The impact of the "Bolsa Família" Program on household diet quality, Pernambuco State, Brazil

Pedro Lima Coelho [1]

Andrea Sales Soares de Azevedo Melo [1]

Abstract *This article analyzes the impact of the Bolsa Família Program (BFP) on the quality of dietsamong households from Pernambuco State using data from the 2008-2009 Brazilian Household Budget Survey. The propensity score matching method, which corrects the sample selection bias, was used to make a comparison between beneficiary families and beneficiaries not in the program. The results show that beneficiary families in the Program scored, on average, 9.05 more on the Diet Quality Index (DQI), compared with families not participating in the BFP. The results point to the effectiveness of the BFP in improving the quality of family diets, particularly in reducing fat and sodium, and increasing variety.*

Key words *Bolsa Familia Program, Nutrition, Diet Quality Index (DQI), Pernambuco*

[1] Centro de Ciências Sociais Aplicadas, Universidade Federal de Pernambuco. Av. dos Economistas s/n, Cidade Universitária. 50740-580 Recife PE Brasil. lcoelho.pedro@gmail.com

Introduction

The literature highlights the importance of good nutrition for quality of life, with a particular emphasis on the negative associations between nutritional deficiency and health status; and between nutritional deficiency and academic and professional performance. These associations are even stronger when it comes to malnutrition during early years of life, which can have a negative impact on the future development of the individual.

Children raised in food deficient households are more likely to have poor general health[1-3], stomachaches and frequent headaches[4], more chronic diseases[2], increased probability of being hospitalized[1], psychosocial problems[2,5,6], problems of depression and symptoms of suicide[7], behavior problems[8] and poorer developmental results[9,10], altered mental proficiency[11], and higher levels of iron deficiency[12].

The FAO[13] estimated there to be 852 million undernourished households in the world, although it is widely recognized that explaining this phenomenon is not just about food production capacity. Runge et al.[14] and Sachs[15] have pointed out that improved technology in production means that current capacity should be sufficient to provide enough food for humanity.

In the literature on nutrition economics, concerns about diet quality involve both ends of the spectrum, from malnutrition[16] to obesity[17]; it is possible even to identify cases of association between malnutrition and obesity[18]. At the lower end, malnutrition can be a direct consequence of chronic hunger, as well as a poor diet resulting from a failure to intake certain nutrients. In both cases, however, the negative effects on productivity and well-being come from a lack of power, proteins, and some micronutrients[19-21].

Barros et al.[22], Lima et al.[23] and Onis et al.[24] studied the extent and distribution of this multifactorial problem in different populations, as well as its association with factors related to schooling and age of the head of household, health care, healthy environment, living conditions and household income. But among the different factors, low family income and poverty have been identified as its main determinants.

According to the annual report of the United Nations Environment Programme[25], about 2.2 billion people currently live in or are close to living in poverty, representing more than a third of the world's population. In extreme situations, the purchasing power of the poor is below a minimum subsistence level and can lead to starvation and death. In less extreme situations, poverty can lead to an insufficient intake of food and nutrients. Also according to the PNUD report[25], among people affected by poverty, 842 million live with chronic hunger, representing 12% of the world's population.

Malnutrition problems are strongly related to issues of poverty and are therefore particularly prevalent in developing countries, where they are a matter of public health. In this sense, there are several examples of countries that use conditional income transfer programs, in order to reduce the problems associated with malnutrition. Mexico, Colombia, Ecuador, Chile, Portugal, and Brazil are all countries that use these programs with the aim of reducing social hardship, including malnutrition[26].

In Brazil, this role falls to the *Bolsa Família* Program (BFP), and this study aims to identify the program's effect on the quality of household diet. The analysis will focus on the state of Pernambuco and draw on data from the Household Budget Survey (HBS) for the years 2008-2009. In addition to socio-economic data about the family unit, the HBS has information from a 24-hour recall about the type and quantity of food consumed by household members.

