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Rafael Moreira Claro[I]

Heron Carlos Esvael do Carmo[II]

Flávia Mori Sarti Machado[III]

Carlos Augusto Monteiro[I]

Income, food prices, and participation of fruit and vegetables in the diet

ABSTRACT

OBJECTIVE: To analyze the influence of income and food prices on household consumption of fruit and vegetables.

METHODS: Data from the 1998/99 Household Budget Survey were analyzed, which was conducted by the Fundação Instituto de Pesquisas Econômicas (Institute for Economic Research Foundation) in the city of São Paulo, Brazil. The influence of income and food price on the relative participation of fruit and vegetables in the total household calorie intake was studied using regression analysis to estimate elasticity coefficients.

RESULTS: There was an increase in participation of fruit and vegetables in total household calorie purchases along with the recorded decrease in prices, increase in family income, and increase in prices of other foods. A one percent decrease in the price of fruit and vegetables would lead to a 0.2% increase in the participation of these items in the total calorie content; a 1% increase in the price of other foods would increase fruit and vegetable participation by 0.07%; and a 1% increase in family income would increase participation by 0.04%. The effect of the prices of other foods was less intense in higher income groups, and in the other two scenarios we were unable to identify consistent income-associated patterns.

CONCLUSIONS: A reduction in the price of fruit and vegetables, which can be achieved by means of public policies, could lead to an increase in fruit and vegetable intake in households in São Paulo and in other cities with similar scenarios.

KEY WORDS: Diet, economics. Food habits. Food. Income. Feeding. Nutrition programmes and policies.

[I] Núcleo de Pesquisas Epidemiológicas em Nutrição e Saúde. Universidade de São Paulo (USP). São Paulo, SP, Brasil

[II] Departamento de Economia. Faculdade de Economia e Administração. USP. São Paulo, SP, Brasil

[III] Gestão de Políticas Públicas. Escola de Artes, Ciências e Humanidades. USP. São Paulo, SP, Brasil

Correspondence:
Rafael Moreira Claro
Departamento de Nutrição
Av. Dr. Arnaldo, 715
01246-904 São Paulo, SP, Brasil
E-mail: rclaro@usp.br

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INTRODUCTION

In the past few decades, conditions favoring the occurrence of nutritional deficiencies gradually gave way to an epidemic of obesity and chronic diseases related to excessive and unbalanced food consumption.[19] The dietary pattern associated with obesity and other chronic diseases is characterized essentially by the insufficient consumption of fruit and vegetables (FV), accompanied by the excessive intake of foods with high energy density and rich in fat, sugar, and salt.[19] The World Health Organization (WHO) estimates that approximately 2.7 million deaths per year worldwide can be attributed to inadequate consumption of FV, and such inadequacy is considered one of the ten major factors determining the global burden of disease.[18]

The minimum daily intake of FV recommended by the Food and Agriculture Organization of the United Nations (FAO) and WHO is 400 g/day, which is

equivalent to 6-7% of the total calories in a 2.300 kcal/day diet.* In Brazil, household availability of FV, based on data from the 2002-2003 Household Budget Survey (HBS), carried out by the *Instituto Brasileiro de Geografia e Estatística* (Brazilian Institute of Geography and Statistics – IBGE), was estimated in 2.3% of total calorie consumption. Availability is less than ideal throughout all the country's geographical regions, and across all economic strata.[9]

The HBSs conducted by the *Fundação Instituto de Pesquisas Econômicas da Universidade de São Paulo* (University of São Paulo Institute for Economic Research Foundation – FIPE-USP) since the 1970's are an important tool for studying changes in dietary habits in the population of the city of São Paulo. The HBS-FIPE, carried out approximately every ten years (1971/1972; 1981/1982; 1990/1991, and 1998/1999), collects detailed information on household budgets. The aim of these surveys is to update the methodology used for calculating the Consumer Price Index (CPI) for the municipality of São Paulo.[3] Even without directly evaluating individual food consumption – the survey evaluates household availability instead – the data generated are useful for characterizing the dietary patterns of families and the relationship between food consumption and socioeconomic variables.[13]

The objective of the present study was to examine the influence of income and food prices on the participation of FV in household food consumption.

