Signs and strategies to deal with food insecurity and consumption of ultra-processed foods among Amazonian mothers

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Abstract

Although food insecurity configures a public health issue in developing countries going through nutrition transition, there is still lack of evidence on how it is affected by social determinants and its relationship with ultra-processed food (UPF) consumption. Using qualitative methods, we investigated the experience of food (in)security among mothers living in the Brazilian Amazon area, identifying aspects of food insecurity promoting UPF consumption. In-depth interviews were performed with 40 women and inductive content analysis was used. Signs of food insecurity included difficulties in food affordability and irregular access to food. Strategies to deal with lack of food quantity took place during food production (growing foods and raising animals), acquisition (gaining food, shopping incentives and food substitutions) and preparation (creativity in cooking). Not being able to afford staple foods was the main aspect of food insecurity promoting UPF consumption, as fresh foods were substituted by UFP options. Our study contributes to the current literature by presenting explanatory insights about the inconclusive quantitative results on the relationship between food insecurity and UPF consumption. Additionally, it supports the need of policies and interventions focused on promoting sustainable food systems and the regional food culture, which may approach food insecurity through an intersectional perspective.

Key-words: food insecurity, ultra-processed foods, mothers, qualitative study, Amazon, Brazil

Introduction

Food insecurity is an increasing public health problem in low and middle-income countries going through nutrition transition – characterized by increased access to cheap, high-fat, added-sugar, and high in salt foods (Popkin et al., 2012) –, being associated to several health problems such as diabetes (Gucciardi et al., 2014), obesity (Franklin et al., 2012) and mental disorders (Weaver & Hadley, 2009). However, the lack of in-depth insight and evidence about the relationship between social determinants of health and food insecurity affects adequate translation of studies approaching the theme into concrete policy and interventions (Krumeich & Meershoek, 2014). In addition, changes in the food environment caused by globalization present important new challenges to understanding eating behaviours and promoting healthy food consumption (Handley et al., 2012). In this scenario, qualitative studies that allow in-depth analyses that consider macro and micro contexts (e.g. global and local food systems, gender roles, socioeconomic status, family dynamics and individual preferences) as we propose in the present study, are needed to help understand manifestations of the food insecurity in a globalized context.

One of the many causes of the nutrition transition is the lack of access to healthy foods that provide the nutrients necessary for a healthy life (Conde & Monteiro, 2014). Changes observed in the Brazilian diet in the last decades, with the increase of ultra-processed food (UPF) consumption, have resulted in the deterioration of the nutritional quality of the overall diet, contributing to excess weight along with micronutrient deficiencies (Monteiro et al., 2010). Ultra-processed foods are products made from industrial ingredients through processes unique to the food industry. They are usually highly palatable, with high amounts of salt, sugar and fat, such as sodas, instant soups, and most ice creams (Monteiro et al., 2019).

Considering the challenges presented by the nutrition transition, the recent publication by the Food Agriculture Organization and the Pan-American Health Organization, “Panorama of Food and Nutrition Security in Latin America and the Caribbean” (FAO/PAHO, 2017), highlights the importance of promoting public policies that guarantee the human right to adequate food and nutrition through promoting the population’s food security. In Brazil, the concept of nutrition and food security has been

discussed for over 20 years, and is currently defined by the Food and Nutrition Security Law (LOSAN) (Silva, 2018) as the "realization of everyone's right to regular and permanent access to quality food in sufficient quantity, without compromising access to other essential needs, based on health-promoting food practices that respect cultural diversity and that are environmentally, culturally, economically and socially sustainable".

Studies using the 2006-2007 Brazilian Demographic and Health Survey have pointed to an association between mild food insecurity and obesity in women and adolescent females (Kac et al., 2012; Velásquez-Melendez et al., 2011). This association has also been observed in other countries, such as the United States of America (Jones & Frongillo, 2007). However, the research around food insecurity often lacks the voices and insights of the people living it, failing to identify how it is experienced and its impacts on decisions related to food, such as food choices, forms of food acquisition, manners of food preparation, and food sharing, among others. Moreover, little has been investigated about the relationship between food insecurity and UPF consumption (Araújo et al., 2018) and previous studies show contradictory results. In the United States, low-income adults classified as food insecure had higher consumption of UPF, including sugary drinks, processed red meat and snacks, than low-income food secure adults (Leung et al., 2014), whereas a study in Brazil did not observe differences in the higher consumption of UPF among food-insecure adults (Araújo et al., 2018).

The focus on women in an urban Amazonian setting is another key contribution of our study. Following the argument by Araújo et al. (2018) about the complexity of the relationship between food insecurity and UPF consumption and the importance of studies investigating the theme among different populations, our approach considers the influence of sociocultural aspects, such as gender and environment, in understanding the manifestations that food insecurity may have. Gender health inequalities have been described by several studies (Chibber et al., 2018), however, despite the central role that women often have in ensuring the food security of the household, little attention has been paid to their own food (in)security experiences (Broussard, 2019). Also, studying how the dynamics between food insecurity and UPF consumption within a recently urbanized setting in which food traditions are still strong and co-exist with a fast increase of UPF

availability (Lima, 2014) might be very elucidating to understand the above-described changes in food consumption.

