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Female-headed households and food insecurity in Brazil

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Abstract The National Household Survey carried out in 2009 by Brazil's bureau of the census contains information on a representative sample of 121,708 households. The questionnaire includes items that enable us to identify households that experience moderate and severe degrees of food insecurity. The results of logistic regression analyses support the hypothesis that the odds of food insecurity are higher among female-headed households compared to male-headed households. Net of statistical controls for region, urban residence, age, monthly per capita household income, and five indicators of the internal composition of the household, the odds of moderate and severe food insecurity are, respectively, 32 % and 16 % higher among households headed by women compared to households headed by men. Further analyses show that the likelihood of food insecurity increases with presence of young children 0–10 years of age and older children 11–18 years of age. The importance of intra-household characteristics is confirmed by results that show that the odds of both moderate and severe food insecurity increase with additional adult males but decrease with additional adult females. Evidence that the presence of adult females reduces food insecurity is consistent with studies of gender differences in household decision making which show that, compared to men, women's spending patterns have a greater positive effect on the welfare of children and other members of the household. The conclusions are discussed in the context of the poverty and hunger alleviation initiatives in Brazil's new social policy agenda.

Keywords Food insecurity · Food security · Female-headed households · Brazil · Gender inequality

In 1996, delegates from more than 180 countries met at the World Food Summit in Rome, Italy to pledge their commitment to an ongoing effort to eradicate hunger in all countries, setting the near-term goal of halving the number of undernourished people by 2015. In the sixteen years since the summit in Rome, the number of undernourished people in the world has hardly changed. Compared to 1990–92, the number of undernourished people in the developing countries has declined by a meager 3 million, a number well within the bounds of statistical error. Today, close to 850 million people remain undernourished. Of those, 820 million live in the developing world (FAO 2010). It is perhaps the greatest enigma of our time that despite the fundamental importance of food for human existence, the number of food-insecure people, or "hungry poor," remains unacceptably high (Shaw and Clay 1998:56).

The World Food Summit in 1996 was not the first attempt to rally international support to address hunger. Writing in 1995, Pinstrup-Andersen et al. (1995, cited in Shaw and Clay 1998:56) estimated that more than 120 international declarations, conventions and resolutions have been reached on various issues relating to the right to food. That right to food and the elimination of hunger were enshrined in the Universal Declaration of Human Rights, adopted at the UN in New York in 1948; in the Universal Declaration on the Eradication of Hunger and Malnutrition, passed at the World Food Conference in Rome in 1974; and in the World Declaration on Nutrition, approved at the International Conference in Rome in 1992.

Access to food is a problem everywhere, especially in the developing world. Food security exists when people have

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assured access at all times to nutritionally adequate and culturally appropriate foods. Among households, food security means access by all members to enough food for an active, healthy life. Food security includes, at a minimum, the ready availability of nutritionally adequate and safe foods, and the assured ability to acquire food in socially acceptable ways, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies. Food insecurity, in turn, is the limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways (Andersen 1990; FAO 2006).

Whereas it is hardly surprising that poor households are more likely to experience food insecurity compared to richer households, the purpose of this study is to go beyond the analysis of poverty effects by exploring the relationship between food insecurity and the gender of the head of household. Using measures of moderate and severe food insecurity available in Brazil's 2009 National Household survey (*Pesquisa Nacional por Amostra de Domicilios*, PNAD) of 121,708 domestic units, this study tests three hypotheses concerning the effects of household characteristics on the probability of moderate and severe food insecurity: Controlling for per capita household income and other key sociodemographic variables, we posit that the probability of food insecurity will be higher in female compared to male-headed households. We further expect the internal composition of the household to affect the nutritional status of its members such that the presence of children and adults will increase the probability of food insecurity but the presence of adult females will lower the probability of food insecurity. The results address issues that have long been debated in the literature on gender, poverty, and female headship.

Research on household headship in developing countries has been largely dominated by efforts to estimate the greater incidence of poverty among female- compared to male-headed households at a point in time, and, more controversially, to document the "feminization of poverty," which refers to the increase over time in the proportion of the poor population that is female (see Medeiros and Costa 2008). Less common are studies that focus on the association between female headship and food insecurity. Most research on this topic has been carried out in the United States (see Nord et al. 2010) and in Africa (e.g., Kennedy and Peters 1992). In Brazil, studies of the nutritional consequences of female headship have been either regional in focus (e.g., Vieira dos Santos et al. 2010) or, in the case of official reports (e.g., IBGE 2009, 2010), have been based on cross-tabulations rather than on multivariate methods that control for the effect of potentially confounding variables. The dearth of research on the effects of female headship on food security is especially conspicuous in Brazil where recent legislation (Section 10 of Decree Law No. 6.872, 2009) not only makes food security a policy priority, but does so with specific reference to the needs of female-headed households.

