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Food diversity among indigenous children from two municipalities of the Brazilian Western Amazon

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Abstract *Our aim was to explore the feeding practices of indigenous children younger than two years old, living in Cruzeiro do Sul and Mâncio Lima, in Acre, Brazil. A cross-sectional study was conducted with indigenous children of the Katukina (Cruzeiro do Sul), Nukini, Nawa and Poyanawa (Mâncio Lima) ethnicities in October 2013. We used a structured questionnaire on the food consumption of the day before the collection, based on the food indicators proposed by the Ministry of Health. A total of 94 children (50% Katukina, 27% Poyanawa, 13% Nukini, and 10% Nawa) were studied. Among children under 6 months of age, although the majority was breastfed, 42.1% drank water, 15.8%, savory food, and 11.1%, local cuisine. In the age groups of 6 to 12 months and 13 to 23 months, a high consumption of ultra-processed foods was identified (52.6% and 28.6% respectively), while the consumption of complementary food was insufficient (33% of fruits and 25% of savory food between 6 and 13 months, and 41.2% of fruits and 19.6% of savory food between 13 and 23 months). The feeding profile of these indigenous children was inadequate for their age, revealing a concerning situation for this population.*

Keywords *Infant nutrition, Feeding behavior, Indigenous population, Child health, Indians South American*

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Introduction

In Brazil, the feeding of children under two years old has been considered a public health problem, due to the low prevalence of breastfeeding (BF) and early introduction of unhealthy foods[1]. This situation extends to the indigenous population of the country, which, despite having an average of 5.1 months of exclusive breastfeeding (EBF), has been using the supplemented breastfeeding (SBF) more often, in 73.7% of times in the case of indigenous children living in Cruzeiro do Sul[2]. The inadequate dietary pattern reflects in the high prevalence of malnutrition (25.7% of nanism), which was revealed in a national survey with 6,050 indigenous children[3]. This study also showed the prevalence of malnutrition was associated with socioeconomic variables such as income, education and access to sanitation services; however, breastfeeding had a protective effect against low weight among children up to 12 months of life[3-4].

Traditionally, indigenous peoples devote most of their time to food-oriented activities[5]. Planting, harvesting, hunting and fishing are daily activities that underpin the group's diet, according to the region where they live[5]. However, the contact with non-indigenous individuals has accelerated a complex process of transformation among indigenous populations, especially regarding the health and nutrition profile[6]. The indigenous sociodiversity in Brazil, associated with the social inequalities in healthcare, had an impact on the high prevalence of child malnutrition, iron deficiency anemia, parasitic and infectious diseases, increasing the mortality rate of indigenous children in the first year of life[6]. Indigenous populations in Brazil have high prevalence of low birth weight and growth deficit, especially among children in the Northern region of the country, whose families were in precarious socioeconomic and sanitary conditions and whose mothers were anemic[3].

In some Amerindian ethnicities, infant feeding is based on breastfeeding during the first year of life, often lasting to three years of age, approximately[7]. The introduction of industrialized foods to the diet is related to the number of adults in the family and to their socioeconomic status, environmental subsistence conditions, and access to urban centers[7]. A recent systematic review, which investigated the nutritional status and feeding habits of indigenous children of the American continent (Mexico, Peru, United States, Brazil and Guyana) showed that, even before six months of age, cassava porridge begins to be offered sporadically and that, gradually, the child's diet starts to include fish and some fruits, refined sugar, cookies and candies in general[7].

Despite this information, few studies investigate the feeding and nutrition conditions of indigenous populations in Brazil. The absence of data on this issue in Brazil and in Acre State reinforces the importance of disclosing the data of this study. In this sense, this article aims to identify the pattern of food consumption among indigenous children under two years of age.

Method

This is a cross-sectional study conducted with indigenous children that live in Cruzeiro do Sul (Katukina ethnic group) and Mâncio Lima (Nukini, Nawa and Poyanawa ethnic groups), Acre, Brazil. The Katukina live on the margins of BR 364 highway, which connects the State Capital Rio Branco to Cruzeiro do Sul and other cities. In the villages, the Pano Language is preserved, and only men speak Portuguese, when they are outside the region[8]. The Nukini live in the Serra do Môa region, a national preservation park; their language is Portuguese, but the Pano mother tongue is taught at schools[8]. The Nawa inhabit the right bank of the Môa River; their homes are traditional of *ribeirinhos*, riverside residents, and they communicate through Portuguese[8]. The Poyanawa group inhabits the right bank of the Môa River and their *malocas* (traditional indigenous houses) have been replaced by regular houses since the contact with non-indigenous people[8].