METHODS

The 1998-1999 HBS-FIPE took place between May 1998 and June 1999, and interviewed a sample of 2.351 households (7.980 individuals) in the municipality of São Paulo, Brazil. The sampling strategy followed the procedures adopted in the previous HBS-FIPE, and is described in detail in the original publication.[3] Briefly, this strategy was based on a simple probabilistic sample, households being randomly selected from the records of the local energy company. Data were complemented by a database containing information on the municipality's slums, elaborated by the Secretariat of Social Development.

The basic information contained in the HBS-FIPE includes all food and drink purchases made by household members during a 30-day period, recorded on a daily basis by the household members themselves in a specially designed notebook. Food purchase records contained information on each purchase made, including name, brand, and type of product, amount purchased, purchase unit, cost, and place of purchase. The HBS-FIPE evaluated approximately 138 thousand purchase records for food, 8.5 thousand records for non-alcoholic beverages, and 2.5 thousand for alcoholic beverages.

To calculate the participation of individual food groups in the total household food purchases, we initially converted to grams any purchase records expressed in other units. We then grouped all records referring to a single type of food during the 30-day period. When appropriate, we excluded the non-edible fraction from the total amount of food purchased for a given item.[8] We subsequently converted the total amount of each food in grams into energy (kcal) using the *Tabela Brasileira de Composição de Alimentos* (Brazilian Chart for Food Composition – TACO).[14] In case the item was not present in this chart, we used the United States Department of Agriculture National Nutrient Database for Standard Reference, release 15** for conversion. Food records lacking clear identification (e.g., "fruit," without further specification) were attributed energy values based on the mean value of foods in this group. Purchase records lacking any specifications (approximately 3.2% of all records) were disregarded. The sum of all food records in each family, after conversion to energy, was regarded as the total calorie content of household food availability for that month.

Once converted to energy, records were classified into the following food groups: cereals and derived products; beans and other legumes; tubers and derived precuts; meat, dairy, and derived products; eggs; fruits and natural juices; leaf vegetables and other vegetables; oils and vegetable fats; animal fats; oleaginous seeds; condiments; non-alcoholic beverages; alcoholic beverages; ready-made meals and industrialized mixes; and processed foods (including soft drinks and artificial juices, biscuits and cookies, sweetened processed cereals, processed meats, sweets, and sauces and broths).

The participation of each food group in the total food availability of each household was expressed based on the percentage of the total calorie content derived from that group. In the case of FV, we also calculated the total amount of calories derived from these foods adjusted for the total calories consumed by the family. This adjusted total is obtained based on the residues of linear regression models that have calories from FV as the outcome variable and total calories as the explanatory variable. To avoid null or negative values (which could not be subjected to the logarithmic transformations necessary for calculating elasticity coefficients), an equal number was added to the residues from the regression models so that the smallest value resulting

* Food and Agriculture Organization of the United Nations. Nutrition Country Profiles – Brazil. Rome; 2000. Available from: http://www.fao.org/ag/agn/nutrition/bra-e.stm [Acessed 12 Dec 2004]

** United States Department of Agriculture. Agricultural Research Service. USDA National Nutrient Database for Standard Reference. Release 15. Beltsville; 2002.

form this addition was higher than zero. This technique for adjusting for total calories using regression models is frequently employed in epidemiological studies of nutrition. For example, in order to evaluate the influence of the intake of a given food or nutrient on the occurrence of a disease, one can annul the potential influence of total calorie intake, which is usually associated with consumption of foods or nutrients.[17]

The price paid by each household for foods in each group was expressed in Reais (R$ – Brazilian currency) per energy unit provided. This price was obtained by dividing household expenses with all foods in the group by the total calories purchased. Calorie-free foods (water, coffee, tea, and infusions) were not included in price calculations. In case a household had not purchased any foods from any given group, prices were imputed. For this imputation, we used the mean price paid by households in the same per capita total expense quintile which had been studied in the same trimester.