Gender, poverty and food insecurity

It is widely assumed that female-headed households experience higher rates of poverty compared to male-headed households (Buvinic and Gupta 1997). In their review of 66 studies concerning female headship and poverty for example, Buvinic and Gupta (1997) concluded that in two-thirds of the cases female-headed households were poorer than male-headed households.

The positive association between female headship and poverty is presumably due to several factors. Compared to male-headed households, female-headed households tend to have a higher dependency ratio and a greater number of non-workers. In addition, men on average earn more than women, largely because women are typically employed in the informal sector of the economy. Moreover, in female-headed households where there is no other adult present, the household head is not only responsible for generating income but also for completing domestic tasks. By restricting mobility and limiting the amount of available free time, the burden women carry can reduce the income generating opportunities for female-headed households. The disadvantages women confront are thought to apply, a fortiori, to lone heads of domestic units. Lacking a male partner, women are deprived of an adult male's earnings, and are unable to avail themselves of the non-market work that a wife usually provides in a male-headed unit. Women who head households also have smaller social networks, and, by virtue of bearing the full weight of household responsibilities, are confined to part-time, home-based occupations (Chant 2008).

The inventory of disadvantages that women face has promoted the conclusion that female-headed households throughout the world figure among the "poorest of the poor." Yet this blanket conclusion runs counter to a growing body of research that suggests that members of female-headed households are not necessarily worse off than their male-headed counterparts (Chant 1997:36). The counter argument to the poorest-of-the-poor thesis rests mainly on two observations, one of which points to the various ways that the relationship between female headship and poverty can be offset by the household's internal composition (Folbre 1991). The presence of other adult earners in the labor force or the presence of elderly pensioners can add to household income. Similarly, co-resident extended kin can also reduce vulnerability by bolstering income-earning capacity and by increasing the supply of people prepared to share the burdens of household maintenance. Older children

in the household, who can take on child care responsibilities of younger siblings, can also free up the amount of work time available to adult women (Chant 1997).

Measurement issues alone may account for the contradictory results of studies that set out to compare the poverty status of male- and female-headed households (Buvinic and Gupta 1997). Results vary depending on whether one measures consumption vs. income or household income vs. per capita household income, and whether the analysis is based on de facto or de jure definitions of the household head (see Deere et al. 2012). The status of the female household head is significant inasmuch as de facto female heads are more likely to receive remittances from temporarily absent household members, thereby reducing or eliminating the income differences between male- and female-headed households (Deere et al. 2012; Villarreal and Shin 2008).

Apart from the methods used to measure poverty, skeptics who contend that female-headed households are not necessarily at a comparative disadvantage follow a second line of reasoning, one that points to the inner workings of the domestic unit and the allocation rules that govern the distribution of scarce resources within it (Thomas 1990). Even when female-headed households have lower incomes than male-headed households, the detrimental effects of low income can be offset by the extent and manner in which income and assets are converted into consumption. A number of studies have found that women devote the bulk of their earnings to household expenditures, and that their spending pattern has positive effects on other members' welfare (Chant 2003; Folbre 1991; Molyneux 2006; Thomas 1990). Men, by contrast, are prone to retain more of their earnings for discretionary personal spending on drinking, gambling, and other individualistic pursuits. Many women in Mexico, Costa Rica and the Philippines assert that they feel more financially secure without men, and claim that, when they are free to make their own decisions, they are better able to cope with hardship (Chant 1997). Analyses of survey data on family health and nutrition in Brazil similarly found that income in the hands of a mother has a bigger effect on her family's health than income under the control of the father. For child survival probabilities, the effect was almost twenty times larger (Thomas 1990). Systematic gender differences in the pattern of household resource allocation could mean that children and other members of female-headed households may be better off than their counterparts in male-headed households.

Competing perspectives on the relative status of female- and male-headed households underscore the notion that a proper comparative assessment of the two types of households depends on a valid measure of quality of life. A core dimension of quality of life is access to enough food for an active and healthy existence, and freedom from the anxiety that obtains when access to food is inadequate or uncertain. Food security can therefore be regarded as a better indicator of quality of life than many commonly used variables, such as income and education, which are, in effect, inputs in the production of quality of life. Food security, by contrast, is the outcome of the joint effect of economic resources, human capital, and a host of other inputs. Food security can thus be thought of as the "bottom line" of the social balance sheet.