According to the 2010 Demographic Census, the total number of indigenous children aged between 0 and 2 years was 202 (104 in the village of Cruzeiro do Sul and 98 in Mâncio Lima)[9]. Thus, for this study, we planned to interview all the children who were in the villages during the month we visited the regions. The exclusion criteria were: not finding the mother or guardian of the child in the residence after two attempts in different periods of the day, or not having the mothers' agreement to their children's participation in the study.

The data were collected in October 2013 by one of the researchers through interviews with the women, conducted during daily visits to the villages. In some places, we stayed overnight, due to the travel time to access the region. The communication with the women who did not speak Portuguese was done through the simultaneous

translation of the interview by indigenous health agents.

The data were obtained using an original collection instrument with data characterizing the child (ethnicity, current age, sex, gestational age, birth weight, and health problems since birth) and the mother (age, educational level, marital status, occupation, family income, and number of children).

Children's food intake was evaluated based on the form of food markers for children under 6 months and from 6 to 23 months, available at the Food and Nutrition Surveillance System (SISVAN) of the Ministry of Health[10]. For the evaluation of children aged 6 to 23 months, we used the questions of the first part of the form, which aim to characterize the introduction of complementary feeding and identify the current type of diet. The form, which referred to the food intake in the day before the survey, was adapted to contain an open field, which allowed us to recognize the consumption of other foods belonging to the local culture.

For the diagnosis of food practice, food was classified into groups according to age range, namely: feeding (exclusive breastfeeding or non-exclusive breastfeeding – Non-EBF, and formula feeding), water, complementary foods (fruits and savory food), and other foods, for children under 6 months; milk (breast milk and formula feeding), complementary foods (fruits and savory food), and other foods, for children aged 6 to 23 months. The category "other foods" was used to include regional preparations that could not be categorized according to the food types currently recognized by the Ministry of Health[10]. The other reported foods were classified according to their levels of processing[11].

In the data description, we used central trend (mean and median) and dispersion (standard deviation and minimum and maximum values) measurements for quantitative variables, and relative and absolute frequencies for qualitative variables. Pearson's Chi-square statistical tests, Fisher's Exact Test and Student's t-test were used, considering the significance level α equal to 5%.

For the analysis of the association between the food consumption variables and the municipality of residence of the children, the sample number varied according to the number of registers with complete data.

This study was approved by the National Research Ethics Committee, under process no. 394.330 and by the Ethics Committee of the Universidade Federal de São Paulo under no. 417,837, according to Resolutions 466/2012 and 304/2000 of the National Health Council (specific to the research area of Indigenous Peoples) as part of the project "Factors associated with early weaning in indigenous children from two cities of the Brazilian Western Amazon[2]." A free and informed consent form (ICF) was obtained by the mothers' signature or by their thumb impression, when they were not literate.

Results

The study population consisted of 94 children, most of them of the Katukina ethnic group, in the city of Cruzeiro do Sul (48.9%), followed by Poyanawa (28.7%), Nukini (12.8%) and Nawa (9.6%), in the city of Mâncio Lima. The average age of the children was 12.7 months (SD = 6.4; min. = 15 days, max. = 23 months); the majority (54.3%) was 13 to 23 months old, male (53.2%), born at 37 weeks or more (98%) and had an average birth weight of 3,238 grams (SD = 599; min. = 1,500 and max. = 4,800); 88% of the children had at least one health problem at some point in their lives, the most frequent being respiratory (83%) and diarrhea (76%). Regarding the mothers' characteristics, their mean age was 26 years (SD = 6.7; min. = 13, max. = 43), most of them had some primary school (73.4%), lived with a partner (75.5%), had an average of 3 children (SD = 2.2; min. = 1, max. = 10), housewife (82.4%) and had an income lower than the national minimum wage (78%).

Table 1 shows the feeding data of children up to six months of age, according to the city of the ethnic groups. Although most children were breast fed (89.5%) and on EBF (52.6%), 42.1% of them consumed water and 15.8%, savory foods. Children under six months of age whose ethnic group is in Mâncio Lima had higher water consumption rates ($p = 0.020$), when compared to those of ethnic groups living in Cruzeiro do Sul.

