronutrients in 500 ml of MP, especially due to the presence of UPF, we used the UL standard (tolerable upper intake level) according to age group (6-11 months, 12-24 months). In the analysis of the MP's nutritional composition according to UPF participation, after estimating the total energy of each MP, we calculated the UPF participation in the preparation considering the proportion of energy contributed to the MP by the included UPF. To assess the correlation between nutritional composition and relative energy participation from UPF, we used a Spearman correlation coefficient. We assessed the amount of carbohydrates, proteins, lipids, calcium, iron, zinc, vitamin A, vitamin C in 100 kcal of the 183 MP included in the study, taking into account the UPF participation in each. The critical level for identifying statistically significant differences was 5%.

We generated scatterplots using each nutrient as the dependent variable and UPF participation as the independent variable. A smoothed line, obtained through a loess function (with 50% of points captured by the line) was included in the graphs of each nutrient to facilitate the visualization of the relationship between variables. We included vertical lines demarcating the quarters of the UPF participation distribution so as to facilitate the visualization of possible differences in nutritional composition according to UPF participation quarter. We included a dotted line to indicate the amount of each nutrient in MHM to enable a comparison of nutrient amounts according to UPF participation.

We carried out the data analysis using SPSS (version 17.0).

The larger project of which this study is part was funded by CNPq (processes 480804/2013-3 and 420247/2016-5) and by the Secretaria Municipal de Saúde do Rio de Janeiro (Rio de Janeiro Municipal Health Secretariat) and was approved by the Secretaria's Comitê de Ética em Pesquisa com Seres Humanos (Ethics Review Committee for Studies on Human Beings) under the number 93/13. We only studied children whose parents or guardians agreed to participate and signed an informed consent form.

RESULTS

Of the 25 MP subtypes we identified, 22 were preparations in which cereal flours and/or fruits and/or sugar were added to the chosen milk product (milk, formula or milk beverage). Of the MP total, 85% contained at least one UPF, such as: chocolate mixture, cookies, milk beverage, instant cereal flours, formula, jam and syrup (corn glucose). Generally speaking, the four MP types had mean values of energy (except for the milk group), proteins, carbohydrates and micronutrients that were superior to mature human milk, and mean lipid values that were inferior to those of MHM. The mean micronutrient values we observed for each of the our MP types exceed MHM values by 3-4 times for calcium, 53-80 times for iron, 5-11 times for zinc, 2-3 times for retinol and by 1.5-6 times for vitamin C (table 1).

Table 1. Mean values of energy, proteins, lipids, carbohydrates, calcium, iron, zinc, vitamin A and vitamin C in 100 milliliters of mature human milk and of milk preparation, according to the type of milk preparation (MP) reported by interviewees responsible for children under two years of age who use the Unified Health System. Rio de Janeiro, 2014.