Even if women who head their household have greater decision-making freedom, and even if they do spend a greater percentage of their earnings on household necessities such as food, it remains an empirical question whether female-headed households in Brazil experience greater or lower food insecurity compared to male-headed households. To answer this question we use data generated by Brazil's 2009 National Household Survey.

National household survey (PNAD) 2009 and measures of food insecurity

The National Household Surveys (*Pesquisa Nacional por Amostra de Domicillios*, PNAD) carried out by Brazil's bureau of the census (*Instituto Brasileiro de Geografia e Estatística*, IBGE) began in 1967 and have been carried out every year since then, except those years when the demographic census was in the field (1970, 1980, 1991, and 2000). The main objective of the PNAD is to track changes in housing, employment, and migration via information collected in the "basic questionnaire" (*corpo básico*), which has remained largely unchanged since the PNAD was initiated. Additional information is sometimes collected via a "supplemental questionnaire" which explores a specific topic that varies from one year to the next. In 2009, one theme in the supplement to the basic questionnaire focused on food security. By providing a nationally representative sample of 121,708 households and 399,387 individuals, the 2009 National Household Survey is an extraordinarily valuable resource.[1]

Following the methods used by Brazil's census bureau (IBGE 2010), the presence and degree of food insecurity is determined by responses to the six questions shown in Table 1, all of which are based on a three-month retrospective period.[2] We classify a household as experiencing "Moderate Food Insecurity" (MFI) if people gave an affirmative response to any of the first four questions. We classify a household as

[1] The analysis is based on the original sample size but is weighted to ensure that the sample of 121,708 households is nationally representative.

[2] The food insecurity scale used in the PNAD questionnaire was derived from the food insecurity measures developed by the U.S. Department of Agriculture. Whereas Brazil's census bureau accepts that these measures are valid operational definitions in the Brazilian context, Coates et al. (2006:1438S), speaking more generally, claim that household food insecurity is often "culturally unique and that a thorough ethnographic process is a necessary step to ground the scale in locally relevant experience."

Table 1 Questions in the PNAD 2009 survey and the typology of food insecurity

Food insecurity[a]		Question
Moderate	1	In the last 3 months, members of this household worried that food would run out before they would be able to buy or receive more food. *[Nos últimos 3 meses, os moradores deste domicílio tiveram a preocupação de que os alimentos acabassem antes de poderem comprar ou receber mais comida?]*
	2	In the last 3 months, members of the household did not have the money for a healthful and varied diet. *[Nos últimos 3 meses, os moradores deste domicílio ficaram sem dinheiro para ter uma alimentação saudável e variada?]*
	3	In the last 3 months, food ran out before members of the household had money to buy more food. [*Nos últimos 3 meses, os alimentos acabaram antes que os moradores deste domicílio tivessem dinheiro para comprar mais comida.*]
	4	In the last 3 months, have members of this household eaten only leftovers because money ran out? [*Nos últimos 3 meses, os moradores deste domicílio comeram apenas alguns alimentos que ainda tinham porque o dinheiro acabou?*]
Severe	5	In the last 3 months, has anyone over 18 years of age gone hungry but did not eat because there was no money to buy food? [*Nos últimos 3 meses, algum morador de 18 anos ou mais de idade, alguma vez, sentiu fome mas não comeu porque não havia dinheiro para comprar comida?*
	6	In the last 3 months, has anyone less than 18 years of age gone hungry but did not eat because there was no money to buy food? [*Nos últimos 3 meses, algum morador de 18 anos ou mais de idade, alguma vez, sentiu fome mas não comeu porque não havia dinheiro para comprar comida?]*

PNAD 2009

[a] Some = 1 or 2 or 3 or 4; Severe = Some +5 or 6

experiencing "Severe Food Insecurity" (SFI) if, in addition, people gave an affirmative response to either of the last two questions.[3]

Food insecurity, region, place, and class

Of the 121,708 households headed by an individual 18 years of age and older, the PNAD 2009 survey indicates that the proportion of all households classified as experiencing Moderate or Severe food insecurity is 30.3 % and 6.1 %, respectively. Panel A of Table 2 shows the distribution of food insecurity rates for five geographical regions in Brazil. The highest rates of food insecurity, both Moderate and Severe, are in the Northeast region, a finding that is not surprising given that the Northeast, which contains 26.3 % of households, is the poorest region of the country. The lowest rates of food insecurity are in the South, the wealthiest region of the country. The geography of food insecurity thus conforms to the longstanding regional differences in economic development in Brazil (Wood and Magno de Carvalho 1988).