Thus, based on Brazil's definition of food security, in this study we aimed to (1) investigate the experience of food (in)security among mothers living in the Western Brazilian Amazon and (2) identify aspects of food insecurity that may promote or prevent UPF consumption. We expect that our study will contribute to a better understanding of the phenomenon of food insecurity in the context of globalization and nutrition transition, particularly among groups with overlapping vulnerabilities, and to the development of appropriate interventions to this population and other similar ones.

Materials and methods

The main study design and setting

This qualitative study was part of a prospective cohort named MINA-Brazil Study (Maternal and Child Health and Nutrition), conducted in Cruzeiro do Sul, Acre, Brazil. The municipality is located in the Western Brazilian Amazon, has an estimated population of 87,673 inhabitants (IBGE, 2018) and is classified as having medium human development (human development index (HDI) of 0.664 while Brazil's HDI average is 0.849) (IBGE, 2015). It has 10.7% of formally employed population and 44.2% of all population has less than half minimum wage income per capita (IBGE, 2018). The study inclusion criteria were: (1) having given birth between July 2015 and July 2016, (2) having given birth in the maternity hospital in Cruzeiro do Sul, and (3) living in the urban area of the municipality, as described elsewhere (Neves et al., 2018). This qualitative research focused on a subsample of the main study during the MINA-Brazil Study's 2-year follow-up – which had an overall 70% retention rate (n=868). All data collection was divided into five waves, conducted every three months, from July 2017 to July 2018. Approaches to the subsampling and qualitative methods are described below.

Sampling of informants

Based on quantitative data from the MINA-Study, participants were divided into quintiles according to their frequency of UPF consumption. Women in the highest and lowest quintiles were randomly invited to participate in the qualitative study. Initially, 34

participants, 17 with high and 17 with low frequency of UPF consumption, were interviewed. After completing these interviews, no more relevant new information related to eating practices and UPF consumption emerged. To test for saturation, six new participants, three with high and three with low frequency of UPF consumption, were included. Saturation was considered reached as the new interviews corroborated information already observed in the first 34, with no new relevant information (Morse, 2015). Thus, the final subsample was composed of 40 women.

Data collection

Quantitative data collection preceded the in-depth qualitative interviews and included: (1) sociodemographic characteristics, (2) frequency of UPF consumption and (3) body mass index (BMI). Sociodemographic characteristics included participants' age, level of education, and household assets. Based on the household assets, a wealth index was constructed as a proxy for the participants' socioeconomic status. Principal component analysis was applied, and the first component was used to generate the index, which was distributed in tertiles. Frequency of UPF consumption was assessed through a simplified food frequency questionnaire. Rather than assessing participants' total diet, we focused on the frequency of consumption of some selected UPF, namely sodas and juice powders, crisps, industrialized biscuits, and instant noodles. Food items were chosen based on (1) the UPF most observed in previous field works at Cruzeiro do Sul and (2) the most consumed UFP according to the Brazilian Consumer Expenditure Survey. Food frequency questionnaires' ability to accurately measure consumption of individual food items or food groups have been described by Feskanich et al. (1993). Participants' height and weight were measured to calculate the BMI following WHO (1995) recommendations.

In-depth interviews were performed at the participants' homes and investigated: (1) regularity of meals, (2) food acquisition, (3) cooking practices, (4) planning of food-related activities, (5) eating out, and (6) nutrition knowledge. Each participant was interviewed twice to ensure dense and rich data. Interviews were fully recorded and transcribed verbatim. Field notes with the researcher's descriptions, perceptions and insights were recorded in a notebook after each day of fieldwork.

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Ethics Committee of the Public Health School from the São Paulo University (protocols 872.613 and 2.454.972, respectively). Written informed consent was obtained from all participants.

Data analysis

An exploratory content analysis was performed using an inductive approach that allowed for themes and codes to emerge from the data. Following the methods of Bernard et al. (2017), the following steps in this analysis were used: (1) pre-analysis, (2) material exploration, (3) data treatment, and (4) inference and interpretation.

- *Pre-analysis:* the researcher that performed the interviews (PdMS) read attentively all the transcriptions and field notes several times to extract all sections of the data that presented relevant information about food (in)security, making notes and highlighting the most salient characteristics of the data.
- *Material exploration:* similar quotes were organized into piles and named. Each pile derived a code. A codebook was developed, including for each code: short and detailed description, inclusion and exclusion criteria, typical and atypical exemplars, and an exemplar categorized as “close but no”.
- *Data treatment:* two coders (MDU and MSdSO) independently applied the codebook to the data set. PdMS compared codifications, deciding the final codification when MDU and MSdDO had different coding. Kappa coefficients for inter-rater reliability between coders were calculated with the aid of GraphPad QuickCalcs (GraphPad Software, United States).
- *Inference and interpretation:* codes were described considering their core and peripheral aspects. For that, we used direct quotes, paraphrases and quantitative information. All data was produced and analysed in Portuguese, with quotes selected to illustrate codes in the results section being later translated to English. Codes are presented in the results section in bold letters.

