Characteristics of Social Vulnerability and Food Insecurity among Urban Families in Extreme Poverty in Brazil

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Abstract This study aimed to characterize food insecurity and strategies to cope with food scarcity in 1,085 families evaluated in a cross-sectional population-based study conducted in a low-income neighborhood of the Rio de Janeiro metropolitan area, Brazil. Data were collected in personal interviews applying a structured survey which included a food frequency questionnaire and the Brazilian Food Insecurity Scale. Families were classified as "extremely poor", if per capita family income was under US$1.00 per day or, otherwise, as "out of extreme poverty". "Extremely poor" families were also stratified as beneficiaries or not of cash transfer programs which were later consolidated within the Programa Bolsa Família. Overall, the studied families lived under critical sanitary conditions. Families in extreme poverty presented worse conditions of household sanitation, food insecurity and reported poorer food quality, less frequent consumption of fruit and vegetables, and increased use of practices and strategies to alleviate food shortages than families free of extreme poverty. The prevalence of moderate or severe food insecurity among "out of extreme poverty" families was at least five times lower than that observed in families living under extreme poverty (p<0.01). Extremely poor family heads were mostly young, female, black or mixed, or low educated individuals, characteristics which regularly coincide with social vulnerability.

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1. Introduction

Income inequality in Brazil has historically been considered a social, political and moral problem related to the economic development model adopted [1,2]. Additionally, income has invariably been the most important marker for qualification and quantification of poverty and a central issue in social policies confronting poverty. For example, the concept of "poverty line" and "extreme poverty line" are income limits used to assess provision of minimum basic needs and minimal food supplies respectively. These categories are frequently used to identify groups in situations of social vulnerability and individuals to be targeted by intervention initiatives [3,4,5].

However, the economist Amartya Sen developed this view suggesting that poverty surpasses income and also includes the deprivation of opportunities, accessibilities, and capabilities [4]. Similar levels of income can thus be translated into distinct dimensions of poverty, since different families might have diverse attitudes and strategies to deal with hunger and privation.

Therefore, it is important to understand how families tackle challenges imposed by poverty in designing public policies and interventions aiming to reduce social inequalities [6,7,8]. Food insecurity expresses the irregular access to adequate amounts and quality of food, and constitutes a violation of basic human rights [5,9].

To identify groups suffering or at risk of food insecurity to target aid actions and food programs a questionnaire based on the perception of food insecurity has been used in several countries, including in Brazil [6,10,12,13,11].

The Brazilian Scale of Food Insecurity (EBIA) is a tool adapted and validated to identify food insecurity in Brazil [14]. Based on 15 yes/no questions, this instrument investigates the perception of household food insecurity and allows categorisation of the degree of food insecurity (light, moderate, or severe).

It considers aspects that vary from being concerned with the possibility of food shortage to the concrete experience of food scarcity in the home [10]. The focus of this study was to characterize social and demographic conditions and strategies used to deal with the food

insecurity of families from a low-income neighborhood associating these conditions with the level of income and receipt or not of cash transfer support of schemes later consolidated within the Brazilian family cash transfer program (Programa Bolsa Família).

2. Material and Methods

In 2005, a population-based cross-sectional study investigated households in Campos Elíseos, a district in the municipality of Duque de Caxias, state of Rio de Janeiro, Brazil. The research was approved by the Research Ethics Committee of the State University of Rio de Janeiro in August, 2004 under the number 02/2004. Participants signed a term of consent, after receiving an explanation of the procedures adopted in the survey.

Setting: The municipality of Duque de Caxias is about 30km from the state capital and is part of the Rio de Janeiro metropolitan area. In 2000, its resident population was 843,000 inhabitants, corresponding to 5% of the Rio de Janeiro state population [15]. Campos Elíseos, one of the municipality's four districts, occupies an area of 98 km², and is an urban area characterized by low-incomes, high population density (about 2,500 inhabitants/km², in 2000) [15], precarious infrastructure and deficient sanitation and is subject to recurrent flooding. This area was selected as it exhibits the highest occurrence of extreme poverty although due to high inequalities, resulting from pockets of wealth, mean per capita income is similar to that of the municipality as a whole.