Panels B and C of Table 2 present the rates of household food insecurity by place of residence and by level of per capita monthly household income. The data indicate that food insecurity rates are higher in rural areas than in urban areas, a finding that is somewhat surprising given that food production mainly occurs in rural areas where access to food stuffs is more feasible. Urban areas, on the other hand, are less likely to produce food due to high population density and lack of arable land.[4] However, as we will later show, the rural-urban difference is likely due to spatial differences in household income, which, as expected (Hadley et al. 2008), exerts the strongest effect on the odds of food insecurity. As shown in Panel C, the proportion of households with both Moderate and Severe food insecurity is highest among households in the lowest income strata (67.6 % and 25.5 %, respectively), and declines as income rises.

Female-headed households and food insecurity

In keeping with the definition adopted by international organizations such as the United Nations, a household in the PNAD survey is understood to comprise individuals who live in the same dwelling and who have common arrangements for basic domestic and reproductive activities such as cooking and

[3] We capitalize Moderate and Severe when the reference is to the indicator of food insecurity but do not do so when the two terms are used as adjectives.

[4] The conclusion that food insecurity is higher in rural areas should be accepted with caution given the way the Brazilian bureau of the census classifies place of residence. The IBGE uses the legal definition of a city, which designates as urban the administrative center of every *municipio*, an entity more or less equivalent to a county in the U.S. Because the definition of urban is based on a legal/administrative criterion rather than the more common definition based on population size, many small places, ones that hardly meet the conventional image of a city, are included in the urban category.

Table 2 Percent of households by category of food insecurity and by region, place, income, and sex Brazil 2009

	Food insecurity (percent of households)			
	Moderate [1]	Severe [2]	*N* [3]	Percent [4]
A. Region				
North	40.3 %	11.5 %	8,558	7.0 %
Northeast	46.1 %	11.5 %	31,868	26.2 %
Southeast	23.3 %	3.4 %	53,419	43.9 %
South	18.7 %	2.7 %	18,811	15.5 %
Center-West	30.2 %	5.1 %	9,052	7.4 %
Total	30.3 %	6.1 %	121,708	100.0 %
B. Place				
Rural	35.1 %	8.4 %	18,198	15.0 %
Urban	29.4 %	5.7 %	103,510	85.0 %
Total	30.3 %	6.1 %	121,708	100.0 %
C. Income[a]				
1	67.6 %	25.5 %	11,886	10.1 %
2	57.5 %	15.6 %	11,691	9.9 %
3	49.8 %	10.6 %	11,837	10.0 %
4	41.7 %	7.8 %	11,758	10.0 %
5	34.6 %	5.1 %	10,564	9.0 %
6	28.2 %	4.4 %	13,050	11.1 %
7	23.4 %	2.3 %	12,197	10.3 %
8	17.7 %	1.5 %	11,457	9.7 %
9	12.4 %	0.8 %	11,713	9.9 %
10	6.8 %	0.3 %	11,794	10.0 %
Total	30.5 %	6.2 %	117,946	100.0 %
D. Sex household head[b]				
Male	28.2 %	5.3 %	80,854	66.4 %
Female	34.5 %	7.6 %	40,854	33.6 %
Total	30.3 %	6.1 %	121,708	100.0 %

PNAD 2009

[a]Monthly per capita household income (deciles)

[b]Age of household head >=18; sample excludes collective housing

eating. The household head is the individual recognized by other members of the unit as having authority within and responsibility for the household.[5]

Among households headed by women, the proportion that experienced MFI and SFI was 6.3 and 2.3 percentage points higher compared to households headed by men (Table 2, Panel D). These differences, moreover, cannot be attributed entirely to differences in the level of monthly per capita household income. As Fig. 1 illustrates, female-headed households are more likely to experience greater food insecurity at all levels of per capita household income, although the gender gap narrows somewhat in the higher income strata.

[5] Six large data collection efforts, such as the demographic census and the PNAD surveys, designate one person within the household as the head of household, and define the status of other members in terms of their relationship to that reference person. In the 1990s, the Brazilian census bureau changed the term "*chefe do domicílio*" (head of household) to "*pessoa responsável*" (responsible person) (http://www.ibge.gov.br/censo/questionarios.shtm).

Multivariate analysis

Whether female-headed households continue to have a higher incidence of food insecurity after controlling for other factors that affect the household's food status is a question answered with multivariate statistical tests. Because both dependent variables—MFI and SFI—are dichotomous (coded 1=yes and 0=no), the appropriate method is logistic regression. The multivariate procedure enables us to introduce simultaneous controls for region of the country, rural-urban place of residence, education, and monthly per capita household income.