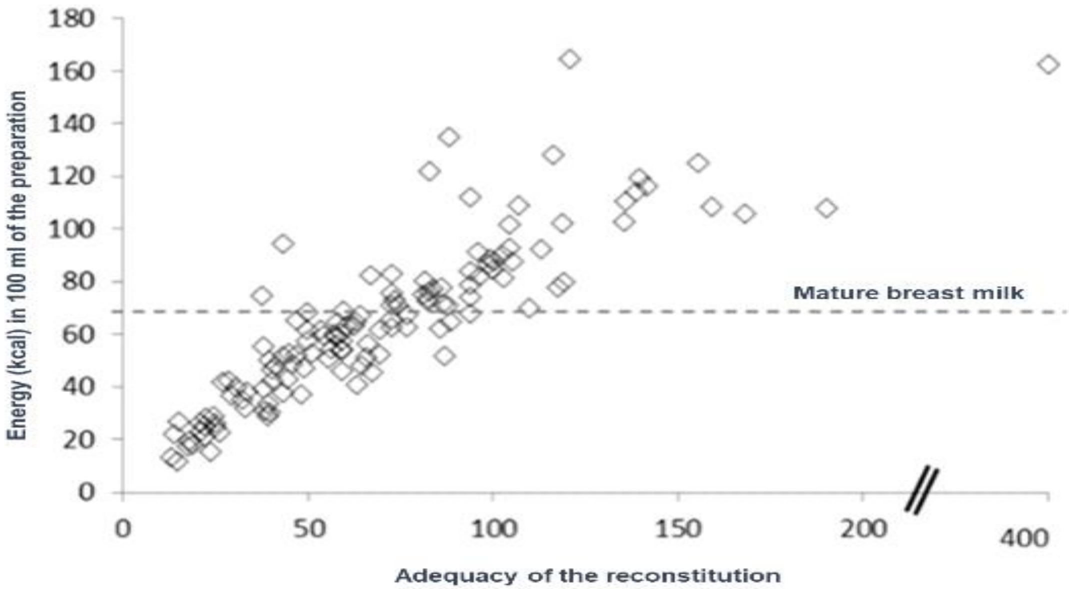
Types and subtypes of MP	N.[a]	Mean in 100 ml of MP								
		Energy (kcal)	Ptn[b] (g)	Lip[c] (g)	Cho[d] (g)	Ca[e] (mg)	Fe[f] (mg)	Zn[g] (g)	VitA[h] (mcg)	VitC[i] (mg)
Mature human milk	-	68.1	1.05	3.9	7.2	28.0	0.03	0.12	50.0	4.0
Milk	**143**	**64.0**	**2.48**	**2.1**	**8.8**	**91.2**	**1.64**	**0.64**	**174.5**	**6.0**
Pure milk	3	42.4	2.27	2.3	3.9	80.0	0.22	0.25	26.5	0.7
Sweetened pure milk	1	68.3	3.14	3.2	6.9	110.2	0.03	0.39	27.7	0.0
Milk w/ thickener	64	58.6	2.41	2.1	7.4	83.6	2.15	0.78	101.3	6.9
Sweetened milk w/ thickener	30	64.9	2.37	2.1	9.1	84.8	1.72	0.71	86.1	5.5
Milk w/ fruit	3	55.2	1.65	1.4	10.0	47.3	0.10	0.21	16.8	8.2
Sweetened milk w/ fruit	5	62.1	2.24	1.5	10.6	72.2	0.29	0.26	28.8	7.0
Milk w/ fruit and thickener	5	73.1	2.57	2.0	11.7	75.0	1.66	0.68	75.1	9.4
Sweetened milk w/ fruit and thickener	8	105.5	3.06	2.9	17.8	87.2	2.06	0.67	92.5	12.5
Milk w/ fruit and chocolate mixture[j]	1	107.8	2.98	2.5	20.0	121.4	0.56	0.37	38.5	5.5
Milk w/ chocolate mixture	15	60.1	2.62	2.2	7.5	147.4	0.89	0.36	53.9	1.5
Sweetened milk w/ chocolate mixture	2	68.9	2.60	2.6	8.9	145.9	1.25	0.19	68.1	2.3
Sweetened milk w/ coffee	5	64.6	2.51	2.4	8.7	85.6	0.05	0.31	21.1	0.0
Fortified milk	1	104.0	6.19	2.9	13.6	173.6	1.61	1.40	126.5	5.3
Porridge	**19**	**82.6**	**3.18**	**2.8**	**11.2**	**115.5**	**2.54**	**0.69**	**121.5**	**8.2**
Porridge	13	81.0	3.25	2.8	10.8	115.1	2.99	0.69	138.8	9.7
Sweetened porridge	6	86.3	3.02	2.9	12.1	116.4	1.58	0.69	84.1	5.0
Formula	**10**	**82.4**	**2.13**	**3.2**	**11.3**	**82.0**	**1.60**	**0.86**	**89.3**	**12.0**
Formula	3	77.0	2.14	3.6	9.02	83.1	1.22	0.75	84.9	12.1
Sweetened formula	1	62.1	1.69	2.5	8.2	66.6	0.93	0.69	59.0	8.1
Formula w/ thickener	2	90.1	2.76	3.3	12.6	94.2	2.05	0.70	103.4	11.9
Sweetened formula w/ thickener	3	80.6	1.65	3.0	11.6	78.5	2.01	1.10	101.5	13.5
Sweetened formula w/ thickener and fruit	1	108.4	2.70	3.2	18.0	80.7	1.28	0.94	68.4	11.4
Milk beverage	**11**	**76.2**	**2.17**	**2.5**	**11.2**	**111.6**	**2.40**	**1.30**	**116.4**	**24.9**
Milk beverage	1	41.1	1.36	1.9	4.7	76.0	0.76	0.57	42.0	9.1
Milk beverage w/ thickener	5	88.4	2.53	2.9	12.8	124.4	3.14	1.68	150.2	20.2
Sweetened milk beverage w/ thickener	3	60.9	1.64	1.8	9.43	89.3	2.22	1.21	107.0	13.8
Milk beverage w/ fruit	1	70.0	2.44	2.3	10.82	83.7	0.87	0.67	55.2	106.2
Milk beverage w/ chocolate mixture	1	102.0	2.50	3.7	14.64	177.3	2.40	0.99	112.0	16.2

[a] [a] Number of MPs according to type/subtype, [b] proteins, [c] lipids, [d] carbohydrates, [e] calcium, [f] iron, [g] zinc, [h] vitamin A, [i] vitamin C, [j] "chocolate mixture" includes strawberry beverage mixtures with cereals and artificial aromas.

The distribution of ARPMP varied between 8.88 and 399.00%. The adequacy of most MP (75%) was inferior to 70%, while 7.6% had an adequacy of over 130%. Mean ARPMP was 85% and was highly heterogeneous among the MP groups, namely: milk: 62%; porridge: 78%; milk beverage: 91%; and formula: 108%.

As expected, ARPMP was directly associated with the amount of energy available in 100 ml of each MP (figure 1). We found many instances in which the energy amounts present in MP exceeded those found in MHM, even when ARPMP was inferior to 100%, which reveals the presence of other ingredients which directly interfere with the increase in energy amounts.

Figure 1. Energy in 100 ml of milk preparations (n=131) according to the adequacy of the reconstitution of powdered milk products in milk preparations reported by interviewees responsible for children under two years of age who use the Unified Health System. Rio de Janeiro, 2014.



Based on the nutritional compositions presented in table 1, we conclude that 500 ml of MP (with the exception of the "milk" type) cover a higher percentage of daily carbohydrate, protein and micronutrient needs and a lower percentage of lipid needs than 500 ml of MHM (table 2).

Generally speaking, the amount of proteins, iron, zinc, vitamin A (expressed as 1 mcg of retinol = 1 mcg of equivalent retinol – ER) and vitamin C in 500 ml of MP exceeded 100% of the daily nutritional needs of the two age groups we analyzed, ranging from 1.1 (calcium) to 9.6 times (vitamin C). Both values were observed for the type "milk beverage", considering the nutritional needs of children aged 13-23 months. For proteins and micronutrients, half of the estimated values represented at least 1.72 times the daily nutritional needs.