Regarding children aged 6 to 12 months, the majority were breast fed (79.2%); however, the percentages of complementary food consumption were low (33.3% ate fruits and 25% savory foods), especially in Cruzeiro do Sul (0% ate savory foods). Water consumption was significantly lower in this region ($p = 0.010$), while ultra-processed food was consumed by the majority of the general population of children aged 6 to 12 months (52.6%) (Table 2).

In the age range of 13 to 23 months, less than half (37.3%) of the children were breast fed,

with a higher breast-feeding occurrence among the ethnic groups located in Mâncio Lima (p = 0.009). However, almost 1/3 of them consumed ultra-processed foods (28.6%, p<0.001) and the vast majority did not consume complementary foods (19.6% ate savory foods, p<0.001) (Table 3).

Regarding the characterization of other foods consumed and their preparation, we observed the Katukina ethnicity had a diet based on the consumption of banana, flour and cassava. In the region called *banana grande* (large banana), there are extensive plantations of banana, which is the second most eaten food by the children, consumed in a preparation called "porridge." The cassava, a typical product of the region, was consumed cooked, plain or with side dishes, and the most common preparation was in the form of flour or paste (gum) to make *tapioca* and other foods. The cassava flour is consumed with other foods or even without them.

In the Nawa and the Nukini ethnic groups, the frequent consumption of water stands out, even among children in BF under 6 months of age. The cassava mass porridge is consumed as the main food and is a typical way to prepare cassava in the region, used to feed children. Among the meats consumed, we observed the consumption

Table 1. Absolute and relative frequencies of food consumption percentages for children under 6 months of age, according to the municipality of the ethnic groups.

Foods	Mâncio Lima		Cruzeiro do Sul		Total		p
	n	%	n	%	n	%	
Feeding							
EBF	3	30.0	7	77.8	10	52.6	0.070[b]
Non-EBF	8	80.0	9	100	17	89.5	0.474[a]
Formula feeding	1	10.0	0	0	1	5.3	>0.999[b]
Water	7	70.0	1	11.1	8	42.1	0.020[b]
Complementary foods							
Fruits	0	0	1	11.1	1	5.3	0.474[b]
Savory foods	2	20.0	1	11.1	3	15.8	>0.999[b]
Other foods	1	11.1	1	11.1	2	11.1	>0.999[b]

[a] Pearson's Chi-square; [b] Fisher's Exact Test. EBF – Exclusive Breastfeeding; Non-EBF – Non-Exclusive Breastfeeding.

Source: Author's elaboration.

Table 2. Absolute and relative frequencies of food consumption percentages for children under 6 months of age, according to the city of the ethnic groups.

Foods	Mâncio Lima		Cruzeiro do Sul		Total		p
	n	%	n	%	n	%	
Feeding							
EBF	13	72.2	6	100.0	19	79.2	0.280[a]
Formula feeding	7	38.9	2	33.3	9	37.5	>0.999[b]
Water	18	100	3	50.0	21	87.5	0.010[b]
Complementary foods							
Fruit	6	33.3	2	33.3	8	33.3	>0.999[b]
Savory foods	6	33.3	0	0	6	25.0	0.277[b]
Other foods	14	87.5	4	66.7	18	81.8	0.292[b]
Ultra-processed foods*	9	60.0	1	25.0	10	52.6	0.303[b]

[a] Pearson's Chi-square; [b] Fisher's Exact Test. * Industrial formulations made mainly of substances extracted from foods, derived from food constituents or produced in laboratory based on organic materials such as petroleum and coal[11].

Source: Author's elaboration.

Table 3. Absolute and relative frequencies of food consumption percentages among children under 13 months of age, according to the city of the ethnic groups.