Some national studies have evaluated the impact of BFP and other income transfer programs on food expenditures. Resende and Oliveira[26] estimated the impact of the Bolsa Escola program (prior to the *Bolsa Família* program) on household expenditures using the 2002-2003 HBS data and observed rising food costs, among other important impacts. With regard to the BFP, a report by the Brazilian Ministry of Social Development[27] noted that food consumption by extremely poor families increased by approximately R\$ 388 per year after receiving the benefit; and a second study by Duarte et al.[28] of rural northeastern families in 2005 concluded that expenditure on food by beneficiary families was on average R\$ 246 more than by non-beneficiaries.

But increased spending on food may not necessarily reflect better nutrition. Assessing the impacts of the program on anthropometric indices (height for age, weight for height, weight for age, and body mass index for age) Andrade et al.[29] found no statistically significant effects of the program. However, despite the poor results, the authors warn that the changes in anthropometric indices would only be noticeable with a longer-term engagement by families in the BFP.

In order to resolve these issues, which are not captured by observation of spending on food,

nor in the short term by anthropometric indices, this paper proposesthe Diet Quality Index (DQI) as a measure of nutritional quality. The DQI evaluates a combination of different foods, nutrients and dietary constituents in relation to dietary recommendations. It measures various dietary risk factors for chronic diseases in order to simultaneously evaluate and monitor diets at the individual and populational levels[30]. The DQI is able to capture changes to eating habits in the short/medium term which may lead to changes in anthropometric indices in the long run.

The method of impact assessment proposed in this paper is propensity score matching, which is a valuable tool in public empirical evaluation policies[26,28,31,32]. By using the 2008-2009 HBS, this study adds a new analytical approach to the understanding of BFP impacts and to evaluating the DQI. There are analyses of the estimated impact of the BFP in various areas, but none related to DQI, nor using the HBS data. There were no studies of this nature and magnitude either in Brazil or in the literature.

The subsequent section details the DQI estimation method, propensity score matching, and finally describes the data and the selected variables. The third section of this article presents and discusses the results obtained from the impact of the *Bolsa Família* Program on the quality of diet of the families studied, while the fourth section presents final considerations.

Methods

This paper was developed in two phases, both of which used data from the Household Budget Survey (2008/2009) for Pernambuco State. In the first phase, the DQI was estimated for each household in the sample. In the second, a difference was established between BFP beneficiary familiesand non-beneficiaries. Propensity score matching was used for estimating this difference. The following sections describe the strategies used during both phases.

The Diet Quality Index

The Diet Quality Index (DQI) was developed by Patterson et al.[33], with the objective of creating a tool for measuring global diet quality to reflect a risk gradient for many chronic diseases related to food consumption. The tool identifies a high quality diet, reflected by a range of nutritional needs and reduced consumption of total and sat-

urated fat, as recommended by the Committee on Diet and Health[34].

The DQI is obtained a points system for ten components, which characterize different aspects of a healthy diet. Each component is analyzed and scored from zero to ten, so that the DQI value ranges from zero to one hundred points, with the maximum score representing complete conformity with the Committee's recommendations.

The first six components are represented by food groups, three components are represented by total fat, cholesterol and sodium nutrients and the last by diet variety. In this paper, "saturated fat" was substituted by the "legumes group", in line with the process followed by Phillip et al.[35]. This option was selected on account of the Brazilian dietary habit of bean consumption. If it had remained part of the group for meat and eggs, there was a risk of over-estimating consumption of the items in that group.

The criteria for the attribution of the maximum, minimum and intermediary scores were based on the consumption of relative proportions from the Committee's recommendations.

The Propensity Score Matching Method

The propensity score matching (PSM) method is used to estimate the impact of the *Bolsa Família* Program on the quality of families' diets, and the variable that is of interest to this paper is the DQI. The PSM, created by Rosenbaum and Rubins[36], is one of the most important methods for pairing and is different from other multidimensional tools in that one control variable can be included, namely the propensity score itself.