Finally, a complementary statistical analysis was performed to investigate differences in the frequency that each code was mentioned between groups with low and

high UPF consumption. This aimed to quantitative compare the experiences and strategies related to food insecurity, potentially aiding the generation of future hypotheses regarding the interaction with UPF consumption. The distribution of frequencies of codes across participants in both groups were compared with Mann-Whitney tests with adjustment for ties. The occurrence (no/yes) of each code was also compared by UPF consumption groups with Chi-square or Fisher exact tests. These analyses were performed in Stata 11.2 (StataCorp, College Station, TX, USA), and p-values <0.05 were considered statistically significant.

Results

We had a total of 40 participants, 20 with low and 20 with high consumption of UPF. Ages ranged from 17 to 43 years, with a mean of 26.7 years. Participants with high UPF consumption were more likely to have excess weight, but no significant differences concerning the sociodemographic characteristics were observed among those with low versus high UPF consumption. Other characteristics are presented in Table 1.

Table 1. Sociodemographic characteristics of 40 mothers living in Cruzeiro do Sul, Acre

		Total (n=40)	Low UPF (n=20)	%	High UPF (n=20)	%	p
Age groups	17-25	18	8	44.4	10	55.6	0.353
	26-34	17	8	47.1	9	52.9	
	35-43	5	4	80.0	1	20.0	
Years of education	≤ 9	10	2	20.0	8	80.0	0.087
	10 – 12	19	11	57.9	8	42.1	
	≥ 13	11	7	63.6	4	36.4	
Wealth index tertiles	1	11	3	27.3	8	72.7	0.154
	2	12	6	50.0	6	50.0	
	3	17	11	64.7	6	35.3	
Nutritional status	normal weight	19	13	68.4	6	31.6	0.027**
	excess weight*	21	7	33.3	14	66.7	

*pre-obesity and obesity, **difference statistically significant

The data were classified into 20 codes. Sixteen of them concerned signs, strategies to deal with, and consequences of food insecurity, and were classified into: (1)

difficulties in food affordability, (2) irregular access to food, (3) food production, (4) food acquisition, (5) food preparation, (6) food consumption, and (7) nutritional deficiency. Four codes concerned the characteristics of (8) the environment, (9) the participants, and (10) the food that contributed to food insecurity. Table 2 presents the codes within each of ten themes and their kappa for inter-rater reliability between coders.

Table 2. Codes from in-depth interviews with 40 mothers living in Cruzeiro do Sul, Acre

	Theme	**Code**	**Kappa**
Signs of food insecurity	difficulties in food affordability	basic	0.89[a]
		regional foods	0.99[a]
		healthy foods	0.92[a]
		chocolates	0.79
		eat-out foods	0.93[a]
	irregular access to food	when available	0.84[a]
		seasonality	0.91[a]
Strategies to deal with food insecurity	food production	growing food	0.81[a]
		raising animals	0.84[a]
	food acquisition	gaining food	0.88[a]
		food substitution	0.86[a]
		food or other needs	1.00[b]
		shopping incentives	0.97[a]
	food preparation	creativity in cooking	0.80
	food consumption	prioritized the children	1.00[b]
Consequences of food insecurity	nutritional deficiency	anaemia	1.00[b]
Characteristics of the environment, the participants and the food	environment	the city	0.85[a]
		the rural area	1.00[b]
	participants	lack of money	0.80
	food	not safe	0.84[a]

[a] kappa values considered "very good", [b] kappa values considered "perfect"

Signs of food insecurity

When discussing the difficulties in food affordability, participants cited three types of foods with different priorities in acquisition that ranged from **basic** to **healthy foods**. Foods that compose a traditional Brazilian meal – i.e. rice, beans and a type of meat – were considered by the participants as **basic** foods, being prioritized over others in

the food shopping and therefore rarely missing in meals. “We buy just the basic [foods], which is the meat or the fish, the rice and beans. Like, really just the basics” (participant 18, high UPF).

Almost all participants affirmed that prices of **regional foods** have been increasing, and for some of them those had become unaffordable. Reactions to price increase depended on the type of regional food. While the increase in the price of cakes and other sweet preparations decreased their consumption among participants, beans (produced in the region) and manioc flour were considered too important in meals and therefore an effort was made to buy them, despite the price increase. “There was a time that beans costed 15 reais per kilo[a] So, it is hard for those who like them. And the beans are essential in the eating, right? We have to eat it at least once a week” (participant 2, low UPF).

Foods that participants considered as **healthy foods**, i.e. fruits and vegetables, were the most cited as unaffordable. Differently from **the basic** and **regional foods**, they were more easily considered dispensable in the meals, therefore being less present in the participants’ eating, although they would like it. “Sometimes we don’t have the money to buy the healthy [food], so we buy canned food. Don’t have vegetables, so eat without them” (participant 11, high UPF). “Today I don’t have a healthier diet because it is not accessible” (participant 33, low UPF).

Chocolates and **eat-out foods** were also considered unaffordable and were the most dispensable as they were not considered important to one’s nutrition or satiety, but to leisure. “We used to go out to dinner. If we were going to the mass, we would go to the city square to eat, but we don’t go anymore. Our income fell, so we can’t anymore. We come home, eat what we have and go to bed” (participant 2, low UPF).