Foods	Mâncio Lima		Cruzeiro do Sul		Total		p
	n	%	n	%	n	%	
Feeding							
EBF	12	60.0	7	22.6	19	37.3	0.009[a]
Formula feeding	4	20.0	2	6.5	6	11.8	0.195[b]
Water	19	95.0	28	90.3	47	92.2	>0.999[a]
Complementary foods							
Fruit	9	45.0	12	38.7	21	41.2	0.773[a]
Savory foods	9	45.0	1	3.2	10	19.6	<0.001[b]
Other foods	19	100	30	96.8	49	98.0	>0.999[a]
Ultra-processed foods*	13	68.4	1	3.3	14	28.6	<0.001[b]

[a] Pearson's Chi-square; [b] Fisher's Exact Test. EBF – Exclusive Breastfeeding; Non-EBF – Non-Exclusive Breastfeeding. *Industrial formulations made mainly of substances extracted from foods, derived from food constituents or produced in laboratory based on organic materials such as petroleum and coal[11].

Source: Author's elaboration.

of game meat (armadillo and agouti). Characterized as riverside communities and communities located near the river, they had higher frequencies of consumption of industrialized products.

Regarding the Poyanawa, a commonly prepared food is called *pirão*, a typical regional dish consisting of a mixture of cassava flour with meat, chicken or fish broth. The children eat the same food as the family, which involves industrialized products (cookies, industrialized juice, yogurt, canned foods, instant noodles, industrialized chicken and beef), as well as rice and beans.

As to ultra-processed foods, the highest prevalence of consumption was observed among the children of Mâncio Lima, especially in the age range of 13 to 23 months (68.4%, p<0.001) (Table 3). The most consumed types of ultra-processed foods were cookies (65.2%) and artificial juice (58.3%) (data not presented in tables).

Discussion

The study showed the breastfeeding of children aged 0 to 6 months is compromised by the early introduction of other foods besides the breast milk. Children aged between 7 and 24 months had little food diversity in their meals, and ultra-processed foods were very common in their diet, especially for those between 6 and 12 months of age.

According to the World Health Organization, breast milk is sufficient to meet the nutritional needs of children up to six months of age, without teas or water[12]. After this period, the gradual introduction of healthy foods concomitant with breastfeeding is recommended up to two years of age or more[12]. According to the ten steps towards a healthy diet in Brazil[10], the recommended diet for children consists of diverse foods of nutritional importance, including cereals/tubers, meats, legumes, fruits, and vegetables.

Food practices are known to be influenced by the availability of food in the region and by cultural habits of food preparation and consumption. In tropical forests, the use of natural resources traditionally characterizes a diversified diet. The region's colonization process influenced the behavior of indigenous families, who began the transition from community habits to the market economy[13]. The indigenous families of São Gabriel da Cachoeira, in the Northwest of the Brazilian Amazon, use the forest resources to compose the people's eating habits, and the food diversity is dependent on the territoriality of the domestic group. However, a change in eating habits was seen, resulting from the development of extractivism, that is, from the practice of paid activities such as the extraction of local resources[13]. Food diversity has also been observed and little practiced in non-indigenous children in Southeast Brazil, suggesting that public policies aimed at the feeding of children under two years of age should be intensified[14].

In the region of Cruzeiro do Sul, the paving of BR 364 highway, since 2000, caused a signifi-

cant change in the food diet of the Katukinas, because the highway scared away the game animals, opening space for professional hunters, and it compromised plantations, composed of banana, cassava, sweet potatoes and papaya. In addition, the people's homes have been turned into houses that need walls and locks. On the other hand, in the region of Mâncio Lima, the ethnic groups live on planting and hunting. The Nukini breed animals (pigs, chicken, ducks, goats and sheep) both for consumption and for trade, and also grow agricultural products (corn, rice, cassava, beans, sugarcane, tobacco and yam), and plant and collect forest fruits (açaí, abacaba, buriti, patuá and pupunha)[8]. The basis of the Nawas' diet is cassava, complemented with hunting and fishing, with the cultivation of sugarcane, *pupunha* heart of palm and pineapple, and with the growing of culinary herbs and spices, medicinal plants and fruit trees[8]. The Poyanawa preserve the subsistence activity based on family agriculture, with planting (rice, sweet potatoes, yams, cassava, corn and fruits) and with the practice of fish farming as a sustainable economic alternative[8]. Industrialized products, which are also part of the food diet, are purchased in Mâncio Lima downtown[8].

