Factors associated with dietary patterns among low-income adults

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Abstract

Objective: To describe the association of socio-economic, demographic and lifestyle characteristics with three eating patterns identified among low-income adults living in the Rio de Janeiro metropolitan area, Brazil.

Design: Data were obtained in a population-based cross-sectional study. The analysed patterns were: (i) ‘Mixed’, in which diverse foods had similar factor loadings; (ii) ‘Western’, which included items with high energy density; and (iii) ‘Traditional’, which relied in rice and beans, traditional staple foods in Brazil. Hierarchical logistic analysis was performed to estimate the association between the independent variables and each one of the dietary patterns. The variables that presented statistical significance <0.20 in the univariate analysis (χ² test) were included in the multivariate models.

Setting: Duque de Caxias, a low-income area in the Rio de Janeiro metropolitan region, Brazil.

Subjects: Adults (n 1009) aged 20 to 65 years (339 men and 670 women).

Results: The ‘Mixed’ pattern was positively associated with smoking (OR = 1.58, 95 % CI 1.00, 2.48 for current smoking v. those who never smoked). The ‘Western’ pattern was positively associated with family income (OR = 3.00, 95 % CI 1.81, 4.97 for those with monthly per capita family income ≥1.0 v. <0.5 times the official Brazilian minimum wage) and inversely associated with family food insecurity (OR = 0.55, 95 % CI 0.36, 0.84). The ‘Traditional’ pattern was associated with family food insecurity (OR = 1.79, 95 % CI 1.27, 2.51).

Conclusions: The results support previous findings relating improvement in economic conditions to reduced adherence to the traditional Brazilian food consumption pattern based on the combination of rice and beans.

From the epidemiological point of view, diet represents a complex combination of exposures. However, epidemiological studies often fail in corroborating the effects observed experimentally for some dietary components. The conventional approach adopted in investigations on food consumption, which is centred on the evaluation of energy, nutrient or food intake as independent variables, does not allow one to consider the effect of the diet as a whole on the risk diseases, as the multicollinearity, confounding and interaction that may occur between the many dietary components are usually not appropriately taken into account1,2,3. For example, the association between the consumption of whole grains and the reduction in the risk for developing chronic diseases may be subject to confounding by the relationship between the use of unrefined products and the intakes of fruits, vegetables and fish4–6.

The identification of dietary patterns employing statistical procedures, such as principal component analysis and cluster analysis, has been considered as an alternative to overcome these limitations. Supposedly, dietary patterns illustrate the real situations of food availability and dietary practices of the study population7–9. Consequently, they facilitate the identification of subgroups that adopt eating habits compatible with the risk for or protection against diseases and provide reliable empirical support to the elaboration of dietary recommendations and guidelines7–9.

Three dietary patterns were identified among adults living in Duque de Caxias, a metropolitan area of Rio de Janeiro, Brazil.
Janeiro, Brazil(10), one of these was characterized as the ‘traditional’ pattern which has also been identified in
other studies carried out in this country(6,11,12). In
1994–1995, Schierer examined the association between
dietary patterns and obesity in adults living in the city of
Rio de Janeiro and also identified three main dietary
patterns: ‘mixed’ (in which diverse food items showed
similar factor loading), ‘traditional’ (characterized by the
consumption of rice and beans) and ‘Western’ (charac-
terized by the consumption of fats and soft drinks)(13).

The traditional Brazilian food consumption pattern,
centred around the consumption of rice and beans, has
been considered to be protective due to its Fe and fibre
contents and low energy density(10,13,14).

The objective of the present study was to estimate the
association between socio-economic, demographic and
lifestyle factors and three dietary patterns in a low-income
neighbourhood in the Rio de Janeiro metropolitan area.

Methods

The data refer to a population-based cross-sectional
study, carried out in 2005 in the district of Campos Elíseos,
in the municipality of Duque de Caxias, one of the
poorest areas in the Rio de Janeiro metropolitan
area, Brazil, which had 244 000 inhabitants in the 2000
population census(15).