Although HBS-FIPE collected information on the income of household members, we believe that the family's total expenditures in the month is more accurately represented by permanent income and purchase power. For this reason, monthly household expenditures were considered as equivalent to monthly family income.

The relationship between family income and food prices and participation of FV in the total food purchase was investigated using elasticity coefficients. These were calculated based on multiple linear regression models of the log-log (or log-linear) type, where elasticity coefficients are given by the regression coefficients (β) of the explanatory variables.[5] The model employed can be defined by the equation

$\text{Ln(Cal\_FV)} = \alpha + \beta_1 \text{ Ln(I)} + \beta_2 \text{ Ln(Price\_FV)} + \beta_3 \text{ Ln(Price\_oth)} + \beta_c \text{ (CV)}$, where:

- *Cal_FV* indicate calories provided by FV adjusted for total calories;
- *I* indicates monthly family income in Reais (R$);
- *Price_FV* is the price of FV per unit of energy (R$/kcal);
- *Price_oth* is the price of other foods per unit of energy (R$/kcal);
- *CV* indicates control variables;
- β_1 is the income elasticity coefficient;
- β_2 is the price elasticity coefficient for the price of the food group itself;
- β_3 is the price elasticity coefficient for the price of other foods;
- β_c is the generic coefficient for control variables.

The following were considered as control variables in the models: absolute number of household members; five dichotomous variables indicating the presence or absence of members in five age groups (0–3, 4–10, 11–18, 19–49, and ≥50); schooling, in complete years; and sex and age of the head of household.

Our analyses initially included all households studied by the HBS-FIPE, and were subsequently performed for individual strata corresponding to quintiles of family income distribution.

The database was organized using Stata 7.0 software, and statistical analyses and tabulations were carried out using SPSS 13.0.

RESULTS

Table 1 presents sociodemographic and economic characteristics of households according to quintiles of monthly family income. Households had a mean 3.4 members, and were in their majority headed by men (71.3%). Mean per capita monthly income was R$514.50, ranging from R$79.30 in the lowest quintile to R$1,545.90 in the highest. The higher the income, the smaller the number of household members (form 4.1 in the first quintile to 2.7 in the last), and the lower the proportion of households with younger members. Income increased with mean age (from 43.5 to 48.1 years) and schooling (from 5.2 to 11.89 years) of head of household.

Expenditures with food corresponded to on average 27.4% of household income, and tended to decrease as income increased. Expenditures with FV corresponded to on average 2.4% of monthly household income and to 10.2% of total food expenditures (5.1% for fruit, 1.3% for leaf vegetables, and 3.8% for other vegetables). Relative participation of fruit and other vegetables tended to increase with income, which was not the case for leaf vegetables (Table 1).

The relative participation of different food groups in the total calories purchased by the household (1,728.1kcal per capita/day) is presented in Table 2. Cereals and derived products showed the greatest participation (25.9%), followed by processed foods (15.3%), oils and vegetable fats (11.7%), milk and dairy (9.9%), and meat (9.7%). FV as a whole accounted for only 4.6% of total calorie availability, and individually, fruit accounted for 3.4%, leaf vegetables for 0.2%, and other vegetables for 1.0% of this total.

Mean price paid for each food group (expressed in R$/1,000 kcal) is also presented in Table 2. The lowest values were those of sugar (R$ 0.17), oils and vegetable fats (R$ 0.27), and cereals and derived products (R$ 0.62), and some of the highest values were those paid for fruit (R$ 2.56), leaf vegetables (R$ 19.72), and other

Table 1. Sociodemographic and economic characteristics of households according to monthly per capita income quintiles (Q). São Paulo, Brazil, 1998-1999