The propensity score represents the probability that a given family receives the benefit of the Program conditioned on observable features. In this particular case, the probability of the family unit being a beneficiary of the *Bolsa Família* Program is conditional to its socioeconomic characteristics. It is this conditionality imposed on the analysis that guarantees the correction of any selection bias, explained by observable features that exist in the choice of the beneficiary families in the Program[28]. An analysis made without the use of this method, or another one with similar pairings, even if controlled for socioeconomic variables, would not be able to adequately separate the influence of these variables.

The use of the PSM requires an assumption of two hypotheses[37]: the first relates to the balance of observable features, or socioeconomic conditions of the families. It means that the DQI is not

a determinant of participation or non-participation in the Program, but is only determined by it. The second implies an existence of common support, meaning that for each control group (non-beneficiary families) there is one corresponding treatment group (beneficiary families).

For the propensity score, it is first necessary to estimate one regression *logit,* to obtain a probability that the families participate in the BFP, with their own socioeconomics features. In this regression, the dependent or explanatory variable is a dummy variable, which assumes a value of one when the family is a beneficiary of the programand zero when this is not the case. The independent variables, in turn, are the socioeconomic factors that affect the inclusion of an individual in the Program, such as income, age or children in the home. The *Logit* regression that is used for the calculation is $D_{PBF} = \Sigma_1^n.\beta_i.X_i$, where D_{PBF} represents the variable *dummy*, X_i represents the family's socioeconomic characteristics and β_i represents the estimated coefficient of the model.

After estimating the propensity score (PS), subgroups are obtained within the control group with similar probabilities to those individuals in the treatment group; and after carrying out the necessary tests, define a number of strata, being able to subsequently calculate the Average Effect with Stratified Pairing, which is one of the existing methods in the literature[37].

For stratification, a distribution of Program beneficiaries and non-beneficiaries is calculated across acertain number of strata of the estimated propensity score, so that the average PS estimates for the two groups present no statistically significant difference in each stratum. Since the DQI is the variable of interest, the firststep is to simply calculate the differences in DQI between the beneficiaries and non-beneficiaries within the strata. The final result is calculated to obtain an overall weighted average for the importance of each stratum in the total beneficiaries' sample.

Samples and variables used in the model

The data used in this analysis relate to the state of Pernambuco and are from the 2008-2009 Household Budget Survey (HBS-IBGE)[38]. 518 households were interviewed in this survey, representing the state as a whole. To estimate the logit model in the first stage of the PSM, two types of variables were used as suggested in the literature. The first type is countable variables that characterize the family according to their annual family income (net receipt of BFP), the

number of residents in the family unit; and age and schooling in number of years of study of the head of the family. The second type involves dummy variables (binary variable of type yes = 1 / no = 0) established to characterize the family in general, including whether there are any children underthe age of 17; the head of household's profile including gender (if male) and race (if white); and the residence itself, stating whether it is located in an urban area, if the street is paved, if it has a bathroom and/or piped water, and if is made out of brick.

Results and discussion

In the first section to follow, we provide a descriptive analysis of the families and their homes; the second shows the results for the estimated Diet Quality Index (DQI); the third section presents the results for the logit model and the fourth contains the analysis of the impact of the *Bolsa Família* Program on the DQI of its beneficiaries.

Descriptive Analysis Sample

Table 1 provides information about the sample that formed the basis for the study, for groups of beneficiaries and non-beneficiaries separately so that it is possible to compare the two. The difference between the two is given in the final column of the table.

The first part of the table shows the results for the *dummies*, which may be summarized in terms of its frequency and proportion. In the second part the results of the accounting variables are presented, which are summarized in terms of the mean and standard deviation.

The table lists the number of households surveyed, as well as some of the characteristics of the head of household and the residence where they live. Comparing the beneficiary families with non-beneficiaries, families who are part of the BFP were found to have a higher frequency of children in the household, a greater frequency of men as head of the household and a lower frequency of white householders. In addition, their homes have a lower frequency of bathrooms, brickwork, plumbing and paved streets.