The current analysis includes data from adults between
19 and 65 years old. A cluster sampling design with three
selection stages was adopted for the selection of subjects.
Primary sampling units (census sector) were the first stage
of selection, households the second and adults the third;
one adult was interviewed in each household. The
sample design included the procedure of ranking the
households according to income inside each census tract,
allowing for sampling also according to this variable.
Statistical tests indicated that data as well as the sample
size were adequate for performing factorial analysis in the
identification of dietary patterns(10).

Data were obtained by means of interviews conducted
in the households from May to December, 2005. All par-
ticipants signed a free informed consent form, and the
research was conducted within the standards demanded
by the Declaration of Helsinki and approved by the Ethics
Committee of the University of the State of Rio de Janeiro.

Food intake was estimated applying a semi-quantitative
FFQ validated for the adult population of Rio de Janeiro(10).
The FFQ listed eighty-two food items, three options of
portion size for each item and eight alternatives for
reporting the frequency of food intake, which varied from
‘never or almost never’ to ‘more than three times a day’.

To identify the dietary patterns, the food items listed in
the FFQ were grouped into twenty-one food groups
based on their nutritional characteristics and considering
the reported intake frequency. Exploratory factor and
principal component analysis were applied to derive
dietary patterns. Orthogonal Varimix rotation of the fac-
tors was applied to improve the interpretation. Six solu-
tions with eigenvalues >1.0 were obtained, and the
Cattell graph method(17) indicated that three patterns
should be retained: (i) the ‘Mixed’ pattern, characterized
by the consumption of cereals, fish and shrimp, leaves,
vegetables, fruits, eggs, meats and caffeinated beverages;
(ii) the ‘Western’ pattern, with high intakes of juices,
cakes and cookies, soft drinks, milk and milk derivatives,
sweets, snacks and fast foods; and (iii) the ‘Traditional’
pattern, characterized by the consumption of rice and
beans, breads, sugar, sauces and fats. Those patterns
together explained 35 % of the total data variance.

Hierarchical analysis

Hierarchical analysis models were developed separately
for each dietary pattern identified in order to estimate its
association with the demographic, socio-economic and
lifestyle variables. The factor scores associated with each
pattern were categorized as lower than or equal to the
median (reference category, codified as ‘0’) or above the
median (codified as ‘1’). A factor score classified as ‘above
the median’ was defined as adherence to a pattern.

In the theoretical model that oriented the hierarchical
analysis, the socio-economic factors were considered as
distal (group 1). In the second group were included
variables related to the family characteristics (number of
family members, presence of children and adolescents,
sex of the household head, family food insecurity), and
the third group was composed by the proximal variables
related to lifestyle. The classification of the independent
variables is described in Table 1.

The association between the independent and the
dependent variables was tested in univariate analysis
using the χ² test, selecting for the hierarchical analysis
those with a significance level <0.20 in order to avoid the
exclusion of potentially important variables. The
hierarchical model was then developed using logistic
regression analysis, considering significance levels <0.10
for the maintenance of variables in the model. Age, sex
and skin colour were maintained in the models as they
were considered important confounding variables.

The first hierarchical level included in the model was
composed by the socio-economic factors that presented
statistical significance in the univariate analysis. In the
second step of the analysis, the factors referring to family
and household were included and their effects verified
in the presence of the remaining factors from the previous
level (those that presented P < 0.10). The same pro-
dure was applied for including the third group of vari-
able (those related to lifestyle). These approaches
guaranteed control by variables from the previous
groups. The final estimator for the effect of distal variables
was the one observed before the introduction of the
proximal variables, while estimators of the effect of the
proximal variables were observed after the introduction of the distal variables in the models, with the exclusion of variables with \( P \geq 0.10 \). Odds ratios and the respective 95% confidence intervals were estimated. The data were analysed using the SPSS statistical software package version 16.0 (SPSS Inc., Chicago, IL, USA).