Sociodemographic/economic characteristic	Total (N=2,351)	Q1 (N=470)	Q2 (N=470)	Q3 (N=471)	Q4 (N=470)	Q5 (N=470)	p-value
Mean members per household	3.4	4.1	3.7	3.3	3.1	2.7	< 0.001*
Members in age group (years) (%)							
0|- 4	17.7	32.6	20.6	17.0	11.1	7.2	< 0.001**
4|- 11	26.9	43.8	33.6	22.5	20.2	14.5	< 0.001**
11|- 19	35.2	45.1	40.9	36.7	30.0	23.2	< 0.001**
19|- 50	85.8	89.1	90.0	83.9	86.8	79.4	< 0.001**
≥ 50	41.8	35.5	37.4	45.2	44.3	46.6	0.001**
Male head of household (%)	71.3	68.1	74.0	74.3	72.3	67.7	< 0.001*
Mean age of head of household (years)	45.6	43.5	44.3	45.8	46.6	48.1	< 0.001*
Mean schooling of head of household (years)	7.8	5.2	5.8	7.1	9.0	11.8	< 0.001*
Monthly income (R$)	1,456.6	321.4	634.7	926.6	1,552.6	3,848.9	< 0.001
Mean per capita monthly income (R$)	514.5 (941.0)	79.3 (30.4)	171.6 (24.9)	279.4 (39.2)	496.8 (97.4)	1545.9 (1,730.6)	< 0.001*
Per capita monthly income spent on (%)							
food	27.4	39.3	32.6	28.1	21.7	15.6	< 0.001*
food in the household	22.9	36.3	28.1	23.2	17.0	11.1	< 0.001*
food outside the household	4.5	3.0	4.5	4.8	4.7	5.5	< 0.001*
fruit and vegetables	2.4 (2.9)	3.4 (4.0)	3.0 (3.4)	2.6 (2.5)	1.8 (2.1)	1.1 (1.2)	< 0.001*
Monthly per capita expenditure with food in the household (R$)	70.2 (58.5)	27.5 (16.1)	47.5 (23.3)	64.6 (31.6)	82.6 (44.1)	128.6 (86.4)	< 0.001**
Household food expenditure (%)							
fruit	5.4	4.5	5.2	5.6	5.6	6.0	0.005**
leaf vegetables	4.0	3.6	4.0	4.4	4.2	3.8	0.006**
other vegetables	1.4	1.3	1.4	1.3	1.4	1.3	0.884**

* ANOVA
** Chi-square test

vegetables (R$ 5.55). The FV group had a mean cost of R$ 4.07/1,000 kcal, vs. R$ 2.39/1,000 kcal for all other foods. Both the price of FV and the joint price of other foods tended to increase with income, especially between the third and fourth income quintiles.

FV participation in total calorie purchases increased significantly from first to last income quintiles, due to an increase in participation of fruit and other vegetables, but not of leaf vegetables (Table 3).

Table 4 presents income and price elasticity coefficients for the participation of FV in total household food purchases. Income elasticity was positive, with similar magnitude in all models estimated, and indicated that a 1% increase in household monthly income would increase the participation of FV in the diet by 0.04%. Price elasticity was negative for the price of FV and positive for the price of other foods. The magnitude of the effect of FV prices was roughly five-fold that of income – a 1% decrease in FV prices would increase the participation of these foods in total food purchases by 0.2%. The influence of the price of other foods in the opposite direction was less important, but was still greater than that of income – a 1% increase in the price of all other foods would lead to a 0.07% increase in FV participation in total calorie purchases. Moreover, our analysis also indicated that an isolated reduction in the price of fruit would yield a larger increase in FV participation than an isolated reduction in prices of leaf vegetables or other vegetables. This was expected given the larger participation of fruit in the FV group.

Table 5 presents income and price elasticity coefficients for participation of FV in total food purchases according to per capita income quintiles. Only in the second and fifth quintiles were income elasticity coefficients statistically significant, possibly reflecting the lower income

Table 2. Relative participation of foods (%) in total calories purchased by household and mean price paid for food group. São Paulo, Brazil, 1998-1999.