2.1. Sampling Design

A probability cluster sample, with three selection stages was adopted and the sample size was estimated based on an extreme poverty prevalence of 14.5% and an error rate of 5%. The neighbourhood is divided by the Brazilian Institute of Geography and Statistics into 322 census tracts [15]. In the first stage, 75 of these tracts were systematically selected using proportional probabilities based on the number of households registered in the 2000 Demographic Census. In the second stage, 15 residences were selected in each census tract, with a total sample size of 1,125 residences. The sampling process considered an implicit stratification of the sectors according to income, which enabled extension of estimates to other domains of interest and increased sample representation. The third stage used random selection of respondents in the households (one adult, one adolescent and one child; or two adults if the household did not contain children).

2.2. Data Collection

Data was collected through personal interviews in the households, between April and December 2005, by a team of trained interviewers. Information on socioeconomic variables, food insecurity and food practices were obtained applying a pre-tested, structured questionnaire. A pilot study was undertaken in the same neighborhood in a census tract excluded from the final sample. After each interview, the questionnaires were reviewed for data quality by a supervisor.

2.3. Study Variables

1) Household characteristics
1.1) Situation of poverty
The households were first stratified according to the per capita income as: (a) "extremely poor", those that earned less than a dollar per capita/day and (b) "out of extreme poverty" (OEP), which earned more than one US dollar per capita per day. At the time of this research, this value was used as the cut-off limit for families' enrolment in the governmental cash transfer program, therefore, "families in extreme poverty" were also stratified in (i) families receiving the support of governmental cash transfer program which were denominated as "families in extreme poverty with cash transfer support" (EPS) and (ii) families in extreme poverty that did not receive support from cash transfer program, which were denominated as "families in extreme poverty without cash transfer support" (EPW).

1.2) Food insecurity
The perception of food insecurity was assessed using The Brazilian Scale of Food Insecurity (EBIA). This scale resulted from adaptation and validation of an instrument applied in the United States [14]. The validation study took into consideration the psychometric characteristics of the scale and suggested cut-off points culturally adapted to the intensity of the phenomenon of experiencing hunger in Brazil [14]. The EBIA consists of 15 yes/no questions; each positive answer counts as one (1) point and the sum of the points allows classification into four categories: (a) absence of food insecurity (non-FI); (b) light (LFI); (c) moderate (MFI), and (d) severe food insecurity (SFI). The questions consider aspects related to the availability of food in the household in the last three months and are presented in an increasing order of severity that varies from the concern of finding themselves without food up to the experience of not having anything to eat.

1.3) Social and demographic profile of the household
The following variables were considered in this description:

A) Sex and age of the household head; age was categorized in 18 to 35; 36 to 60, and above 60 years old.

B) The skin color of the household head was classified by interviewers as black, mixed, or white. C) Schooling of the household head: the classification was based on the last educational level concluded with classification as illiterate (unschooled) or by the number of years of study: 4 or less, 5 to 8, 9 to 11, and 12 or more.

D) Number of family members: categorized as up to four members, which is less than or equal to the median number of members in the studied families, and more than four members.

E) Presence of children under 5 years old and teenagers (10-18 years old) (yes/no). This question recognises the additional social and biological vulnerability that can be created through the increased nutritional and health needs of young children and adolescents.

1.4) Sanitary conditions in the household:
A) Water supply: public water supply or other sources (for example, well or rainwater collection) B) Garbage collection: removal by public service or other destiny (for example, buried, burnt, left in the open);

C) Sanitation: nature of sewage system or alternatives (for example, rudimentary sewerage and septic tank);

D) Drinking water: treated (filtered, boiled or chemically treated) or not treated.

E) Number of toilets: without toilet, one toilet, or more than one toilet;

1.5) **Food practices in situations of food scarcity:** respondents were asked what were the usual family procedures in times of food shortage, answering yes/no to the following options: dividing food between family members; skipping meals; reducing portion size; prioritizing children before serving adults; using only one or two food types to prepare meals; and receiving food donations.

1.6) **Self-perception of food quality:** respondents were asked to rate the overall quality of food in the household as great/good, regular/bad or very bad and as healthy or unhealthy.