Models 1 and 3 in Table 3 show the effects of various socio-demographic variables on MFI and SFI. Excluding indicators of the internal composition of the household, Models 1 and 3 explain 24.9 % and 22.5 % of the variance in Moderate and Severe food insecurity, respectively. The coefficients for the region dummies in Model 1 indicate that, compared to the North (the reference category), MFI is highest

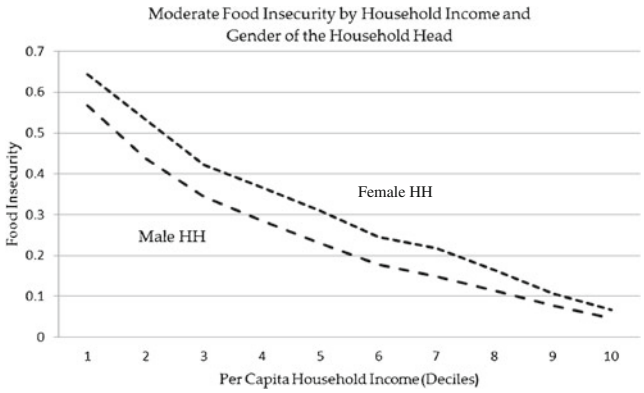

Fig. 1 Moderate food insecurity by household income and gender of the household head

in the Northeast and lowest in the Southern region. With respect to place of residence, the odds ratio for urban areas is substantially higher compared to rural areas. Controlling for the other variables in the equation, the odds of MFI and SFI shown in columns 2 and 6 are 68 and 63 % higher in urban compared to rural places. Both indicators of food insecurity decline with increases in age, years of schooling completed, and monthly per capita household income.

The odds ratios for each decile of monthly per capita household income, shown in columns 2 and 6, are in relation to the highest income decile, which is treated as the reference category. The odds of Moderate and Severe food insecurity are 17 and 56 times higher in the poorest households compared to the richest households. The plot of the odds ratios by income decile presented in Fig. 2 shows that the relationship is non-linear. In contrast to the upper income range, as income increases from the first to the fourth income decile we see a steeper decline in food insecurity, especially with respect to Severe food insecurity.

The gender of the head of household is the independent variable of primary interest. The coefficients, shown at the top of Table 3, indicate that gender exerts an independent effect on the probability of food insecurity. Compared to male-headed households, the odds ratios for those headed by women are 43 and 54 % higher (columns 2 and 6) with respect to both Moderate and Severe food insecurity, controlling for region, place of residence and the various socio-demographic characteristics (age, education, and monthly per capita household income).

Model 2 and Model 4 introduce five indicators of intra-household composition on the assumption that intra-household characteristics such as the number of children in the household and the number of adult members can influence the probability of food insecurity. The key question is whether gender differences in household food insecurity persist after accounting for the individual-level variables as well as the household's internal composition. The estimates shown in columns 4 and 8 indicate that, other things being equal, households headed by women are 32 % more likely to experience moderate food insecurity and 16 % more likely to experience severe food insecurity compared to comparable households headed by men. Put another way, even if female-headed households had the same scores as male-headed households on all of the variables in the equation, households headed by women would nonetheless experience higher rates of moderate and severe food insecurity.

A second yet equally important concern looks to the coefficients associated with each of the household-level variables for insight into the determinants of food insecurity. The coefficients indicate the independent effects of each intra-household indicator, controlling for the gender of the household head. We entered the five indicators of internal composition into Models 2 and 4 as sets of dummy variables, using 0 as the reference category, as shown in the lower portion of Table 3. By entering the indicators as dummy variables, the coefficients for 1, 2, and 3+ permit us to detect non-linear effects in the relationship between the various indicators of household composition and the odds of Moderate and Severe food insecurity.

The coefficients for the dummy variables confirm the presence of non-linear effects, as indicated by the level of food insecurity per number of resident children ten years of age or less. Although the presence of one child has no effect on MFI (column 4), the presence of two children increases the odds of Moderate insecurity by 12 %. The presence of three or more children 0–10 years of age has a much larger effect, increasing the odds of MFI by 36 %. We observe a similar non-linear pattern with respect to SFI (column 8). The presence in the household of two and three or more children increases the odds of Severe food insecurity by 14 and 44 %, respectively. Similar effects are observed with respect to older children 11–18 years of age.