Another signal of food insecurity was the irregular access to food, which could be related to lack of affordability (resulting in eating the food **when available**) or access (due to **seasonality)**. Both categories concerned mainly fruits and vegetables, however, for three participants experiencing harsher food insecurity, sometimes an entire meal could be missing. **Seasonality** affected access to foods cultivated at home by the

[a] Current average price at the time of the interview was eight Brazilian reais per kilogram.

participant or by some family relative that shared the produce with her. “During the winter is better, because of the rain, you know… it waters the plants, so they grow more in the winter” (participant 14, low UPF).

Strategies to deal with food insecurity

Strategies developed by the participants to deal with food insecurity focused primarily on dealing with the quantity (during production, acquisition, preparation) and secondly with quality of foods (during consumption).

Strategies related to food production concerned **growing food** or **raising animals** to home consumption. **Growing food** increased access **healthy foods**, which was particularly important when money was limited. “I used to like to grow food because if we have vegetables at home, we won’t feel hungry, because anything can become a soup” (participant 1, high UPF). **Raising animals** was most often related to chickens, either for their meat or egg consumption. Chickens could be eaten when there was no other meat available – “It depends on the day… Like, there is no meat today, no fish… she [participant’s mother] goes to the backyard, kills a chicken, and lunch is guaranteed” (participant 9, high UPF).

When related to food acquisition, strategies concerned **gaining food**, **food substitutions** and **food shopping**. **Gaining food** was mainly from family, either the participant’s parents or the children’s father. Foods gained were most often **healthy foods**, when grown at home, followed by **regional foods**, often also produced at home. “We get the manioc flour from my mom. We get more from her than we buy, because she produces it” (participant 19, low UPF). On some occasions, participants were given **basic** foods, which showed a higher economic vulnerability, as they could not afford what was considered the minimum to make a meal.

Food substitution strategies were used when the desired food was not affordable. The meat component of the meal was most often substituted, reinforcing the importance given to the presence of such items in the meal. “When we can buy [red] meat, we buy it. When we can’t, we buy sausages” (participant 11, high UPF). For participants with very limited financial resources, the substitutions went beyond the food aspect, making them choose between buying **food or other needs**. “I try to cut [expenses]. If I was going to

buy four packs of laundry soap, I buy three. Or two…. So I can buy the meat, you see?" (participant 15, low UPF).

Strategies related to **shopping incentives** were searching for the lowest prices or payment facilities. The most common strategy concerned comparing prices between supermarkets. Buying in markets that allowed participants to pay at the end of the month was also cited by some. However, those stores were smaller shops that had limited food options, which contributed to **food substitutions**. "When I don't have money to buy meat, I go to the store that allows me to take now and pay later. But they don't have what I want [fresh meat], so I buy some spam, some [canned] sardines…" (participant 11, high UPF).

Only a few participants mentioned strategies during food preparation. For those, **creativity in cooking** could help them overcome a lack of food. "I consider myself very creative in the kitchen, you know? If we have just a little bit of chicken, I cut it very small, put some rice to cook with it… In this matter I was always able to figure something out" (participant 1, high UPF). Deploying such a strategy meant that the strategies related to food production and acquisition had not been enough, indicating a higher vulnerability among those that used them.

Strategies used during food consumption among participants were focused on food quality, as the main problem dealt with in this case was the lack of **healthy foods**, not **basic** foods. Thus, participants **prioritized the children**'s access to foods considered important to the health and development, in particular fruits, of their children. "I don't really eat fruits... I leave it to them [children], you know?" (participant 14, low UPF).

Consequences of food insecurity

Only a few participants mentioned nutritional deficiencies, i.e. **anaemia**, as a consequence of inadequate eating. "I think that she [daughter] had anaemia because of me, because I should have eaten more during pregnancy. I would only eat foods that didn't have broth, didn't have vegetables" (participant 3, high UPF).

Characteristics of the environment, the participants and the food

Important distinctions were evident between the urban area, where participants in this study were living, and the rural area, where many of them have lived or had relatives living in. **The city**, as the participants called the urban area, was characterized by high cost of living. “Everything here costs too much, it is too expensive for us to eat. In a few weeks I don’t know how it will be, because it gets harder and harder every day” (participant 40, low UPF).

For most participants, food access was more difficult in **the city** than in **the rural area** because “in the city, everything has to be bought” (participant 33, low UPF). The facility of producing food through **growing food** or **raising animals** in **the rural area** contributed to the amount of **given foods**, particularly **regional foods** that participants received from relatives living there. “I never buy beans and manioc flour. Sometimes, when I am out of them, I may buy a little, but the next day, if I go to my mom’s, I will bring flour. She gives me half a sack of flour... So, I don’t buy flour and these [regional] foods. We rarely buy açai[b], there is a lot of it in my mom’s house, so we bring it from there” (participant 19, low UPF).

However, some characteristics of **the rural area** food environment contributed to food insecurity. Among those, **seasonality** was the most important, creating irregular, non-permanent food access. In addition, there was lower food diversity – “There [in the rural area], the fruit would be a banana, an orange… My dad used to grow manioc, these type of things, but I didn’t have the foods that I have access today […] for fruits and vegetables, I eat much better nowadays” (participant 7, low UPF).