Table2. Adequacy of 500 ml of milk preparations with regard to nutritional recommendations, according to age group, among children under two years of age who use the Unified Health System. Rio de Janeiro, 2014.

Mature human milk and MP types	Percentage adequacy of 500 ml of product with regard to energy and nutrient recommendations								
	Energy	Ptn[a]	Lip[b]	Cho[c] (%)	Ca[d]	Fe[e]	Zn[f]	VitA[g]	VitC[h]
6 to 12 months									
Mature human milk	**49.2**	**61.8**	**65.0**	**37.9**	**53.8**	**2.2**	**24.0**	**50.0**	**40.0**
Milk	46.2	145.9	35.0	46.3	175.4	118.8	128.0	174.5	60.0
Porridge	59.7	187.1	46.5	58.9	222.1	184.0	138.0	121.5	82.0
Formula	59.5	125.3	53.5	59.4	157.6	115.9	172.0	89.5	120.0
Milk beverage	55.1	127.6	41.6	58.9	214.6	173.9	260.0	116.5	249.0
12 to 23 months									
Mature human milk	**39.6**	**57.1**	**58.3**	**36.0**	**28.0**	**5.0**	**24.0**	**119.0**	**153.8**
Milk	37.2	134.9	31.4	44.0	91.2	266.6	128.0	415.5	230.7
Porridge	48.0	173.0	41.8	56.0	115.5	423.3	138.0	121.5	315.4
Formula	47.9	115.9	47.8	56.5	82.0	266.6	172.0	212.5	461.5
Milk beverage	44.3	118.1	37.3	56.0	114.1	400.0	260.0	277.0	957.7

[a] proteins, [b] lipids, [c] carbohydrates, [d] calcium, [e] iron, [f] zinc, [g] vitamin A, [h] vitamin C.
Mean values of energy and nutrients compared with the DRI[17,18,19,20,21].
References: Energy (EER): 7-12 months: 691.85 kcal, 13-23 months: 860.73 kcal[17]. Macronutrients: proteins (EAR): 6-12 months: 1.0 g/kg/day and 1-3 years: 0.87 g/kg/day; lipids (AI): 6-12 months: 30 g; carbohydrates (AI): 6-12 months: 95 g/day and 13-23 months: 100 g/day[18]. Micronutrients: calcium (AI): 6-12 months: 260 mg/day and (EAR): 1-3 years: 500 mg/day [19]; iron (EAR): 6-12 months: 6.9 mg/day and 1-3 years: 3.0 mg/day; zinc (EAR): 6-12 months: 2.5 mg/day; 1- 3 years: 2.5 mg/day, vitamin A (equivalent retinol – ER) (AI): 6-12 months: 500 mg/day and (EAR):1-3 years: 210 mcg/day[20]; and vitamin C (AI): 6-12 months: 50 mg/day and (EAR) 1-3 years: 13 mg/day[21]. For lipids, we used the AMDR for the age group 1-3 years (30 to 40% - using the mean point, 35%).[18]

We found excessive values (that exceed the UL) for zinc, vitamin A and vitamin C in 500 ml of some MP. In the MP type "milk", subtype "fortified milk", zinc values exceeded the UL for children aged 6-12 months (5 mg) and reached the limit for children aged 1-3 years (7 mg).

We also found excessive amounts of zinc in MP type "milk beverage" for the age group 6-12 months (6.5 mg), in subtype "milk beverage with thickeners" for both age groups (8.4 mg) and in subtype "sweetened milk beverage with thickener" for the age group 6-12 months (6.05 mg). We found excessive values of vitamin A (over 600 mcg) in MP type "milk" (872.5 mcg), and the subtype "fortified milk" (632.5 mcg); in the type "porridge" (607.5 mcg) and subtype "porridge" (694 mcg). The observed values of this vitamin were very close to the maximum level (582 mcg) in the type "milk beverage" and also in the subtype "milk beverage with chocolate mixture" (560 mcg), but exceeded the UL in the subtype "milk beverage with thickener" (752.5 mcg). The vitamin C values present in the subtype "milk beverage with fruit" (531 mg) exceeded the UL for the age group 1-3 years (400 mg).

The analysis of the nutritional composition of the 183 MP according to relative participation of energy from UPF in 100 kcal reveals that, when compared with the composition of MHM, regardless of the percentage of energy from UPF, MP have much higher values of all nutrients, except lipids.