The food security consequences of the number of adult members of the household are contingent on the age and gender of the people living in the domestic unit. The presence of male and females over the age of 65 tends to reduce the odds of both moderate and severe food insecurity. The number of males 19–65 years of age, however, increases the likelihood of MFI and SFI. The presence of two adult men increases the odds of Moderate insecurity by 29 %; the presence of three or more adult men increases the odds of Moderate food insecurity by 42 %. Comparable estimates for Severe food insecurity are 22 % and 41 %.

Whereas the presence of adult males increases the likelihood of household food insecurity, the presence of adult females has the opposite effect on food insecurity, especially with respect to Severe food insecurity, as indicated by the estimates shown in column 8 (Table 3, bottom panel). The addition of one, two, and three or more adult females reduces the odds of Severe food insecurity by around 34 %.

The last question we address is whether the food insecurity effects of additional female members of the household are the

Table 3 Moderate and severe food insecurity regressed on gender of household head, region, place, years of school, age, income, and intra-household composition, Brazil 2009 (logistic regression coefficients and odds ratios)

		Moderate food insecurity				Severe food insecurity			
		Model 1		Model 2		Model 3		Model 4	
		B [1]	Exp(B) [2]	B [3]	Exp(B) [4]	B [5]	Exp(B) [6]	B [7]	Exp(B) [8]
FHH[a]	Male (ref)								
	Female	.357*	1.429	.276*	1.317	.430*	1.538	.151*	1.163
Region	North (ref)								
	Northeast	.118*	1.125	.146*	1.157	−.240*	.787	−.194*	.824
	Southeast	−.436*	.646	−.412*	.662	−.781*	.458	−.753*	.471
	South	−.656*	.519	−.626*	.535	−.918*	.399	−.888*	.412
	Center-West	−.175*	.839	−.153*	.858	−.529*	.589	−.505*	.603
Place	Rural (ref)								
	Urban	.517*	1.676	.518*	1.678	.489*	1.631	.508*	1.662
Age	In years	−.006*	.994	−.005*	.995	−.004*	.996	−.001*	.999
Schooling	In years	−.055*	.946	−.054*	.947	−.099*	.906	−.094*	.910
Income[b]	1	2.836*	17.050	2.763*	15.841	4.032*	56.399	3.983*	53.681
	2	2.462*	11.733	2.394*	10.959	3.476*	32.326	3.478*	32.385
	3	2.202*	9.044	2.146*	8.554	3.118*	22.612	3.151*	23.348
	4	1.876*	6.530	1.854*	6.384	2.781*	16.134	2.837*	17.069
	5	1.686*	5.396	1.664*	5.283	2.473*	11.859	2.543*	12.722
	6	1.451*	4.266	1.426*	4.163	2.189*	8.926	2.260*	9.579
	7	1.155*	3.175	1.171*	3.226	1.906*	6.725	1.915*	6.789
	8	.912*	2.489	.904*	2.470	1.410*	4.095	1.451*	4.267
	9	.529*	1.698	.526*	1.692	.863*	2.369	.875*	2.400
	10 (ref)								
Intra-household composition	Children 0–10								
	0 (ref)								
	1			−.002[ns]	.998			−.116*	.890
	2			.109*	1.115			.127*	1.135
	3+			.307*	1.359			.363*	1.438
	Children 11–18								
	0 (ref)								
	1			−.010[ns]	.990			.011[ns]	1.011
	2			.091*	1.095			.089*	1.093
	3+			.206*	1.228			.360*	1.433
	Adults 65+								
	0 (ref)								
	1			−.050[ns]	.951			−.041[ns]	.960
	2			−.227*	.797			−.501*	.606
	3+			−.512*	.599			−.676[ns]	.509
	Males 19–65[c]								
	0 (ref)								
	1			.146*	1.157			.041[ns]	1.042
	2			.253*	1.288			.196*	1.217
	3+			.348*	1.416			.342*	1.407
	Females 19–65[c]								
	0 (ref)								
	1			−.057*	.945			−.412*	.662

Table 3 (continued)

		Moderate food insecurity				Severe food insecurity			
		Model 1		Model 2		Model 3		Model 4	
		B [1]	Exp(B) [2]	B [3]	Exp(B) [4]	B [5]	Exp(B) [6]	B [7]	Exp(B) [8]
	2			−.031[ns]	.970			−.421*	.657
	3+			.020[ns]	1.021			−.443*	.642
Constant		−.637		−.577	.562	−2.824		−2.963	
R Square		0.249		0.252		0.225		0.231	