Participants’ **lack of money** contributed to food insecurity in **the city** context. This situation was especially common when the participant had an unemployed partner – “Tomato… these types of foods, I only buy when I have enough money. Because he [husband] is unemployed, I am not buying them” (participant 25, high UPF) – or had no partner – “Now, with the divorce, there is less money coming. [...] I try not to think [about money], because if I think too much… I am mentally weak, I already had post-partum depression. So, I try not to think too much because it unsettles me” (participant 1, high UPF).

[b] Amazonian berry.

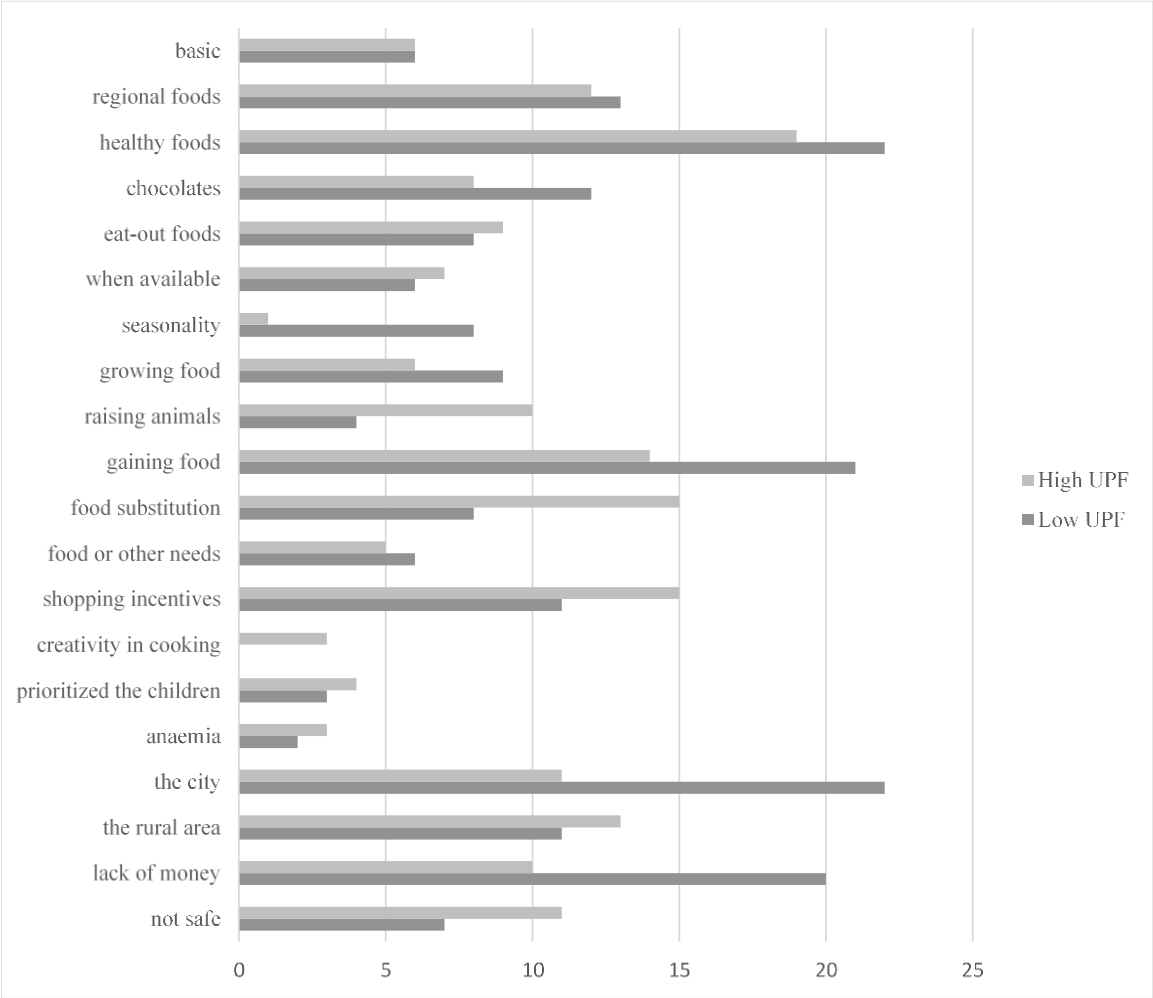
Foods' characteristics could represent food insecurity, as participants affirmed that some foods were not biologically safe for consumption. The foods with potential for being **not safe** were mainly fruits and vegetables, followed by meat. Participants concerns about fruits and vegetables were related to the use of pesticides and "poisons" used to cultivate them. "The apples in that supermarket are terrible, they taste of poison" (participant 1, high UPF). In relation to meat, participants worried about the use of hormones – "Nowadays the chicken… you buy a chicken and it is full of hormones and all this stuff, you know?" (participant 10, high UPF) –, and eventually about the addition of other substances in meat-products – "There was a time that people were saying that they put cardboard in the chicken [nuggets]. I was scared" (participant 5, low UPF).