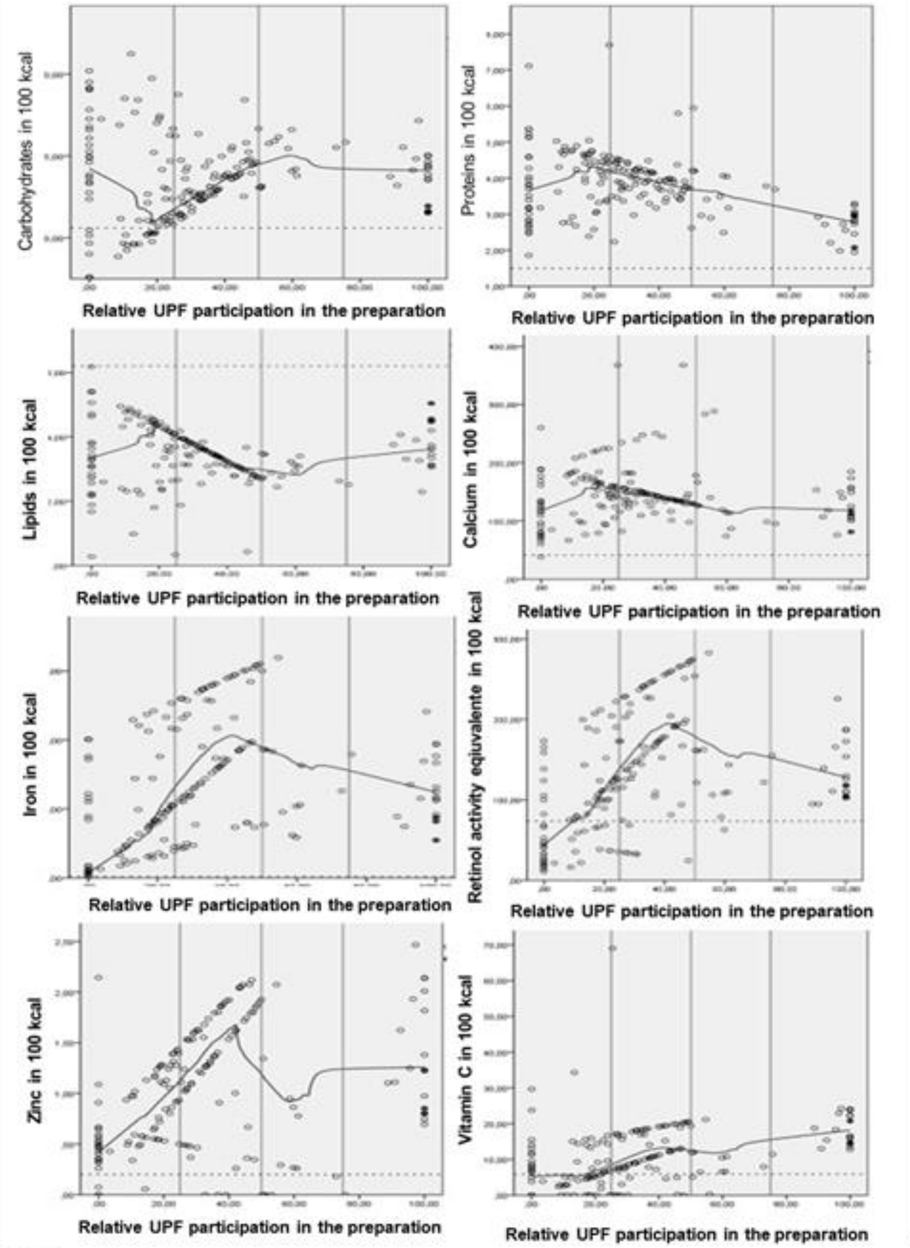
Protein and lipid values were negatively correlated and carbohydrates were positively correlated with relative UPF participation in MP (table 3). Although these correlations were not high (modular values varied between 0.160 and 0.300), they were statistically significant. Iron, zinc, vitamin A and vitamin C had a positive, statistically significant correlation with relative UPF participation in MP, varying between 0.419 and 0.525. Calcium values had a negative correlation that was not statistically significant. The association between macro and micronutrient values and relative UPF participation in MP is non-linear (figure 2). Macro and micronutrient values, regardless of relative UPF participation, are very different from those of MHM.

Table 3. Correlation between amount of nutrients and percentage of UPF participation in milk preparations reported by interviewees responsible for children under two years of age who use the Unified Health System. Rio de Janeiro, 2014.

Spearman correlation	Nutrients							
	Ptn[a]	Lip[b]	Cho[c]	Ca[d]	Fe[e]	Zn[f]	VitA[g]	VitC[h]
Correlation coefficient	-0.300	-0.160	0.187	-0.528	0.506	0.419	0.499	0.525
P value	0.000	0.030	0.011	0.486	0.000	0.000	0.000	0.000

[a] proteins, [b] lipids, [c] carbohydrates, [d] calcium, [e] iron, [f] zinc, [g] vitamin A, [h] vitamin C.

Figure 2. Distribution of macro and micronutrients in 100 kcal of milk preparations (n=183) according to the percentage of energy from ultra-processed foods reported by interviewees responsible for children under two years of age who use the Unified Health System. Rio de Janeiro, 2014.



Legend
- Vertical lines delimit quarters of the Distribution of UPF participation.
- Dotted lines indicate the amount of each nutriente in mature human milk.
- Full lines: obtained through a loess function, indicate the direction of the relationship between variables.

DISCUSSION

Results reveal that the vast majority of MP reported by study participants were composed of cow's milk (88.5%) with added thickener and/or sugar and/or fruit (86.9%, including preparations of the "porridge" type"), or not (pure cow's milk: 1.6%). Furthermore, 85% of them contained at least one UPF.

A large percentage of the preparations that included powdered milk products had an inadequate reconstitution, resulting, in most cases, in a product concentration that was inferior to manufacturer recommendations. Even so, they were hyperproteic, hypercaloric and had high levels of micronutrients, when compared with MHM. Additionally, they generally exceeded daily nutrient needs for proteins and micronutrients in 500 ml of product. Although the MP were positively correlated with carbohydrates and many of the micronutrients we analyzed, and negatively correlated with proteins and lipids, in terms of relative UPF participation in MP, regardless of this participation, they had a nutritional profile that is markedly different from that of MHM.