The table also provides the mean and standard deviation of income, age, education, and number of people per family unit. The families who benefited from the BFP were found on average to have lower income, younger age of head of household and lower education than non-bene-

Table 1. Frequency and proportion of households by characteristics of the head of household and residence – HBS 2008/2009, Pernambuco.

Variable	Beneficiaries		Non-beneficiaries	
Dummy variable type	**Frequency**	**Proportion**	**Frequency**	**Proportion**
Family with child under 17 years	137	89.54	183	50.27
Gender – male	114	74.51	222	60.99
Race – white	44	28.76	115	31.59
Location – urban	39	25.49	173	47.53
Bathroom	143	93.46	349	95.88
Brickwork	148	96.73	359	98.63
Plumbing	117	76.47	323	88.74
Paving	65	42.45	226	62.09
Countable variable type	**Average**	**Standard Deviation**	**Average**	**Standard Deviation**
Income	777.59	683.07	2087.91	3696.07
Age	42.46	11.72	49.54	16.69
Schooling	4.19	3.61	6.85	4.83
Number of residents	4.46	1.87	3.10	1.56

ficiaries. They were also found to have a greater number of people per household.

It should be clear that these characteristics do not relate to program impact; they only help to characterize better the family groups. In other words, they give some idea about the policy focus, and whether it has reached the target audience of the most vulnerable families, which in this case, it appears to have done so.

The Diet Quality Index

In order to calculate the DQI, data processing was carried out manually, based on information about food consumption in the 2008-2009 HBS-IBGE. The DQIis analyzed as a continuous variable in the *logit* model, but to characterize the results for food quality, the households were classified according to the degree to which they had an adequate diet. Table 2 shows the classification of the 518 families from the study, whether they participated in the BFP or not, and the difference between the groups in the last column.

In the comparison between the two groups the program's beneficiaries were found proportionately to have a more appropriate diet. It is, however, not yet possible to attribute this to the Program. As explained above, the impact of the Program can only becalculated when each family or group of familiesis compared withyour match (result of the pairing) of the untreated group. But one should also note that even the average fam-

ilies also demonstrate a high degree of dietary inadequacy.

Estimation and discussion of the logit model

Table 3 shows the results for the *logit* model. The coefficients represent the weights of the characteristics of each household and head of household on the probability of a family unit being a beneficiary of the *Bolsa Família* Program (BFP).

The analysis makes it possible to evaluate the coefficients and, for the most part, the variables have the expected signs, and are consistent with the theory: when positive, they imply that the feature increases the probability of the recipient and when negative imply thatthe feature reduces the probability of belonging to the program.

The variable's signals of *age* and *age squared* suggest that the greater the ageof the head of household, the greater the chances of receiving the benefit; beyond a specific point, however, the trend is reversed, thus reducing the probability that the family is part of the social program. The presence of children in the residence and a greater number of residents also have positive impacts on the probability of participation in the program.

The variables relating to the characteristics of the residence were not significant, except for the plumbing, but Duarte et al.[28] also found no significance in these characteristics. However the

Table 2. Family Unit Classification according to degree of dietary adequacy according to Bowman et al.[39] for the families of the 2008/2009 HBS in Pernambuco.

Score	Diet Category	Beneficiaries		Non-beneficiaries		Total	
		Nº	%	Nº	%	Nº	%
< 51	Inadequate	42	27.3	138	38.0	180	34.7
51 |-| 80	Needs to change	99	64.3	219	60.1	318	61.4
Total		154	100	364	100	518	100

Table 3. Coefficients estimated by logit model.