Foods considered more insecure were produced further away, creating a continuum from foods produced at home (the most biologically safe) – "She [mother] always brings vegetables. Because she doesn't put poisons... those [that we can find] around have too many pesticides" (participant 14, low UPF) – to the ones produced outside the region (the least biologically safe) – "We know that they [Cruzeiro do Sul's farmers] use pesticides. Even so I prefer vegetables from here, because I know it [the pesticide] is less aggressive than the ones they use in other places. I believe that food grown outside have even more aggressive pesticides" (participant 13, low UPF).

Comparison of codes between UPF consumption frequency groups

When comparing the number of times each code was mentioned across the two UPF consumption groups (Figure 1), participants with high UPF consumption mentioned difficulties in food affordability more often in almost all food categories. This suggests that they face higher barriers to access **regional** and **healthy foods** than participants with low UPF consumption. Although it might appear contradictory that participants with high UPF consumption considered **chocolates** expensive more often, this observation can be understood through their choices regarding other cheaper UPF sweets and snacks. "I like chocolates and biscuits. Chocolates are expensive, but I eat a lot of biscuits, almost every day. I have been eating a lot of biscuits" (participant 39, high UPF).

Figure 1. Number of mentions of each code among high and low UPF consumption



The higher frequency which low UPF consumption participants **gained foods** could have also contributed to their perception that foods were accessible, even though **lack of money** was more frequently cited among them. Thus, the type of foods gained, which were mostly **regional** and **healthy foods**, is important for understanding these participants' low UPF consumption. Their more frequent comments about **seasonality** and **growing foods** corroborate the central role that fruits and vegetables had in the foods they received from their supporting network.

The apparent higher difficulty of accessing foods among high UPF consumption participants reflects on higher use of all the strategies to deal with food insecurity, except **gaining food**. Two strategies increased UPF consumption, **food substitutions** and

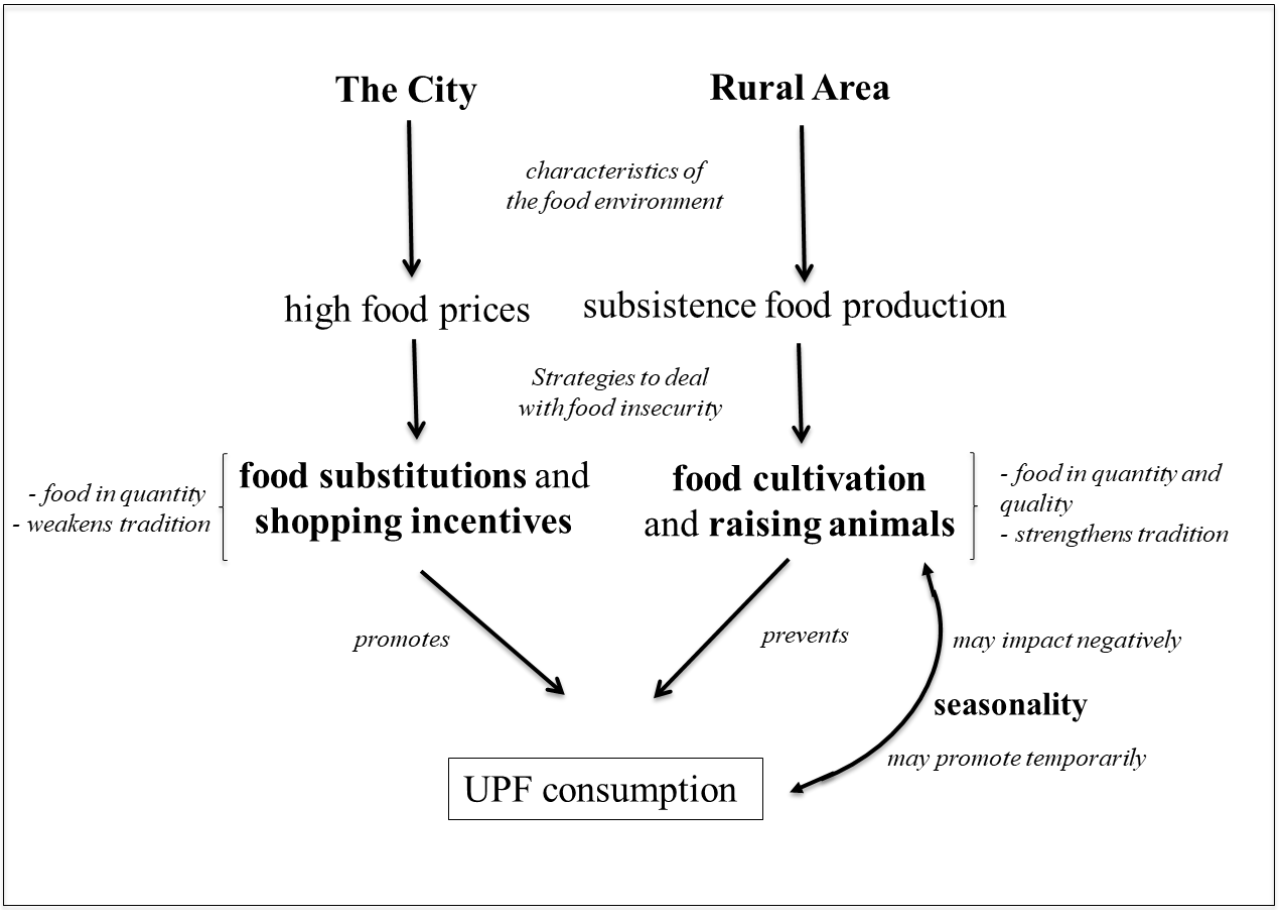
shopping incentives, while one limited participants' access to healthy foods, **prioritizing the children**.