Food group	%	Price (R$/1.000Kcal)
Cereals and derived products	25.9	0.62
Beans and other legumes	3.1	0.78
Tubers and derived products	2.0	1.34
Meats	9.7	2.74
Milk and dairy*	9.9	1.68
Eggs	1.0	1.31
FV	4.6	4.07
Fruit	3.4	2.56
Vegetables	1.2	6.97
Leaf vegetables	1.0	5.55
Other vegetables	0.2	19.72
Oils and vegetable fats	11.7	0.27
Animal fats	0.5	1.32
Sugars	8.1	0.17
Alcoholic beverages	1.0	4.49
Oleaginous seeds	0.3	4.94
Processed foods**	15.3	3.52
Ready-made meals and industrialized mixes	2.7	2.95
Total calories (kcal/day per capita)	1,728.1	1.28

FV: Fruit and vegetables
* Excluding cream and butter.
** Including sweets (4.4%; R$4.22); soft drinks and artificial juices (3.5%; R$2.54); processed meats (3.0%; R$1.86); processed cereals (0.4%; R$1.89); biscuits and cookies (3.3%; R$0.91), and sauces and broths (0.7%; R$2.64).

variance in these strata. Price elasticity coefficients for FV were negative and statistically significant across all income strata (ranging around 0.20). Price elasticity coefficients for non-FV foods were positive and statistically significant within the first four income strata (ranging form 0.17 to 0.04), but were not significant in the highest income group.

DISCUSSION

The records of monthly food purchases collected by the HBS allowed us to evaluate the influence of family income and food prices on participation of FV in the household diet. FV participation in the total calories purchased by the household increased as family income and the price of other foods increased and as the price of FV itself decreased. The greatest increase was found to occur with decreases in FV prices, followed by increases in prices of other foods and higher income. The effect of prices of other foods lost intensity among higher income strata; there were no consistent income-related patterns for the other two effects.

The main limitations of the present study are related to the fact that the HBS measure household availability rather than food intake proper, since the fraction of purchased food that is not consumed is unknown and food consumption outside the household is not measured.

The use of total monthly expenditures as a proxy for family income does not necessarily constitute a limitation. In cross-sectional studies, such as the present one, monthly expenditures tend more accurately reflect the long-term income of the household, since they are less subject to month-to-month variation.[15] Expenditures are a good measure of family income, except for the case of households with significant participation of non-monetary earnings and those that base a large proportion of their expenditures on future income. Such expenditures, which include purchases with postponed payment or in installments, are generally made for the purchase of durable goods rather than food.[15,16]

The major advancement in the present study in comparison to the literature on FV consumption is in the procedures used to identify relative participation of these foods in the diet. Given the vertiginous growth in obesity and diet-associated chronic diseases in

Table 3. Participation of food groups (%) in the total calories purchased by the household according to monthly per capita income quintiles (Q). São Paulo, Brazil, 1998-1999.

Food group	Q1 N=470	Q2 N=470	Q3 N=471	Q4 N=470	Q5 N=470	p-value*
FV	4.1	4.6	4.6	4.5	5.3	0.044
Fruit	3.0	3.3	3.4	3.3	4.0	0.049
Vegetables	1.1	1.2	1.2	1.3	1.4	0.002
Leaf vegetables	0.9	0.9	1.0	1.1	1.2	0.001
Other vegetables	0.2	0.3	0.2	0.2	0.2	0.356
Total calories (kcal/day per capita)	1,075.2	1,602.8	1,946.0	2,024.1	1,992.2	< 0.001

* ANOVA

Table 4. Elasticity coefficients* for explanatory variables for total calories contributed by fruit, leaf vegetables, and other vegetables, adjusted for total calories. São Paulo, Brazil, 1998-1999.

Explanatory variable	Regression model**			
	1	2	3	4
Monthly income	0.03	0.04	0.03	0.04
FV prices	***	-0.18	-0.20	***
Price of foods other than FV	***	***	0.07	0.07
Fruit prices	***	***	***	-0.11
Leaf vegetable prices	***	***	***	-0.04
Other vegetable prices	***	***	***	-0.07
R^2 of models	0.05	0.13	0.15	0.12

* All elasticity coefficients are significant with $p < 0.05$
** All models controlled for total household members, presence of person ≥ age 50 years, and schooling of head of household
*** Variable not used in the model

Brazil (and in most countries worldwide), FV would ideally be added to the diet as a replacement for foods of higher energetic density and lower nutrient and fiber content.