1.7) **Daily intake of fruit and vegetables:** respondents were asked whether fruit and vegetables respectively were consumed on a daily basis (yes/no questions).

2.4. Data Analysis

All statistical analyses took into account the effect of the cluster sampling design and sample weights. The proportion (%) of families in each category of the studied variables was estimated. Associations between family income and receipt of cash transfer support with sanitary, social, and demographic variables was ascertained through the Chi-square homogeneity test (statistical significance of $p<0.05$). When an association ($p<0.05$) was observed, the partitioned Chi-square test was applied to identify the categories most different from the others.

3. Results

We analyzed data from 1,085 households (non response rate of 3.6%). The proportion of extremely poor families was 39% with 23% of those assisted by an official cash transfer program. The per capita income of families out of extreme poverty varied between US\$1.74 and US\$3.86 per day. Among "families in extreme poverty without cash transfer support" (EPW) there was a higher proportion ($p=0.05$) of female headed households (34%) than in "families in extreme poverty with cash transfer support" (EPS) (23%) and "out of extreme poverty" (OEP) families (27%). Also, compared with EPS (49%) and OEP households (39%), there was a higher proportion ($p<0.01$) of younger family heads (18-35 years old) in the EPW group. The proportion of black and mixed household heads was smaller ($p<0.01$) among OEP households compared to that observed for EPS and EPW households (65 vs. 81 vs. 73%, respectively) (Table 1).

Table 1. Household demographic and social characteristics according to income level and receipt of cash transfer program assistance. Duque de Caxias-RJ, Brazil, 2005

Household characteristics*	Extreme poverty[1] with cash transfer (EPS) (n=99) (%)	Extreme poverty without cash transfer (EPW) (n=327) (%)	Out of extreme poverty[2] (n=631) (OEP) (%)	P value (χ2 test)
Household head is female	23[a]	34[b]	27[a]	0.05
Age of household head (years old)				<0.01
18-35	42[a]	49[b]	39[a]	
36-60	55[a]	44[b]	52[a]	
>60	3[a]	7[b]	10[b]	
Household head skin color is black or mixed	81[a]	73[a]	65[b]	<0.01
Schooling of the household head[3]				<0.01
Illiterate	5[a]	7[a]	5[a]	
≤ 4 years of study	54[a]	68[b]	42[a]	
5-8 years of study	38[a]	21[a]	45[b]	
9 or more years of study	3[a]	4[a]	8[b]	
≥4 members in the household	73[a]	56[b]	24[c]	0.03
Children or adolescent in the household	84[a]	84[a]	63[b]	<0.01
Food insecurity situation				<0.01
Without food insecurity	16[a]	10[a]	47[b]	
Light food insecurity	42[a]	43[a]	45[a]	
Moderate or severe food insecurity	42[a]	47[a]	8	

[1] extreme poverty: family income per capita < US\$1.00 per day
[2] out of extreme poverty: family income per capita ≥ US\$1.00 per day
[3] n=891 due to missing answers
*different letters indicate significant differences among the strata (p-value <0.05)

Among OEP households, the proportion of heads with at least five years of study was higher than that observed for EPS and EPW households. Conversely there was a greater proportion of household heads with four years or fewer in school among EPW households (68%) when compared to their EPS (54%) and OEP (42%) counterparts.

Proportions of families with four or more members were significantly different in the three analyzed groups, being smallest for OEP (24%) and highest in the EPS group (73%). The presence of children and teenagers was more frequent ($p<0.01$) among EPS and EPW households (84%) than among the OEP group (63%) (Table 1). The

prevalence of moderate or severe food insecurity was at least five times lower among OEP (8%) than EPS or EPW households (42 and 47%, respectively). Similarly, the absence of food insecurity was reported by 47% of the OEP households, which was higher than the proportion estimated for families with income below the limits of extreme poverty receiving (16%) or not receiving (10%) cash transfers (Table 1).