The findings that many of the reported MP were composed of non-recommended ingredients corroborate other studies which show an early introduction of foods in the first year of life, and the expressive participation of ultraprocessed foods,[3] which have an unfavorable nutritional profile[24] and whose consumption may lead to adverse consequences over the life course, such as excess weight and obesity,[25] high blood pressure[26] and cancer.[27] Given that the data we analyzed in this study were collected in 2014 and there is a trend toward an increase in UPF participation in Brazilians' diets recorded over the past decades, we may assume that the presence of UPF in MP may be even more expressive.

Although 85% of MP had at least one UPF among their ingredients, a small percentage was composed of formula (5%), possibly due to its high cost, when compared with cow's milk. This is the only UPF recommended as a MP ingredient for children under one year of age,[15] in situations in which breastfeeding is no longer practiced. Formula-based MP, for the most part, also included instant cereal flours, something that is not recommended, and had high levels of proteins and carbohydrates. Formula-based MP may lead to rapid and excessive weight gain in the first years of life and increase the risk of excess weight and obesity in childhood and adult life. The high protein levels of formula-based MP, resulting from the inclusion of flours, merits notice.[28]

As already mentioned, milk-beverage-based MP had higher micronutrient levels than MHM, with the exception of calcium. Milk beverages contain food additives and sugars, 51% milk (at least) and other milk or non-milk ingredients; because of this, they are not considered substitutes for breast milk and, consequently, are not recommended for children up to three years old.[29] However, as can be seen, this product is consumed by children under two years of age.

As for ARPMP, the group "milk", which encompassed the largest number of MP included in the study (n=95), had the lowest mean percentage of reconstitution adequacy (62%), in contrast to the percentage found for formula (108%). These results went against the expectation of a more adequate reconstitution of powdered cow's milk than formula, given the lower cost of the former. Possible explanations are the inclusion of a measuring spoon in formula packages, but not in powdered milk packages, which makes it easier for parents and guardians to use this product according to manufacturer instructions, and the fact that families that use formula have higher income, which enables them to use the product in the recommended concentration.

One factor that may influence the inadequate reconstitution of powdered whole cow's milk is the continuation, in older ages, of its dilution, something only recommended for children up to four months of age by the Health Ministry[15] and by the Municipal Health Secretariat, in which this study was carried out.[30] Although the ARPMP was generally inferior to 100%, what seems to explain the hypercaloric nature of MP is the fact that many of them (85.8%) also include instant cereal flours (considered a UPF, since they include sugar and food additives) and/or sugar and/or other products (fruits, chocolate mixture).

MP were considered hyperproteic, however, the type "milk beverage" had a lower level, possibly as a result of containing a minimum of 51% of milk in its composition.[29] It is worth noting that cow's milk is a potential allergen for children under one year of age and its consumption has been associated with the development of atopy due to its high protein content.[31]

MP not only had lower levels of lipids, but also low levels of essential fatty acids and predominance of saturated fatty acids.[14] In human milk, lipids are the main source of energy for infants (50 to 60%), as well as an important source of essential fatty acids, especially linoleic acid, alpha linolenic acid and long chain derivatives, arachidonic acid and docosahexaenoic acid, which are crucial to the development of the central nervous system and in retina function, in addition to carrying fat-soluble vitamins and hormones,[14] something we did not find in the MP. Even though formula and milk beverages are products based on modified cow's milk, they do not meet nutrient expectations, either qualitatively or quantitatively.

The four MP types had high levels of micronutrients. Vitamins act in various reactions and cascades in the metabolism, while minerals act upon their regulation; as a result, micronutrient deficiency or excess may cause different illnesses.[32,33] Considering that, in addition to MP, children aged 6-23 months also receive other foods which also contain these nutrients, the excess found in MP is concerning.

Children who are fed fortified foods and formula may consume excessive amounts of iron, zinc, calcium and vitamin A.[34] Voluntary food fortification increases the likelihood of zinc and retinol consumption in excess of the UL.[35] Chronic excessive consumption of foods rich in pre-formed vitamin A affects the development and normal metabolism of bones and the central nervous system, alters the cardiovascular system, calcifying the heart valves.[36] Chronic consumption of high doses of zinc increases blood levels of LDL cholesterol and reduces HDL levels.[37]

All MP, with or without UPF, had an unbalanced nutritional composition, with higher levels of carbohydrates, iron, zinc, equivalent retinol and vitamin C than those observed in MHM.

The fact that the analyzed MP had a very different nutritional profile than MHM, regardless of the relative UPF participation in the preparations' total energy, and regardless of whether or not they were based on formula, reveals the urgency of intensifying measures to promote, support and protect breastfeeding.[38-41] This conclusion is reinforced when we consider the trends shown by breastfeeding indicators in Brazil over the past three decades. The prevalence of exclusive breastfeeding among children under six months of age, breastfeeding among children aged up to two years and continued breastfeeding at 12 months of age saw a growing trend until 2006 and a relative stabilization between 2006 and 2013. The indicator of continued breastfeeding at two years had a different performance: a relatively stable prevalence, at around 25% between 1986 and 2006, and subsequent rise, reaching 31.8% in 2013.[42]

The qualification of health professionals' approaches to promoting, protecting and supporting breastfeeding is crucial. For children who are partially breastfed or not breastfed, we must provide professionals, especially those working in primary health care, better training with regard to the nutritional composition of MP and their preparation and how to handle supplementary feeding. We must broaden and intensify permanent training initiatives that help to implement guidelines on this subject, which can be found in policies and documents such as the "Estratégia Amamenta" and "Alimenta Brasil",[43] the *Caderno Saúde da Criança: Aleitamento Materno e Alimentação Complementar* – CAB 23[15] and the *Guia Alimentar para Crianças Menores de Dois Anos*,[44] whose new edition will soon be published.