Indeed, until the conclusion of the present article, we were unable to find studies estimating income and price elasticity for the participation of FV in the diet, especially studies aimed at providing subsidy for the choice of strategy to be employed for the promotion of a healthy diet. Generally speaking, in the studies found in the literature, FV intake is evaluated based on the absolute amount of purchased, or even by the participation of these items in the total household expenses.[1,6,7,12,20] Elasticity coefficients obtained by this means are not informative as to whether higher income or lower prices are associated with greater participation of FV in the diet, and may reflect simply absolute variations in the amount of these foods purchased, or even variations in the type of FV purchased.

The results of the present study indicate the increase in family income or the reduction of the relative prices of FV as possible ways to increase participation of FV in the diet. Public fund-transfer policies are the major means of increasing the income of a significant fraction of the population in a direct and immediate fashion. However, the implementation of these policies is limited mainly by the financial capabilities of the public budget. The magnitude of the benefit and the choice of social stratum to be contemplated tend to be defined by political criteria, which in some cases may limit the outreach and magnitude of benefits. Furthermore, especially among low-income families, earnings still tend to be divided amongst several groups of expenditures, thus without guaranteeing that significant changes will occur in the participation of FV in the diet.[2] Estimated income elasticity values showed a limited influence of family income on the participation of FV in the diet. It is possible that, as seen in other settings,[2] the level of affluence of the household is a more important determinant of quality and variety of fruit and vegetables than of the proportion these foods represent in the diet.[10]

Price-reduction policies are in principle more viable measures, and are more likely to yield immediate and effective results, given the more direct and targeted character of the influence of prices on consumer choices. The formula most widely adopted for conceding

Table 5. Elasticity coefficients* for explanatory variables for total calories contributed by fruit, leaf vegetables, and other vegetables, adjusted for total calories, according to per capita family income quintiles (Q), according to two regression models.** São Paulo, Brazil, 1998-1999.

Explanatory variable in the model	Q1	Q2	Q3	Q4	Q5
Regression model 1			Elasticity		
Monthly income	-0.02 ns	0.14	0.04 ns	0.07 ns	0.08
FV prices	-0.14	-0.20	-0.23	-0.19	-0.22
Price of foods other than FV	0.16	0.12	0.16	0.05	0.01 ns
R^2 of the model	0.31	0.18	0.21	0.15	0.21
Regression model 2			Elasticity		
Monthly income	-0.02 ns	0.14	0.04 ns	0.06 ns	0.08
Price of fruit	-0.08	-0.13	-0.15	-0.10	-0.16
Price of vegetables	-0.03 ns	-0.01 ns	-0.06	-0.03 ns	-0.04 ns
Price of foods other than FV	0.17	0.12	0.16	0.04	0.00 ns
R^2 of the model	0.22	0.15	0.13	0.06	0.15

* All elasticity coefficients are significant with $p < 0.01$, except when indicated by "ns"
** All models controlled for total household members, presence of person ≥ age 50 years, and schooling of head of household.

price subsidies in Brazil is stimulating price reduction throughout the product's entire productive chain. In the case of FV, this could be achieved by means of exemptions from added value and sales taxes; by subsidizing transportation and storage systems; by reducing FV import taxes, through incentives to rural producers; and through the creation of public channels for wholesale and/or retail supported by lower commercialization costs and greater outreach. The obvious disadvantages of subsidies across the entire productive chain are the high cost to the public administration and the risk of creating an imbalance in the supply/demand relationship for the subsidized product in case supply is not equally stimulated.

Although initially exempting the FV production chain from taxation would signify a loss of revenue for the public sector, reductions in healthcare expenditures may contribute to equilibrate the public budget.[4,19] Imposing a small tax on groups of foods considered as unhealthy would be a solution for obtaining the necessary resources for implementing FV subsidies.[11] However, we could not detect a pattern that indicated in a conclusive manner the best candidates for taxation.