Variable	Coefficient	Standard Deviation
Income	-0.537*	0.096
Age	0.063**	0.033
Age^2	-0.001*	0.000
Nº of residents	0.144*	0.049
Schooling	-.0.072*	0.022
Child	0.839*	0.207
Gender	0.352**	0.168
Race	0.228	0.159
Urban	-0.359**	0.161
Bathroom	0.337	0.339
Brickwork	0.547	0.248
Plumbing	-0.354***	0.209
Paving	0.011	0.157
Intercept	-2.515***	1.693

Note: Significant a * < 1%, ** < 5%, *** < 10%. Pseudo R^2 = 0.3270.

fact of being located in rural areas resulted in a greater likelihood of receiving the *Bolsa Família*.

From the estimated *logit* model, one obtains the probabilities of each family unitreceiving treatment (i.e. being a beneficiary of the BFP). Among the non-beneficiaries, results reveal a highly concentrated distribution close to zero, with relative asymmetry. Due to the asymmetry, if the comparison between the beneficiary and non-beneficiary units was carried out this time, one would have a bias in the analysis, because there would be nosufficient units to perform an efficient *matching*. Thus, from five layers of the sample, as shown in Table 3, one obtained subgroups with scores similar for individuals in the treatment group to those in the treated group, ensuring a more appropriate comparison to investigate the impact of the Program.

As might be expected there are among the beneficiaries a higher proportion of families with a higher probability (greater than 40%) of participating in the BFP. It should be noted that this probability was calculated as a function of family characteristics, which is different to just considering the fact that it is the beneficiary; in this case the probability would be 100%.

The impact of the *Bolsa Família* on the Diet Quality Index (DQI)

After stratified pairing, the impact of the BFP on the Diet Quality Index (DQI) of the families is calculated, using the differences explained previously. Table 4 shows this impact per stratum and the total effect.

On average, the BFP effect contributed with an increase of 9.05 to the QDI. If the comparison is made using only usual methods the effect that is attributed to the BFP is found to be 6.47. There is a bias inherent in comparing relatively different families, and this is eliminated when the HBS model is used. It is worth pointing out that on account of the proposed method, it was possible to observe that the gain in the IQD grows with the probability of participation in the Program, until it reaches approximately 60%, at which point it begins to fall. This result shows that although there is a positive gain in the quality of the diet of families in all strata with the exception to the first one, this gain is largest for those families that present conditions of intermediate eligibility for the Program.

Evaluating the BFP impact on the components of QDI separately, positive differences on the quality of diet treatment (beneficiaries) and control (non-beneficiaries) groups are observed. The results of this analysis are presented in Table 5.

For the foods group, a comparison was made with the quantity of portions; for total fat, choles-

terol, sodium and dietary variety, average scores were compared, remembering that the higher the score, the higher the quality of diet.

The analysis presented in Table 5 shows that, in general, the BFP family units consumed the groups of food in greater portions when compared to non-beneficiaries. Only the consumption of the milk group and derivatives did not prove to be consistent with other food groups. According to what is found in the Research iBase[40], however, these results concluded that for the beneficiary's family, in the Northeast, there were an increase of reported consumption of all groups of food with a lower proportion of milk and its derivatives. Furthermore, by comparing the scores for total fat, cholesterol, sodium and dietary variety, one can verify that the beneficiary families have higher scores than non-beneficiaries. One may thus conclude that the BFP has a positive impact on these indicators.

Final considerations

The *Bolsa Família* Program is a social policy that ties a basic guarantee of income to certain conditions. The Program is concerned with ensuring food safety and good health, in addition to promoting access to school for children and keeping them in school. In the short term, the Program aims to alleviate the problems arising from poverty, and in the long term, aims at investment in human capital and thus breaking the intergenerational cycle of poverty.

One problem regarding this policy is to ensure that it is being successful in meeting its objectives. Thus, several analyses have been carried out in order to determine its effects on beneficiary families by observing the increase in food consumption, number of hours worked and attendance. Using data from the 2008-2009 HBS for the state of Pernambuco, this research aimed to analyze qualitative food consumption, as it is used as a variable of the Diet Quality Index (DQI).