Overall household sanitary conditions were precarious for all analyzed strata, for example, the proportion of households served by public water supply did not surpass 64% (OEP). However, families living under extreme poverty presented worse sanitary conditions when compared to those out of extreme poverty (Table 2). The absence of a toilet inside the residence was observed in 4% of EPW households; conversely, a greater proportion

(19%) of residences with more than one toilet was observed among OEP households (p<0.01) (Table 2). The strategy of equally dividing food among family members was reported in half of EPS and EPW households differing significantly from the OEP group (30%). Adults missing a meal or reducing portion size was reported by 2% of OEP households which was significantly smaller than was observed in EPS (29%) or EPW (23%) groups. Adults prioritizing children was more frequent (p<0.01) in EPS or EPW households (48%) when compared to OEP (19%). The utilization of only one or two food types to prepare a meal was reported in 83% and in 80% of EPS and EPW homes respectively, differing from OEP homes (58%) (p<0.01). A higher proportion (p<0.01) of EPS received food donations compared to the other two groups (Table 3).

Table 2. Household sanitary conditions according to income level and receipt of cash transfer program assistance, Duque de Caxias-RJ, Brazil, 2005

Household characteristics	Extreme poverty[1] with cash transfer (EPS) (%)	Extreme poverty without cash transfer (EPW) (%)	Out of extreme poverty[2] (OEP) (%)	P value (χ2 test)
Sanitary conditions				
Public supply of water	57[a]	59[a]	64[b]	p<0,05
Garbage collection	80[a]	83[a]	92[b]	p<0,05
Sewage removed by public service	69[a]	68[a]	84[b]	p<0,05
Drinking water filtered or treated	69[a]	70[a]	83[b]	p<0,05
Number of toilets				p=0.03
No toilets	0[a]	4[a]	0[a]	
One toilet	93[a]	90[a]	81[b]	
More than one toilet	7[a]	6[a]	19[b]	

[1] extreme poverty: family income per capita < US$1.00 per day
[2] out of extreme poverty: family income per capita ≥ US$1.00 per day
*different letters indicate significant differences among the strata (p-value <0.05).

Table 3. Strategies related to food insecurity, self-perception of food quality, and eating habits among households of Duque de Caxias-RJ, Brazil according to the income level and receipt of cash transfer program assistance, 2005

Strategies	Extreme poverty[1] with cash transfer (EPS) (%)	Extreme poverty without cash transfer (EPW) (%)	Out of extreme poverty[2] (OEP) (%)	P value (χ2 test)
Family's strategy under food scarcity				
Equally dividing the food among the family members	51[a]	50[a]	30[b]	<0.01
Adults skipping a meal or reducing the amount of food	29[a]	23[a]	2[b]	<0.01
Adults reducing food to prioritize an infant	48[a]	48[a]	19[b]	<0.01
Using one or two food items to prepare meals	83[a]	80[a]	58[b]	<0.01
Receiving food donations	16[a]	4[b]	2[b]	<0.01
Food quality				<0.01
Great/good	33[a]	30[a]	68[b]	
Regular	60[a]	61[a]	31[b]	
Bad/very bad	7[a]	9[a]	1[b]	
Eating habits				
Healthy food	65[a]	62[a]	79[b]	p< 0,05
Daily fruits consumption	36[a]	34[a]	64[b]	p< 0,05
Daily vegetables consumption	65[a]	53[a]	78[b]	p< 0,05

[1] extreme poverty: family income per capita < US$1.00 per day
[2] out of extreme poverty: family income per capita ≥ US$1.00 per day
*different letters indicate significant differences among the strata (p-value <0.05).

Self-perceived great/good food quality among OEP households (68%) differed significantly from those in EPS (33%) and EPW (30%) homes. Only 1% of OEP families considered their food to be bad/very bad, differing significantly from the other groups (7% EPS and 9% EPW) (Table 3). Healthy food consumption was reported by 79% of OEP families, a proportion significantly higher than observed for EPS (65%) and EPW (62%) households. Significant differences were observed in the daily consumption of fruit and vegetables, which was more frequent in OEP households (64% and 78%, respectively) than in EPS (fruits: 36 and vegetables: 65%) and EPW (fruits: 34 and vegetables: 53%).

4. Discussion

In general, households living in extreme poverty with and without cash transfer aid (EPS and EPW respectively) were quite similar in many aspects, particularly concerning sanitary conditions and strategies for coping with food scarcity. Other common characteristics observed for these two groups were the predominance of households led by black or mixed race individuals, the presence of children and adolescents in the household, and the perception of food insecurity. The most important differences between EPS and EPW households were the greater proportions of female, young and low educated heads and smaller proportions of families with four or more members. It is possible that the level of schooling could have influenced families' insertion in the cash transfer program due to the necessary information and documentation being accessed more easily by a more educated family head.