However, despite the observed contrasts, statistical data analysis comparing of the number of times each code was mentioned across both groups showed that neither the distribution of frequencies nor the occurrence of each code was statistically different between them ($p > 0.05$). This indicates that, despite the different patterns of food consumption, there were dynamics between food insecurity and UPF consumption affecting that population in general. Our results suggest that, although one group had low UPF consumption and the other one had high UPF consumption, many of the factors promoting UPF eating were similar to both of them.

Discussion

To our knowledge, this study was the first to qualitatively investigate the manners in which food insecurity influences UPF consumption. In our study, the main problem confronting the participants was inadequate access to food of high quality. Lack of food quantity was not a problem to most women as they used strategies, such as food substitutions, to prevent food scarcity. However, such strategies were not as efficient for addressing the lack of access to foods considered healthy, sometimes guaranteeing food quantity in detriment of its quality (Figure 2). The problem of food quality observed among mothers, however, was not restricted to a personal level, but indicates broader environmental problems. That is to say that their issue with food quality reflects aspects of the current global food system – in which there is an abundance in food with low quality, but a scarcity of affordable healthy food to some populations (Swinburn et al., 2019; Gittelsohn & Sharma, 2009).

Figure 2. Relations between strategies to food insecurity and UPF consumption



*codes are represented in bold letters

Cheap UPF, low in quality, were chosen when there was lack of resources to food. This observation reveals an important role of UPF in the diets of families going through food insecurity, as such foods were not chosen for their palatability, as were eating-out and chocolates, but for affordability. Consumption of UPF, i.e. fast-foods, have also been observed due to convenience rather than desire among mothers from deprived parts of London, UK. Interestingly, however, in Cruzeiro do Sul, only UPF ingredients and snacks – and not fast-foods – were cheap. This observation highlights differences in UPF types that are options for food-insecure populations in different settings, as studies in other regions of Brazil (Sato et al., 2014) and in Asia (Mahajan, 2009; Watson, 1997) have also described fast-foods as expensive to low-income populations and desired because of their representation of social status in some groups.

The close interaction between food insecurity and UPF consumption observed in our study resonates with the discussion presented by the Lancet Commission on The

Global Syndemic of Obesity, Undernutrition and Climate Change (Swinburn et al., 2019). A syndemic is defined as when two or more health problems synergistically affect population health in contexts of economic and social inequalities. In the report, Swinburn et al. (2019) discuss the links between undernutrition, obesity and climate change, shedding light on the importance of addressing these combined challenges concomitantly, with common solutions. The authors highlight the role of UPF in this scenario, as UPF production is associated with high greenhouse-gas emissions and malnutrition. Our results reinforce these relationships as mothers with high UPF consumption were more often overweight or obese (Table 1) and not having a healthy diet was associated by participants with malnutrition (i.e. anaemia).

This study also adds to the discussion on the relationship between food environment and UPF in food insecure contexts, showing that UPF not only affects the environment because of its large-scale agricultural production and long-haul transportation, as discussed in other studies (Swinburn et al., 2019; Hadjikakou, 2017), but that the food environment affects consumption of UPF in contexts of food insecurity. This observation corroborates the Lancet Commission (Swinburn et al., 2019), which states that it is necessary to understand the way in which people experience obesogenic environments. In this regard, our study raises awareness to the experiences of particularly food insecure, economically and socially vulnerable people in these environments.

Some specific aspects of the Amazonian recently urbanized setting created a dynamic between the setting and the participants' socioeconomic status that has not been explored in the literature. In our study, the setting (urban or rural) in which people were more vulnerable to food insecurity depended on their socioeconomic status. Participants with very few economic resources experienced the worst food access conditions in the city, as "everything had to be bought", meaning that they could afford less food variety than what they were able to raise and cultivate in the rural area, having to rely more often on UPF. For participants with better socioeconomic status, on the other hand, the rural area represented more vulnerability to food insecurity as they had lower access to a variety of fruits, vegetables and other foods, besides being susceptible to seasonality.

Such strategies related to food production were not described in another more urbanized setting in Brazil (Sato et al., 2017). Thus, we shed light on the potential of

promoting vegetable gardens in contexts of recent urbanization, as agriculture is still part of the population's culture. Our study suggests that encouraging local and/or subsistence agriculture in urban settings similar to Cruzeiro do Sul will not only help guarantee food quantity, but also quality – nutritional and biological – while preserving cultural aspects, both in terms of practices related to food and the types of foods consumed, as needed to reach food security. This strategy is even more needed when the urban setting is remote, which increases substantially the prices of the foods that come from other regions, as illustrated by our participants' quotes.

Our results contribute to the current discussion on the resilience and adaptive capacity of food systems (Willet et al., 2019; FAO/PAHO, 2017) by pointing to an environmental aspect of food insecurity particularly relevant to remote areas. Most importantly, they highlight the vulnerability that recently urbanized, medium developed areas might present to the introduction of UPF, its relationship with food security (as UPF promotes and is promoted by it) and its negative impact on traditional eating practices.