Table 4. Average results of the DQI of Control Groups and groups that receive treatment according to the stratum of propensity score.

Lower limit of strata of Propensity Score	Number of Families		Average DQI		Effect
	Beneficiaries	Non-beneficiaries	Beneficiaries	Non-beneficiaries	Δ^5
0	14	96	55.64	58.95	-3.31
0.2	27	65	61.74	50.77	10.97
0.4	43	34	61.79	49.47	12.32
0.6	43	17	59.65	49.18	10.47
0.8	26	6	60.15	54.17	5.98
Total/Average	153	218	60.34	51.28	9.05

Table 5. Average result of each of the control group components and the group making the treatment.

Components	Treatment	Control	Average	Effect
Group of cereals, breads, tubers and roots (portion)	4.23	3.93	4.02	0.3
Group op vegetable (portion)	1.13	0.87	0.95	0.26
Group of fruits (portion)	1.28	1.03	1.1	0.25
Group of milk and derived (portion)	1.63	1.68	1.67	-0.05
Group of meat and eggs (portion)	0.93	0.91	0.918	0.02
Group of vegetables (portion)	0.67	0.48	0.53	0.19
Total fat (punctuation)	6.18	5.45	5.66	0.73
Cholesterol (punctuation)	5.07	4.73	4.83	0.34
Sodium (punctuation)	4.63	4.02	4.2	0.61
Variety of diet (punctuation)	7.26	6.56	6.77	0.7

Since it is not possible to comparea family over two periods, we used the propensity score matching method, which allows for comparison between different groups at a given point intime. The ideal would be to compare the data of the beneficiary families with data from ahypothetical situation, involving non-beneficiaries. However, this comparison is not possible, so that the pairing between two groups, control and treatment, offer an alternative to reduce selection bias, as the group benefited from the BFP is not chosen randomly.

The result estimated from the pairing of sub-groups, and the average difference of DQI of the families and non-participants concluded that there is a positive difference between the average of the treatment and the control group. Furthermore, it was found that the greater the probability of being a beneficiary of the BFP, the greater the portion allocated fromtransfers to the consumption of healthier foods. The results show that the DQI average value among beneficiary households is 9.05 higher than the average DQI value ofnon-participant families.

To disaggregate DQI components, one can analyze the consumption of each of these in the index. The average consumption of food portions of groups is generally higher among participating families compared with non-participants; with the exceptions of the groups for milk and dairy products. In addition, when comparing the scores of the components for *total fat*, *cholesterol*, *sodium* and *dietary variety*, beneficiary families were also found to have higher scores than non-beneficiaries.

We conclude that there is a positive effect of income transfers on the quality ofdiet of households from Pernambuco. This result shows that the BFP increases investment in human capital by improving the nutrition of individuals and, consequently, in breaking the intergenerational cycle of poverty in the long run.

In calculating the DQI of families from Pernambuco based on data about dietary intake from the 2008-2009 HBS, and using the propensity score method to reduce BFP selection bias, this research has not only contributed to the positive results arising from program analysis, but also by means of the methodology used to find them. Thus, when using this strategy, this study has proposed a new approach to the diagnosis of public policies related to nutrition.

Finally, it makes it all the more pressing to pursue further study of the factors leading to the existence of an inflection point on the Program's contribution to the quality of families' diets so that best and greatest gains might be achieved.

Collaborations

PL Coelho was responsible for working with the data and execution of the models used to calculate the Diet Quality Index (IQD) for the estimation of the Propensity Score Matching and the impact of the *Bolsa Família* Program on IQD. ASSA Melo was responsible for designing the research, monitoring and reviewing the estimates made, and preparing the final report.

References

1. Cook JT, Frank DA, Berkowitz C, Black MM, Casey PH, Cutts DB, Meyers AF, Zaldivar N, Skalicky A, Levenson S, Heeren T, Nord M. Food Insecurity Is Associated with Adverse Health Outcomes Among Human Infants and Toddlers. *J Nutr* 2004; 134(6):1432-1438.