We must also intensify regulatory measures to combat food publicity directed at children. The Conselho Nacional dos Direitos da Criança e do Adolescente (National Child and Adolescent

Rights Council - Conanda)[45] bans television and radio advertising, banners, packages and promotions directed at children, including food marketing.

We must also follow the Norma Brasileira para Comercialização de Alimentos para Lactentes e Crianças de Primeira Infância e de produtos de puericultura correlatos (Brazilian Norm for the Commercialization of Foods for Infants and Children in Early Childhood and related products - NBCAL).[46] It is crucial that health professionals contribute to monitoring violations regarding the Human Right to Adequate Food, taking the NBCAL into consideration.[30]

In order to guarantee access to information regarding the qualitative and quantitative characteristics of foods, their labels must include the necessary information on their nutritional composition, enabling more conscious, health-promoting choices. Studies show that the exact amounts of sugar present in foods are often omitted, making their determination difficult, and leading to their underestimation.[47,48]

We must also encourage other initiatives, such as breastfeeding rooms at workplaces,[41] Human Milk Banks[49] and the Iniciativa Hospital Amigo da Criança (Baby Friendly Hospital Initiative),[50] among others. The new *Dietary Guidelines for Children Under 2 years* (forthcoming) will be a crucial instrument for promoting breastfeeding and healthy supplementary feeding. Its implementation will make updated information available to the population and will guide actions in health and education networks.

It is worth noting that 110 of the 301 initially identified MP were not included in the study as a result of incomplete information in the 24HR. Research into components of MP not included in the study indicates that they have similar ingredients and combinations as those analyzed. Though it is impossible to know if the nutritional composition of these MP differed from those analyzed in terms of the amounts of different ingredients, we may state that the loss of 110 MP did not prevent the qualitative description of the MP reported by the study participants.

It is also worth remarking upon the choice of the food composition table from POF[8] in order to obtain nutrient information, since it is a compilation of several tables, including those comprised of many fortified foods, unlike what happens in Brazil.[51] However, this table is used in many studies, including ones carried out in Brazil; therefore, this choice enables greater comparability with other studies.

One limitation of the POF table is the lack of details on UPF, often including an average composition of certain UPF; however, depending on the brand, the composition of a given UPF may be very different. In order to minimize this limitation, in this study, we added nutritional information available on UPF labels reported by participants to the POF table. We would ideally have access to complete, up-to-date tables. Since this is not possible, we believe that the inclusion of information found on labels enables a wider-reaching analysis of the foods included in MP.

One of the study's strengths is the detailed description of ingredients and amounts used in a wide range of MP offered to children who use SUS, considering the NOVA classification of foods,[7] based on the extent and nature of their processing. Another strength is its pioneering nature, bringing visibility and providing elements to advance the knowledge regarding a crucial, but still understudied, theme in supplementary feeding.

CONCLUSIONS

MP consumed by children under 2 years of age who use SUS in Rio de Janeiro City had a nutritional profile that differs considerably from what is recommended, with high levels of some nutrients and low levels of others, regardless of the level of UPF participation in their composition. Regulatory measures that favor breastfeeding and discourage the consumption of inadequate foods in the first two years of life must be intensified, as must permanent training actions for health professionals, so as to qualify their approaches regarding the offer and composition of MP and regarding adequate, healthy diets in early life.

Given the current epidemiological context and the findings presented here, we suggest studies on the centesimal analysis of UPF, giving priority to those with voluntary fortification which are consumed by children under two years of age, due to possible micronutrient excesses, as well as the periodical updating of food composition tables. The analysis of MP consumed by children in national epidemiological studies, such as the ongoing Estudo Nacional de Alimentação e Nutrição Infantil (National Child Food and Nutrition Survey), will enable us to know the profile of MP consumed by Brazilian children.

REFERENCES

1. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Ações Programáticas e Estratégicas. II Pesquisa de Prevalência de Aleitamento Materno nas Capitais Brasileiras e Distrito Federal. Brasília: Editora do Ministério da Saúde; 2009.
2. Bortolini GA, Vitolo MR, Gubert MB, Santos LMP. Early cow's milk consumption among Brazilian children: results of a national survey. J Pediatr (Rio J). 2013; 89:608-13.