Brazil PNAD 2009

[a] Age Household Head >= 18

[b] Monthly per capital household income in deciles

[c] Not including head of household

*p<=.05

same for male- and female-headed units. If the presence of additional women in the household lowers the likelihood of food insecurity, then it is reasonable to hypothesize that the adult female effect would be larger in female-headed households compared to households headed by men. Tests for statistical interaction between the gender of the household head and the number of resident adult females were statistically significant but the direction of the differences by the gender of the household head were contrary to expectation. To show the differences, Table 4 presents separate B coefficients and odds ratios for the dummy variables associated with Females 19–65, within male- and female-headed households. The findings are especially revealing with respect to Severe food insecurity, shown in panel B. All of the B coefficients in the panel were negative (columns 1 and 3) indicating that the presence of additional women reduces food insecurity in both male- and female-headed households. [6] However, the B coefficients in column 1 and 3 were consistently larger in male- compared to female-headed households. To illustrate the point, we can say that the odds ratio for the 3+ dummy variable indicates a 52 % reduction in the odds of severe food insecurity within male-headed households (column 2) and 17 % reduction within female-headed households.

Why the presence of adult females reduces the likelihood of severe food insecurity (especially in male-headed households) is an open question. Regrettably the PNAD 2009 survey does not contain data that permit a more detailed analysis, such as information on the distribution of resources within the household, or on the strategies that members of the household adopt to cope with low income and other poverty related factors. Nonetheless, the evidence that, other things being equal, the presence of adult females reduces food insecurity suggests that women are better able than men to manage the resources at their disposal in a manner that achieves greater food security. This interpretation, which is necessarily speculative, is consistent with studies of gender differences in household decision making (Chant 2003, 2010; Thomas 1990) which show that, women's spending patterns have a greater positive effect than men's on the welfare of children and other members of the household.

Gender inequality, food insecurity, and poverty alleviation in Brazil

Although policy discussions regarding female-headed households are hardly new, they remain controversial. The growing availability of household-level data in developing countries has enabled a new generation of studies that question the long-held assumption that female-headed households are poorer than male-headed households (although findings vary

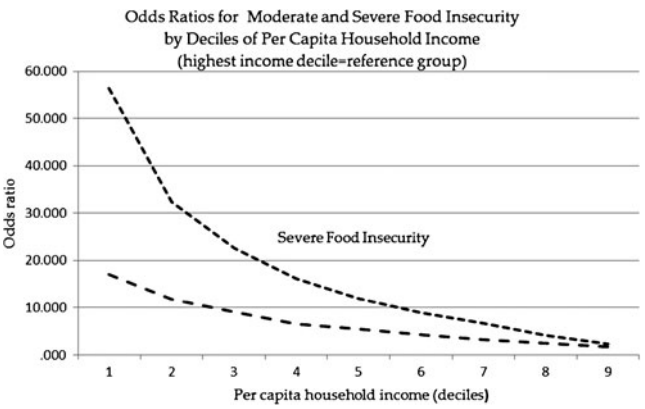

Fig. 2 Odds ratios for moderate and severe food insecurity by deciles of per capita household income (highest income decile=reference group)

[6] Statistical tests for the interaction between the gender of the household head and the other indicators of the internal composition of the household were not statistically significant.

Table 4 Effect of adult females in the household on food insecurity by gender of household head (logistic regression coefficients and odds ratios)

	Male head		Female head	
	B [1]	Odds ratio [2]	B [3]	Odds ratio [4]
A. Moderate food insecurity				
Females 19–65				
0 (ref)				
1	−.125*	.882	.017[ns]	1.017
2	−.094*	.910	.037[ns]	1.038
3+	−.042	.959	.097[ns]	1.102
B. Severe food insecurity				
Females 19–65				
0 (ref)				
1	−.709*	.492	−.114*	0.892
2	−.687*	.503	−.286*	0.766
3+	−.733*	.480	−.181*	0.834

[a] Controlling for the socio-demographic variables in Table 3

[b] Adult Females >= 19–65 years of age

*means statistically significant where P< .05. ns means: not significant.

according to the measure of poverty). Current research similarly points to the need to account for differences in the composition of households as well as factors that can offset the detrimental effects of low income, such as the internal rules that govern consumption, the allocation of income and other resources within the households, and the coping mechanisms that people adopt.

This study reflects the concerns of current household research but shifts the focus from poverty per se to food insecurity, net of the effects of poverty. Food insecurity is strongly affected by income, but variations in food insecurity cannot be reduced entirely to the poverty level of the household. As such, measures of food insecurity present an opportunity to revisit the debate regarding the relative status of male- and female-headed households, and to generate new insights into the determinants of quality of life.