2. Weinreb L, Wehler C, Perloff J, Scott R, Hosmer D, Sagor L, Gundersen C. Hunger: its impact on children's health and mental health. *Pediatrics* 2002; 110(4):e41.

3. Dunifon R, Kowaleski-Jones L. The influences of participation in the National School Lunch Program and food insecurity on child well-being. *Social Service Review* 2003; 77:72-92.

4. Alaimo K, Olson CM, Frongillo EA Jr, Briefel RR. Food insufficiency, family income, and health in US preschool and school-aged children. *Am J Public Health* 2001; 91(5):781-786.

5. Kleinman RE, Murphy JM, Little M, Pagano M, Wehler CA, Regal K, Jellinek MS. Hunger in children in the United States: potential behavioral and emotional correlates. Pediatrics 1998; 101(1):e3.

6. Murphy JM, Wehler CA, Pagano ME, Little M, Kleinman RE, Jellinek MS. Relationship between hunger and psychosocial functioning in low-income American children. *J Am Acad Child Adolesc Psychiatry* 1998; 37(2):163-170.

7. Alaimo K, Olson CM, Frongillo EA. Family Food Insufficiency, but Not Low Family Income, Is Positively Associated with Dysthymia and Suicide Symptoms in Adolescents. *J Nutr* 2002; 132(4):719-725.

8. Slack K, Yoo J. Food hardship and child behavior problems among lowincome children. *Social Service Review* 2005; 79(3):511-536.

9. Whitaker R, Phillips S, Orzol S. Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children. *Pediatrics* 2006; 118(3):e859-e868

10. Jyoti DF, Frongillo EA, Jones SJ. Food insecurity affects school children's academic performance, weight gain, and social skills. *J Nutr* 2005; 135(12):2831-2839.

11. Rose-Jacobs R, Black MM, Casey PH, Cook JT, Cutts DB, Chilton M, Heeren T, Levenson SM, Meyers AF, Frank DA. Household food insecurity: Associations with at-risk infant and toddler development. *Pediatrics* 2008; 121(1):65-72.

12. Skalicky A, Meyers AF, Adams WG, Yang Z, Cook JT, Frank DA. Child food insecurity and iron deficiency anemia in low-income infants and toddlers in the United States. *Matern Child Health J* 2006; 10(2):177-185.

13. Food and Agriculture Organization (FAO). *The State of Food Insecurity in the World*. Rome: FAO; 2012.

14. Runge CF, Senauer B, Pardey PG, Rosegrant MW. *Ending Hunger in our Lifetime: Food Security and Globalization*. Baltimore: Johns Hopkins University Press; 2003.

15. Sachs JD. *The End of Poverty: Economic Possibilities for Our Time*. New York: The Penguin Press; 2005.

16. Ramos MKP. *Descrição da agenda para intensificação da atenção nutricional à desnutrição infantil e suas metas nos municípios brasileiros* [dissertação]. Brasília: Universidade de Brasília; 2014.

17. Bahia LR, Araújo DV. Impacto econômico da obesidade no Brasil. *Revista Hospital Universitário Pedro Ernesto* 2014; 13(1).

18. Vagner Ferreira do Nascimento, Patrícia Bachiega, Alisséia Guimarães Lemes, Fernanda Muálem de Moraes Mendes. Estado nutricional de profissionais em ambiente pré-escolar. *Gestão e Saúde* 2015; 6(1):323-335.

19. Dasgupta P, Ray D. Inequality as a determinant of malnutrition and unemployment: theory. *Economic Journal* 1986; 96:1011-1034.