3. Carvalho CA, Fonseca PCA, Priore SE, Franceschini SCC, Novaes JF. Consumo alimentar e adequação nutricional em crianças brasileiras: revisão sistemática. Rev. Paulista de Pediatria, 2015; 33(2):211-221.
4. Batalha MA, França AKTC, Conceição SIO, Santos AM, Silva FS, Padilha LL, et al. Processed and ultra-processed food consumption among children aged 13 to 35 months and associated factors. Cad. de Saúde Pública 2017; 33(11):e 00152016.
5. Furtado MC. Preparações lácteas consumidas por crianças menores de dois anos usuárias do SUS no município do Rio de Janeiro: caracterização, adequação às recomendações e composição nutricional segundo a participação de alimentos ultraprocessados. Rio de Janeiro. Dissertação [Mestrado em Alimentação, Nutrição e Saúde] - Universidade do Estado do Rio de Janeiro; 2018.
6. Brasil. Ministério do Planejamento, Orçamento e Gestão. Instituto Brasileiro de Geografia e Estatística – IBGE. Diretoria de Pesquisas. Coordenação de Trabalho e Rendimento. Pesquisa de Orçamentos Familiares. Tabela de Medidas Referidas para os Alimentos Consumidos no Brasil. Rio de Janeiro: IBGE; 2011.
7. Monteiro CA, Cannon G, Levy RB, Mourabac JC, Jaime P, Martins AN, et al. NOVA. A estrela brilha. World Nutrition. 2016; 7(1-3): 28-40.
8. Brasil. Ministério do Planejamento, Orçamento e Gestão. Instituto Brasileiro de Geografia e Estatística – IBGE. Diretoria de Pesquisas. Coordenação de Trabalho e Rendimento. Pesquisa de Orçamentos Familiares. Tabelas de Composição dos Alimentos Consumidos no Brasil. Rio de Janeiro: IBGE; 2011.
9. Brito MA, Brito JR, Arcuri E, Lange C, Silva M, Souza G. Densidade relativa. Empresa Brasileira de Pesquisa Agropecuária – Embrapa. Disponível em: <http://www.agencia.cnptia.embrapa.br/Agencia8/AG01/arvore/AG01_196_21720039246.html>. Acesso em: jul. 2018.
10. Dewey KG, Brown KH. Update on technical issues concerning complementary feeding of young children in developing countries and implications for intervention programs. Food Nutr Bull. 2003; 24:5-28.
11. Dewey KG, Cohen RJ, Rollins NC. Feeding of non-breastfed children 6-24 months of age in developing countries. Food Nutr Bull. 2004; 25:377-402.
12. World Health Organization. Guiding principles for feeding non-breastfed children 6-24 months of age. World Health Organization, 2004.
13. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Dez passos para uma alimentação saudável: Guia alimentar para crianças menores de dois anos: um guia para o profissional da saúde na atenção básica. Brasília: Ministério da Saúde; 2010.
14. Euclydes MP. Nutrição do lactente: base científica para uma alimentação saudável. Viçosa-MG: Universidade Federal de Viços; 2005.
15. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Saúde da criança: aleitamento materno e alimentação complementar. Brasília: Ministério da Saúde, 2015.
16. World Health Organization. Complementary Feeding of Young Children in developing countries: a review of currents scientific knowledge. Geneva: WHO/NUT/98.1; 1998. p. 228.

17. Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Food and Nutrition Board. Institute of Medicine of the National Academies. The National Academies Press. Washington, DC; 2005.
18. Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients). Washington: National Academy Press; 2002/2005.
19. Institute of Medicine. Dietary Reference Intakes for Calcium and Vitamin D. Washington: National Academy Press; 2011.
20. Institute of Medicine. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Washington: National Academy Press; 2001.
21. Institute of Medicine. Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids. Washington: National Academy Press; 2000.
22. Gunnarsson BS, Thorsdottir I, Palsson G. Iron status in 2-year-old Icelandic children and associations with dietary intake and growth. Eur J Clin Nutr. 2004; 58:901-6.
23. World Health Organization. Child Growth Standards. Length/height-for-age, weight-for-age, weight-for-height and body mass index-for-age: methods and development. Geneva: WHO Department of Nutrition for Health Development; 2006.
24. Louzada ML, Martins AP, Canella D, Baraldi L, Levy R, Claro R, et al. Alimentos ultraprocessados e perfil nutricional da dieta no Brasil. Revista Saúde Pública 2015b; 49: 38.
25. Mendonça RD, Pimenta AM, Gea A, Fuente-Arrillaga C, Martines-Conzalez MA, Lopes AC, et al. Ultraprocessed food consumption and risk of overweight and obesity: The University of Navarra Follow-Up (SUN) cohort study. Am J Clin Nutr. 2016.
26. Mendonça RD, Lopes AC, Pimenta AM, Gea A, Martines-Conzalez MA, Bes-Rastrollo M. Ultra-Processed Food Consumption and the Incidence of Hypertension in a Mediterranean Cohort: The Seguimiento Universidad de Navarra Project. Am J Hypertens. 2017.
27. Fiolet T, Srour B, Sellem L, Kesse-Guyot E, Allès B, Méjean C, et al. Consumption of ultra-processed foods and cancer risk: results from NutriNet-Santé prospective cohort. BMJ 2018.
28. Appleton J, Russell CG, Laws R, Fowler C, Campbell K, Denney-Wilson E. Infant formula feeding practices associated with rapid weight gain: A systematic review. Maternal & Child Nutrition. 2018; 14e12602.
29. Brasil. Ministério da Agricultura, Pecuária e Abastecimento. Instrução Normativa nº 28. 2007 jun 12. Pub DOU [Jun 14 2007].
30. Accioly E, Saunders C, Lacerda EMA. Nutrição em obstetrícia e pediatria. Rio de Janeiro: Guanabara Koogan; 2009.
31. Greer FR, Sicherer SH, Burks AW. American Academy of Pediatrics Committee on Nutrition; American Academy of Pediatrics Section on Allergy and Immunology. Effects of early nutritional interventions on the development of atopic disease in infants and children: the role of maternal dietary restriction,

breastfeeding, timing of introduction of complementary foods, and hydrolyzed formulas. Pediatrics. 2008; 121:183-91.