The violation of the right to adequate food appeared an everyday situation for a considerable proportion of participant households, since the self-perception of moderate and severe food insecurity was significantly frequent among extremely poor families. Moreover, as expected, the level of income affected the quality of food in the household as families living in extreme poverty reported lower prevalence of daily fruit and vegetable consumption than among "out of extreme poverty" (OEP) families. Conversely, the self-perception of healthy food was modestly more prevalent in OEP households. The findings concerning selfperception of food quality and fruit and vegetable consumption are comparable to those of Segall-Correa and Salles-Costa, who found elevated intake of energydense processed foods among families in extreme poverty that received support from the Programa Bolsa Família (PBF) [16]. Additionally, these results are similar to studies that evaluated food insecurity and fruit and vegetable consumption, such as in extremely poor women in Canada [17,18,19], adults in Trinidad and Tobago [20], Canadians with diabetes [21], and low-income adults [22].

Furthermore, fruit and vegetables can be more expensive and less accessible than energy-dense foods. Price is considered a limiting factor of access to healthier food choices by low-income urban populations and is related to the consumption of unhealthy high-fat and high-sugar foods [5,11,23]. As observed by Drewnowski and Specter, foods prices directly influence the consumption of energy-dense foods by poor people; additionally, these authors suggest that the consumption of low-cost foods is frequently associated with low nutritional quality [24].

EPS and EPW households share the same strategies to cope with food scarcity. However, Uchimura et al. observed that portion size reduction is not a deliberately adopted strategy, since it is imposed by the constraints that lowincome families face [25].

These authors carried out a qualitative study with beneficiaries of the PBF in southern Brazil and also found that using limited numbers of food types (mostly rice and beans) in one meal was recurrent among the studied group [25].The study's data on sanitary conditions in the area demonstrates a shortfall against expectations even though Brazil's improvements in these indicators are modest compared to its economic growth [26]. The current Brazilian government recently launched the Growth Acceleration Program (Programa de Aceleração do Crescimento) which has prioritised improvement of infrastructure and basic sanitation across the population. However, at the current time the area studied has seen modest improvement in sanitary conditions such as access to the sewerage network, access to potable water and garbage collection. Absence of such advances presents a permanent challenge to amelioration of household conditions of health and quality of life of this extremely poor population. As an inheritance of the country's historically exclusionary and unequal economic development, social inequalities are still present in Brazil, despite recent remarkable economic growth and progress of socioeconomic indicators [26]. However, these statistics often disguise disparities present, particularly in urban areas that concentrate extreme poverty. Such areas are often characterized by lack of access to basic goods and services, such as urban infrastructure, acceptable housing, piped treated water, regular garbage collection, and proper sanitation. The study area is a typical example of these conditions. However, even in this poverty, there are variations among households that require addressing in tailoring and targeting social policies.

The data suggested that even among families who share the same low-income environment, small differences in education may provide higher income and, consequently, better access to food and basic services (such as appropriate sewerage, drinking water, and garbage collection) as was the case of OEP families evaluated in this study. Therefore, public policy design requires closer and more differentiated appraisal of potential target groups. Monitoring actions aiming to reduce poverty and food insecurity should incorporate indicators of environmental conditions and family profile, to characterize, for example, the social vulnerability of the household heads, which implies difficulties in employment, income, and social support. In 2006 Brazil established the Food and Nutritional Security Law, which gives responsibility to the government for the right to regular and permanent access to food. This is also guaranteed in the Federal Constitution 2010 [27]. Future studies should therefore include components to facilitate assessment of nutritional status when evaluating food insecurity.