The present study showed that reductions in FV prices may positively influence the participation of these foods in the dietary patterns of the population of the city of São Paulo. This influence remained consistent across all income strata, indicating that a policy for reducing FV prices would result in increased consumption of these foods by the population as a whole. The use of a similar methodology to analyze the 2002-2003 HBS-IBGE will indicate to what extend the present results can be extended to other Brazilian settings.

REFERENCES

1. Abdulai A, Aubert D. A cross-section analysis of household demand for food and nutrients in Tanzania. *Agric Econ*. 2004;31(1):67-79.
2. Blisard N, Stewart H, Jolliffe D. Low-income households' expenditures on fruits and vegetables. Washington; 2004. (Agricultural Economic Report, 833).
3. Carmo HCE. Pesquisa de Orçamentos Familiares 98-99: Principais resultados. *Inf. FIPE*. 2000;231:12-7.
4. Finkelstein EA, Ruhm CJ, Kosa KM. Economic causes and consequences of obesity. *Annu Rev Public Health*. 2005;26(supl):239-57.
5. Guo X, Popkin BM, Mroz TA, Zhai F. Food price can favorably alter macronutrient intake in China. *J Nutr*. 1999;129(5):994-1001.
6. Hoffmann R. Elasticidades-renda das despesas com consumo de alimentos em regiões metropolitanas do Brasil em 1995-1996. *Inf. Econ*. 2000;30(2):17-24.
7. Hoffmann R. Elasticidades-renda das despesas com consumo físico de alimentos no Brasil metropolitano em 1995-1996. *Agric. Sao Paulo*. 2000;47(1):111-22.
8. Instituto Brasileiro de Geografia e Estatística. Estudo Nacional das Despesas Familiares-ENDEF: 1974-1975. Rio de Janeiro; 1978.
9. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2002/2003: Aquisição alimentar domiciliar *per capita*, Brasil e grandes regiões. Rio de Janeiro; 2004.
10. Krebs-Smith SM, Kantor LS. Choose a variety of fruits and vegetables daily: understanding the complexities. *J Nutr*. 2001;131(2S-1):487s-501s.
11. Kuchler F, Tegene A, Harris JM. Taxing Snack Foods: What to expect for diet and tax revenues. Washington: United States Department Of Agriculture. Economic Research Service; 2004. (Agriculture Information Bulletin, 747-08).Disponível em: http://www.ers.usda.gov/Publications/AIB747/aib74708.pdf [Acesso em nov 2004]
12. Menezes T, Silveira FG, Magalhães LCG, Tomich FA, Vianna SW. Gastos alimentares nas grandes regiões urbanas do Brasil: aplicação do modelo AID aos microdados da POF 1995/1996 IBGE. Brasília: IPEA; 2002. (Texto para Discussão, 896).
13. Monteiro CA, Mondini L, Costa RBL. Mudanças na composição e adequação nutricional da dieta familiar nas áreas metropolitanas do Brasil (1988-1996). *Rev Saude Publica*. 2000; 34(3):251-8.
14. NEPA/UNICAMP. Tabela brasileira de composição de alimentos. Taco. Versão 1. Campinas; 2004.
15. Ramsey JB, Lampart C. The decomposition of economic relationships by time scale using wavelets: expenditure and income. *Stud Nonlinear Dynam Econometrics*.1998;3(1):23-42.
16. Ravallion M. Issues in Measuring and Modelling Poverty. *Econ J*.1996;106(438):1328-43.
17. Willett W, Stampfer MJ. Total energy intake: implication for epidemiologic analyses. *Am J Epidemiol*.1986;124(1):17-27.
18. World Health Organization. The world report 2002: reducing risks, promoting healthy life. Geneva: World Health Organization; 2002.
19. World Health Organization. Diet, nutrition and the prevention of chronic diseases. report of a joint WHO/FAO expert consultation. Geneva; 2003. (WHO-Technical Report Series, 916).
20. You Z, Epperson JE, Huang CL. Consumer demand for fresh fruits and vegetables in the United States. Athens: University of Georgia;1998. (Research Bulletin University of Georgia, 431). Disponível em: http://pubs.caes.uga.edu/caespubs/pubs/PDF/RB431.pdf [Acesso em nov 2004]

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