In this sense, our study identified the presence of non-traditional eating habits combined with the regional food culture among children living in Cruzeiro do Sul and Mâncio Lima, Acre. This transition of eating habits is also observed among the indigenous peoples of Alto Xingu, in Mato Grosso, e.g. with the use of refined sugar, cookies and candies in general[15]. The nutritional adaptation of native diets with the Westernization of eating habits predominates, with the introduction of items such as salt, sugar, industrialized and refined products[16]. In general, the situation commonly described is characterized by the reduction of food diversity, with an increase in the consumption of simple sugars and fats, and with the reduction in the intake of fiber and micronutrients[16]. The same circumstances were reported in the study conducted by Coelho et al.[17], with non-indigenous children under 24 months, using the SISVAN forms of food consumption markers[11], which showed that 55.4% of the evaluated children presented obesity-related risk behaviors, such as the consumption of industrialized juice and soda.

The intake of processed foods such as sugar, fried foods, soft drinks, candies, snacks, stuffed cookies, among others, should be avoided especially in the first years of life[10]. The consumption of this type of food is associated with overweight and obesity in the childhood, which reflects in the development of various allergic, metabolic and cardiovascular diseases[18].

As well as the type of food consumed, the food diversity is also important for the growth and healthy development of children[10], something that was not seen in the usual feeding practices of the ethnic groups we studied. The basis of the diet of Amazonian Amerindians is banana and cassava; the protein comes from hunting (fishes and wild animals)[19]. Thus, the children's diet is poor in caloric density, which is probably responsible for the delayed growth and for the deficient nutritional status observed among indigenous children[19]. This same food pattern, or even a worse one, was observed in the studied population, in which we found an insufficient consumption of foods with adequate nutritional density and the presence of foods considered unhealthy for child development. These findings are similar to the nutritional epidemiological profile evaluated in other ethnicities in Brazil, such as the Wari' community, an indigenous community living in Rondônia, in the Southwestern Amazon. The prevalence of short stature (61.7%) and underweight (51.7%) in Wari' children under five years of age are one of the highest rates among indigenous populations in Brazil[20]. The height deficit was also identified in Guarani children under 5 years of age, in the states of Rio de Janeiro and São Paulo, being 96% higher than the average for indigenous children in Brazil (25.7%)[21]. That study highlights the high prevalence of chronic malnutrition and anemia among the Guarani children, and it underlines the serious inequalities in health and nutrition that affect indigenous children in the country[21].

Although the assessment of the nutritional status was not the object of this study, the nutritional deficit among indigenous children in all age groups from the sixth month of life on, in the Kaiowá and Guarani communities – in the indigenous area of Caarapó, Mato Grosso do Sul – was influenced by the low educational level and by the precarious socioeconomic, environmental and health conditions[22]. We observed similar situations in the ethnicities located in Mâncio Lima and Cruzeiro do Sul. A study conducted in the Teréna indigenous community, in Mato Grosso do Sul, showed similar results. The prevalence of child malnutrition was elevated, higher than that identified in the urban indigenous community and in the rural area of the Midwest region, but lower than the reported rates for indigenous groups in the Amazon region. The malnutrition

was also more frequent when children belonged to families with lower per capita incomes, were male and aged 6 to 23 months[23].

Thus, the diet of indigenous children reflects a worrying situation in the child health of this population, and these findings may indicate strategies to be thought and discussed with the indigenous peoples. Among the limitations of this study, there was the number of documents needed to acquire access to indigenous lands, besides the ethical-legal authorizations, due to the characteristic of the study population. Such conditions demanded significant time prior to data collection. The lack of current data in the Indigenous Health Care Information System (SIASI), of the National Health Foundation (FUNASA)/MS, made it difficult to know the real number of children in the study age group, limiting the sample to about 50% of the planned group. It is also noteworthy that the access to the indigenous communities prevented the scope from including other indigenous villages of the region. In addition to the distance, the access depended on the water level of the river – which could be flooded or dry, in the Amazon "drought" period – or even on air transport.

Conclusion

The feeding pattern of indigenous children was proven inadequate, consisting of regional foods and ultra-processed food products. The insufficient food diversity and the consumption of foods of low nutritional value reflect their current food situation, which is worrying for the health of the indigenous children under 2 years of age living in Cruzeiro do Sul and Mâncio Lima, Acre, Brazil.

Collaborations

VBS Maciel and ACFV Abrão participated in the conception, design, analysis and interpretation of the data, manuscript writing, critical review and approval of the final version of the article. KP Coca and LS Castro participated in the analysis and interpretation the data, the writing of the manuscript, the critical review and approval of the final version of the article.

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