5. Conclusion

This work investigated households living in a low-income area of Duque de Caxias, Rio de Janeiro, framing a context of food insecurity in a deprived urban area. By

describing the families' demographic profile, sanitary conditions, and strategies to deal with food scarcity, it has provided policy makers and designers of monitoring studies with a broader understanding of living conditions. The data were collected when the widening of public policies against poverty in Brazil were just beginning. Thus, this study may represent a reference for future studies assessing the impact of recent social changes observed in low-income urban areas in this country. Deficient environmental and sanitary conditions were part of the poverty scenario; nevertheless, this condition was not reserved for the extremely poor, also affecting those families with income over the level of extreme poverty, though in modestly lower proportions. The most compelling results related to factors revealing the social vulnerability of extremely poor families, especially those headed by youngsters and black women. The condition of extreme poverty demonstrates the worst combination of social and economic vulnerability in the context of the capitalist urban system. This study attempts to understand how an impoverished community may contain households yet poorer differentiated in the abilities of the families and also in access to public goods and services and social rights guaranteed to all by the government. All households in this study lived within one geographic area with roads, street lighting and other conditions theoretically equal. However the condition of extreme poverty indicated by income below one dollar was sufficient to identify greater social, economic and biological vulnerability of families. We know that income is one of the dimensions of the condition of poverty, though we could suggest that in the urban context income deprivation represents a more grave reduction in dignity and ability to survive. This study has identified that the condition of families in extreme poverty exhibits greater vulnerability in relation to the physical, economic and social access to food; in this case low family income appears to be the greatest limiting factor to ensuring food and nutritional security and in guaranteeing the availability of adequate and suitable food for all members of the family. Government action focuses on the population as a whole. As a result the most vulnerable families may find themselves on the margins of public policy solutions. Thus in a context of greater social inequalities, those most in need may be excluded from enjoyment of their rights and, though implementing strategies to alleviate hunger such as portion size reduction or not eating on a day of shortage to allow a child to eat, fail to definitively reduce their vulnerability. Food security is achieved when all people, at all times, have physical, social and economic access to sufficient, appropriate and reliable food supplies to satisfy their dietary needs and preferences to sustain an active and healthy life. In Brazil public policies assume distinct dimensions to food security: production, availability and access, food supply being an integral part of the concept of food security. Though Brazil has many programs and public facilities to guarantee the human right to adequate food and food security, sadly, these do not always reach those in greatest need. How can this be resolved? Current policies of the Brazilian Federal Government must urgently consider specifically measures and mechanisms capable of identifying families in this situation: the presence of hunger in the home in the context of extreme poverty, particularly in urban households in which income is the primary means of access to food that makes up the daily diet. Development of responses to enable the increase of social support of these families remains an urgent requirement. Such responses could incorporate inclusion of other members of the household, not just children, in the education system. Increasing differentiation of the contexts of extreme poverty and its multidimensionality is imminently necessary in Brazilian population studies. In order for future studies to contribute to development of new methods to confront extreme poverty they may wish to consider provision of investment in the physical condition of homes, where structures are appropriately safe. Furthermore, study of families who do not possess their own property or live in very precarious conditions such as *casas cedidas*, the practice of being allowed to construct properties on the land of friends or relatives without purchase or rent payment, may represent another method of differentiation.

This study has shown that the definition of extreme poverty in the context of inequality in Brazil may be more acutely associated with the presence of the hunger stage of food insecurity in metropolises and urban areas than in rural areas. A broader understanding of what poverty represents, specifically in relation to deprivation of food types and other basic needs, require better designed and planned public policies with the objective of increasing the capabilities, skills and opportunities of individuals within households. Furthermore, the equitable provision of access to those public goods and services guaranteed by law requires a pro-active approach to public management which has the removal of extreme poverty inside and outside the home as its goal. An urgent area of work remains the empowerment of communities in extreme poverty, placing them central to the process of expanding rights advocacy, demanding the rights enshrined in the Brazilian constitution.

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Conflicts of Interest

The authors declare no conflicts of interest.

Authorship

This paper is part of D.S.F. Doctorate in Nutrition thesis; D.S.F.: data treatment and statistical analysis, results interpretation, and manuscript conception and writing. R.S.: study conception, results interpretation, and manuscript final revision S.M.C.S.: Doctorate dissertation co-supervisor, manuscript conception, data interpretation, and manuscript final revision. R.A.P.: Doctorate dissertation supervisor, study conception, manuscript

conception, data analysis and interpretation, manuscript writing and final revision.

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