20. Strauss J, Thomas D. Health, nutrition and economic development. *Journal of Economic Literature* 1998; 36:766-817.

21. Wheeler D. Basic needs fulfillment and economic growth. *Journal of Development Economics* 1980; 7:435-451.

22. Barros FC, Victora CG, Scherpbier R, Gwatkin D. Iniquidades sociais na saúde e nutrição de crianças em países de renda baixa e média. *Rev Saude Publica* 2010; 44(1):1-16

23. Lima ALL, Silva ACF, Konno SC, Conde WL, Benício MHA, Monteiro CA. Causas do declínio acelerado da desnutrição infantil no Nordeste do Brasil (1986-1996-2006). *Rev Saude Publica* 2010; 44(1):17-27.

24. Onis M, Blössner M, Borghi E, Frongillo EA, Morris R. Estimates of global of childhood underweight in 1990 and 2015. *JAMA* 2009; 291(21):2600-2606.

25. Brasil. Atlas do Desenvolvimento Humano no Brasil. Brasília: PNUD; 2014.

26. Resende ACC, Oliveira AMHC. Avaliando resultados de um programa de transferência de renda: o impacto do Bolsa-Escola sobre os gastos das famílias brasileiras. *Estudos Econômicos* 2008; 38(2):235-265.

27. Brasil. Ministério do Desenvolvimento Social e Combate à Fome (MDS). *Sumário Executivo: Avaliação de Impacto do Programa Bolsa Família*. Brasília: MDS; 2007.

28. Duarte GB, Sampaio B, Sampaio Y. Programa Bolsa Família: impacto das transferências sobre os gastos com alimentos em famílias rurais. *Rev. Econ. Sociol. Rural* 2009; 47(4):903-918.

29. Andrade MV, Chein F, Ribas RP. *Políticas de transferência de renda e condição nutricional de crianças: uma avaliação do Bolsa Família*. Belo Horizonte: Cedeplar, Universidade Federal de Minas Gerais; 2007.

30. Previdelli AN, Andrade SC, Pires MM, Ferreira SRG, Fisberg RM, Marchioni DC. Índice de Qualidade da Dieta Revisado para população brasileira. *Rev Saude Publica* 2011; 45(4):794-798.

31. Menezes-Filho N, organizador. *Avaliação econômica de projetos sociais*. São Paulo: Fundação Itaú; 2012.

32. Diamond A, Jasjeet S. Genetic matching for estimating causal effects: A general multivariate matching method for achieving balance in observational studies. *Review of Economics and Statistics* 2013; 95(3):932-945.

33. Pattersson RE, Haines OS, Popkin BM. Diet quality index: capturing a multidimensional behavior. *J Am Diet Assoc* 1994; 94(1):57-64.

34. National Research Council (NRC). Committee on Diet and Health, Food and Nutrition Board, Commission on Life Sciences. *Diet and Health: Implications for Reducing Chronic Disease Risk*. Washington: National Academy Press; 1989.

35. Philippi ST, Latterza AR, Cruz ATR, Ribeiro LC. Pirâmide alimentar adaptada: guia para escolha dos alimentos. *Rev Nutr* 1999; 12(1):65-80.

36. Rosembaum R, Rubin DB. The central role of propensity score in observational studies for causal effects. *Biometrika* 1983; 70(1):41-55.

37. Heckman J, Ichimura H, Todd P. Matching as an econometric evaluation estimator: evidence from evaluating a job training program. *Review of Economic Studies* 1997; 64(4):605-654.

38. Instituto Brasileiro de Geografia e Estatística (IBGE). *POF 2008 2009 - Antropometria e estado nutricional de crianças, adolescentes e adultos no Brasil*. Rio de Janeiro: IBGE; 2010.

39. Bowman SA, Lino M, Gerrior SA, Basiotis PP. *The Healthy Eating Index: 1994-96*. Washington: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion; 1998.

40. Instituto Brasileiro de Análises Sociais e Econômicas (IBASE). *Repercussões do Programa* Bolsa Família *na segurança alimentar e nutricional: relatório síntese*. Rio de Janeiro: IBASE; 2008.