This study allowed us to identify a hierarchy regarding people's needs and food choices. In this regard, meat was very valued, as described in other countries, such as Argentina, France and the USA (Ruby et al., 2016). This cultural valorisation of meat is important to understand UPF consumption on food insecure situations. In order to keep the "meat" component in the meal, fresh meats were often replaced by UPF meat-based products, as sausages and canned meat. On the other hand, foods considered less essential to the meals such as "healthy foods" were only consumed when this was possible, similarly to "eating out". This helps understanding the low consumption of fruits and vegetables among food insecure groups described in several studies (Leung et al., 2014; Walker et al., 2007). Based on the relevance of food symbolism observed, we argue that it is important that public policies and primary care promote fruits and vegetables, particularly regional options, as part of the basic, daily eating. For that, it is necessary not only to educate people, but to ensure their access to such foods without compromising others. For nutrition education actions, the Brazilian Dietary Guidelines (Brazil, 2014) is an important tool, as it promotes consuming largely plant-based diets, as Brazil is one of the few countries – along with Germany, Sweden and Qatar – to promote

environmentally sustainable diets that ensure food security through national dietary guidelines (Swinburn et al., 2019).

Particularities related to gender roles are evidenced by the participants' main responsibility for all food-related activities, which put them in the position to create strategies to deal with food insecurity. Such pressure might help understating negative mental health impacts of food insecurity through a gendered perspective. In addition, the women's strategy to prioritize the children's eating in terms of quality and quantity reinforces the higher vulnerability experienced by women to the effects of food insecurity. Thus, we advocate for the importance of intersectional approaches that take into consideration several vulnerabilities when studying and intervening on food insecure populations.

Our study helps to problematize the approach of a complex concept such as food insecurity in research. Although household food insecurity measurement scales – such as the Brazilian Household Food Insecurity Measurement Scale (EBIA) (Segall-Corrêa et al., 2014) and the Food Insecurity Experience Scale (FIES) (Cafiero et al., 2018) are of great importance to access food insecurity across populations, there is limited possibility to assess the food's quality. These scales use the participant's subjective evaluation to score how healthy and diverse the diet quality is, which, despite unquestionably important, does not account for the consumption of low quality, cheap UPF in the household. Albeit it could be burdensome and expensive to fully investigate the quality of total food intake, our study shows that focusing on the presence of UPF in the diet of food insecure people can be relevant to deal with food insecurity through the scope of The Global Syndemic, since UPF have a close relationship with malnutrition and the climate change.

Our results may also help to elucidate the inconclusive results on the relationship between food insecurity and UPF consumption (Walls et al., 2018) from quantitative studies. We point that their limited approach to food quality might be overlooking people that, as a result of strategies to guarantee food for the family, renounce the foods considered healthy and replace them with UPF. Thus, we suggest the need for further studies investigating this relation across a range of food insecurity levels, including more severe food insecurity with the expression of hunger. In addition, these observations add

to the understanding of the apparent paradox between mild to moderate food insecurity (when food quantity can still be provided) and higher obesity prevalence among vulnerable populations (Jones & Frongillo, 2007), as low-quality UPF replacements to fresh foods guaranteed food quantity.

This study has some limitations. First, we did not focus on people previously classified as food insecure. We considered this choice adequate in relation to our aims, as we wanted to investigate broad experiences and signs of food insecurity that not necessarily are considered by the existent classifications. Secondly, it could be argued that having participants in all three wealth index tertiles could be a weakness, as food insecurity is expected to be present among the lowest-income group. However, having people within all tertiles of wealth was important, as they could present different experiences with food insecurity. Also, wealth classification was based on comparison within our sample, not indicating, however, that participants in the higher tertile had a high socioeconomic status compared to the Brazilian population in general.

Conclusion

Our study contributes to the current literature on food insecurity by investigating how this phenomenon occurs among a group of women living in the Brazilian Amazon. Most participants did not suffer from lack of food quantity, but many of them had poor food quality, lacking particularly in fruits and vegetables. Observed food substitutions unveiled important negative effects that food insecurity may have on food culture and health, as UPF often replaced regional, fresh foods in everyday meals. There was a hierarchy in the foods acquired, where staple foods such as meat were substituted by UFP options when the fresh ones were unaffordable in order to keep their presence in meals. No significant differences in the frequency that each code was mentioned were observed between groups with high and low UPF consumption, indicating broader food environment factors affecting all participants.

These results add to the discussion about the environmental aspect of food insecurity through shedding light on the vulnerability that recently urbanized, remote areas may have to the introduction of UPF, supporting the importance of promoting sustainable food systems, capable of locally producing biologically safe foods and

protecting the regional food culture. The study raises awareness to multiple vulnerabilities acting together upon people's eating practices (e.g. being female, having low socioeconomic status and living in remote areas), reinforcing the need of actions and policies aimed at this audience that consider the evaluation of food insecurity, taking account of the consumption of UPF and the strategies to tackle this growing reality. This means implementing strategies to promote availability and accessibility of healthy foods across the food system to create double-duty or triple-duty actions to tackle food insecurity and unsustainable food environments.

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