Using two measures of food insecurity derived from items included in Brazil's 2009 National Household Survey, we find that, net of the effects of age, income, education and place of residence, female-headed households experience higher rates of moderate and severe food insecurity compared to male-headed households. Further analyses show that various indicators of the internal composition of the household have statistically significant and non-linear effects on food insecurity. Most revealing of the findings is the observation that, independent of the gender of the household head, the presence of additional adult males in the household increases the likelihood of food insecurity. The presence of additional adult females has the opposite effect, reducing the odds of moderate and, especially, severe food insecurity, particularly in male-headed households. Our interpretation of the findings with respect to gender differences in household food insecurity is consistent with studies that find that, in contrast to men, women's preferences regarding expenditures and consumption tend to have a greater positive effect on the welfare of other members of the household.

The measurement of food insecurity allows analysts to estimate the prevalence of food deficiency as a means for government and development agencies to better target at risk populations and to monitor and evaluate program success. Household food insecurity measurement needs to be simple, cost effective and produce valid operational definitions of the concept (Hackett et al. 2008:767). The methods developed in the United States (see Radimer et al. 1990) and adapted to Brazil (Hackett et al. 2008) generally meet these criteria, although they are also subject to question when applied to the comparison of male- and female-headed households. The concern focuses on the potential bias caused by possible gender differences in responses to the questionnaire items. Several studies have shown that women experience stressors such as food insecurity more intensely than men (Hackett et al. 2008).[7] It is therefore conceivable that the observed differences in food insecurity rates among male- and female-headed households (as reported by the household head) reflect gender specific perceptions of food insecurity rather than actual differences in the household's nutritional status.

Plausible as this contention may be, Hackett et al. (2008) report no gender response bias with respect to the food security measures used in Brazil's 2009 household survey. When Hackett and her colleagues evaluated the dimensionality of the items included in the composite scale, and when they estimated differences in item severity between male and female respondents, they found that the validity and the psychometric properties of the scale were not affected by the respondent's gender. The absence of gender differences bolsters our contention that the higher rates of food insecurity reported by female heads of household in this study are real and are unlikely to be an artifact of male and female differences in the perception of nutritional status.

Food insecurity has come to play an important role in Brazil's new social policy agenda. In 2003, Brazil's President Luiz Inácio Lula da Silva implemented the national program *Fome Zero* (Zero Hunger) to boost agricultural production and to alleviate hunger and food insecurity. *Fome Zero*, which replaced the *Programa Comunidade Solidária*, earlier created by President Fernando Enrique Cardoso in 1995 (Peres 2005),

[7] Psychometric research by Monello and Mayer (1967) came to the opposite conclusion. When adolescents and adults of both sexes described their subjective experiences of hunger and satiety, males appeared to experience hunger more intensely and in a more specific physical way than females whose experience was more diffuse and cerebral (cited in Hackett et al. 2008).

consists of as many as thirty subprograms designed to eliminate both the proximate and ultimate causes of hunger. Under this umbrella, the largest and most well know initiative is *Bolsa Família*, a conditional cash transfer program (CCT) that provides direct financial aid to the poor.

The National System of Food Security and Nutrition (Sistema Nacional de Segurança Alimentar e Nutricional, SISAN), which became law (No. 11.346) in September 2006, expanded the definition of human rights to encompass food security (IBGE 2010). The de jure scope of citizenship now includes the right to permanent access to adequate and nutritional food in a manner that "does not compromise other essential needs," and does so in a way that is environmentally, culturally, and economically sustainable. Decree Law No. 6.872, adopted in 2009, confirmed food security as a policy priority and specifically recognized the importance of meeting the needs of female-headed households (Section 10). Subsequent legislation (Decree 7.282, 2010) established a system to monitor and evaluate food security and to identify "violations of the right to an adequate diet" associated with race, gender and social inequality.

The attention given to food security in Brazil's current social policy underscores the need to measure the prevalence of food insecurity and to identify the factors associated with variations in the prevalence of food insecurity. The results of this study show that, independent of the effects of place of residence and socio-economic status, both moderate and severe levels of household food insecurity are associated with the gender of the head of household and with the household's internal composition. Empirical evidence that female-headed households experience a higher risk of hunger confirms the importance of measures of food insecurity in the study of households and gender inequality. Estimates of the gender differences in food insecurity in 2009 also provide a benchmark against which future studies of gender inequality can assess the effectiveness of food-related components of Brazil's new social policy agenda.

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