32. Greenbaum LA. Rickets and hypervitaminosis D. In: Kliegman RM, Stanton BF, Schor NF, Geme JW, Behrman R H. Nelson. Textbook of Pediatrics. Philadelphia: Saunders Elsevier; 2012. p. 200. Disponível em: https://www.elsevier.com/books/nelson-textbook-of-pediatrics/kliegman/978-1-4160-2450-7. Acesso em: 29 mar 2018.
33. Holick FM. Vitamin D status: measurement, interpretation and clinical application. Annals of Epidemiology. 2009; 19(2):73-78.
34. Faber M. Complementary foods consumed by 6-12-month-old rural infants in South Africa are inadequate in micronutrients. Public Health Nutr. 2005; 8(4):373-381.
35. Sacco JE, Dodd KW, Kirkpatrick SI, Tarasuk V. Voluntary food fortification in the United States: potential for excessive intakes. European Journal of Clinical Nutrition. 2013; 67:592-597.
36. Bennasir H, Sridhar S, Abdel-Razek TT. Vitamin A from physiology to disease prevention. International Journal of Pharmaceutical Sciences Review and Research. 2010; 1(1):68-73.
37. Fosmire G J. Zinc toxicity. The American Journal of Clinical Nutrition. 1990; 51:225-227.
38. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Área Técnica de Saúde da Criança e Aleitamento Materno. Rede Amamenta Brasil: os primeiros passos (2007–2010). Brasília: Ministério da Saúde; 2011.
39. World Health Organization. Innocenti declaration: on the protection, promotion and support of breastfeeding. Ecol Food Nutr. 2010; 26(4):271-3. https://doi.org/10.1080/03670244.1991.9991210.
40. Gontijo TL, Xavier CC, Freitas MIF. Avaliação da implantação do Método Canguru por gestores, profissionais e mães de recém-nascidos. Cad. Saúde Pública. 2012; 28(5):935-44. https://doi.org/10.1590/S0102-311X2012000500012.
41. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Ações Programáticas e Estratégicas. Cartilha para a mãe trabalhadora que amamenta. Brasília: Ministério da Saúde, 2010c.
42. Boccolini CS, Boccolini PMM, Monteiro FR, Venâncio S I, Giugliani ERJ. Tendência de indicadores do aleitamento materno no Brasil em três décadas. Rev Saúde Pública. 2017; 51:108.
43. Brasil. Ministério da Saúde. Gabinete do Ministro. Portaria nº 1920, de 5 de setembro de 2013. Institui a Estratégia Nacional para Promoção do Aleitamento Materno e Alimentação Complementar Saudável no Sistema Único de Saúde (SUS) -Estratégia Amamenta e Alimenta Brasil, 2013.
44. Brasil. Ministério da Saúde. Departamento de Atenção Básica. Coordenação-Geral de Alimentação e Nutrição. Guia alimentar para crianças menores de 2 anos - Versão para consulta pública - Brasília, junho/julho de 2018.
45. Brasil. Presidência da República. Secretaria de Direitos Humanos. Conselho Nacional dos Direitos da Criança e do Adolescente. Resolução nº 163, de 13 de março de 2014, que dispõe sobre a abusividade do direcionamento de publicidade e de comunicação mercadológica à criança e ao adolescente. Publicada no DOU nº 65, de 04/04/2014, Seção 1, p. 4.

46. Brasil. Decreto n.º 8.552, de 3 de novembro de 2015. Regulamenta a Lei n.º 11.265, de 3 de janeiro de 2006, que dispõe sobre a comercialização de alimentos para lactentes e crianças de primeira infância, e de produtos de puericultura correlatos. Diário Oficial da União 4 jan. 2006.
47. Rangan A, Allman-Farinelli M, Donohoe E, et al. Misreporting of energy intake in the 2007 Australian Children's Survey: differences in the reporting of food types between plausible, under- and over reporters of energy intake. J Hum Nutr Diet 2014; 27:450-8.
48. Kobe H, Krzisnik C, Mis NF. Under- and over-reporting of energy intake in Slovenian adolescents. J Nutr Educ Behav 2012; 6:574-83.
49. Brasil. Agência Nacional de Vigilância Sanitária. Banco de Leite Humano: Funcionamento, Prevenção e Controle de Riscos. Brasília: ANVISA; 2008.
50. Brasil. Ministério da Saúde. Portaria n.º 1.153, de 22 de maio de 2014. Redefine os critérios de habilitação da Iniciativa Hospital Amigo da Criança (IHAC), como estratégia de promoção, proteção e apoio ao aleitamento materno e à saúde integral da criança e da mulher, no âmbito do Sistema Único de Saúde (SUS) [portaria na internet]. Diário Oficial da União 28 mai 2014; Seção 1. Disponível em: http://bvsms.saude.gov.br/bvs/saudelegis/gm/2014/prt1153_22_05_2014.html
51. Pennington JAT, Wilson DB. Daily intakes of nine nutritional elements: analyzed vs. calculated values. Am Diet Assoc 1990; 90:375-81.

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Furtado MCQ contributed to conception and design of the study; data collection; data analysis and interpretation; writing, revising and approval of the final version of the article. Castro IRR contributed to conception and design of the study; data collection coordination; data analysis and interpretation; writing, revising and approval of the final version of the article. Silva ACF contributed to conception and design of the study; analysis and interpretation of results; and writing the article. de Moraes MM contributed to data analysis and interpretation.

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