Results

One thousand two hundred and fifty-three individuals were interviewed, of whom 222 (17.7%) reported implausible energy intake (below 2093 kJ/d \((n = 5)\) or above 25121 kJ/d \((n = 217)\) and were excluded. Also excluded were twenty-two individuals with incomplete data on other variables. Analysis was done for 1009 individuals (males: 34%, \( n = 339 \); females: 66%, \( n = 670 \)). The mean age was 39 (SD 12) years, no significant difference was observed in the mean age according to sex \((P = 0.73)\), Student’s \( t \) test.

The results of the univariate analysis are summarized in Table 2. In short, all socio-economic variables were associated \((P < 0.20)\) with the ‘Mixed’ and ‘Western’ patterns. The sex of the household head and all lifestyle variables were also related to the ‘Mixed’ pattern. The number of household members, presence of children in the household and family food insecurity are the family variables that were associated with the ‘Western’ pattern; the only lifestyle variable associated with the ‘Western’ pattern was smoking. The ‘Traditional’ pattern was associated with the following family variables: working activity, number of household members, sex of the household head and family food insecurity; additionally, it was associated with the lifestyle variables of smoking, physical activity and alcoholic beverage consumption.

In the multivariate hierarchical analysis, it was observed that smokers presented adherence to the ‘Mixed’ pattern. Having a monthly per capita family income higher than 0.5 times the official Brazilian minimum wage (at the time of the study this value corresponded to S$120.00) had a direct association with adherence to the ‘Western’ pattern; nevertheless, belonging to families that reported food insecurity was associated with reduced adherence to this pattern. An increased adherence to the ‘Traditional’ pattern was observed for those living in households with food insecurity (Table 3).

Discussion

The present analysis described the association of socio-economic, demographic and lifestyle characteristics with three eating patterns identified among low-income adults living in the Rio de Janeiro metropolitan area, Brazil. The results showed that even small increases in income are related to increased adherence to the ‘Western’ pattern, even though the mean income in this area is very low compared...
Table 2 Association between demographic, socio-economic and lifestyle factors and dietary patterns among adults (n 1009), Duque de Caxias, Rio de Janeiro, Brazil, 2005

<table>
<thead>
<tr>
<th>Group 1: Socio-economic factors</th>
<th>'Mixed' pattern</th>
<th>'Western' pattern</th>
<th>'Traditional' pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (%) Adherence (%)*</td>
<td>P value ($\chi^2$)†</td>
<td>Adherence (%)*</td>
<td>P value ($\chi^2$)†</td>
</tr>
<tr>
<td>Education (years of study)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤4</td>
<td>30:9</td>
<td>51:0</td>
<td>0:197</td>
</tr>
<tr>
<td>5–7</td>
<td>23:3</td>
<td>54:3</td>
<td>37:3</td>
</tr>
<tr>
<td>8–10</td>
<td>21:7</td>
<td>50:5</td>
<td>47:4</td>
</tr>
<tr>
<td>≥11</td>
<td>24:1</td>
<td>44:6</td>
<td>52:8</td>
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<tr>
<td>Working activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>45:9</td>
<td>52:6</td>
<td>65:0</td>
</tr>
<tr>
<td>No</td>
<td>54:1</td>
<td>48:2</td>
<td>55:2</td>
</tr>
<tr>
<td>Monthly per capita family income (multiple of official Brazilian minimum wage)</td>
<td>0:080</td>
<td>&lt;0:005</td>
<td>0:346</td>
</tr>
<tr>
<td>&lt;0:5 (&lt;US 60:00)</td>
<td>48:9</td>
<td>54:0</td>
<td>40:9</td>
</tr>
<tr>
<td>0:5–1:0 (US 60:01–120:00)</td>
<td>30:4</td>
<td>49:0</td>
<td>61:5</td>
</tr>
<tr>
<td>≥1:0 (≥US 120:00)</td>
<td>20:7</td>
<td>43:0</td>
<td>66:9</td>
</tr>
<tr>
<td>Group 2: Factors regarding the family and the household</td>
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<td>0:006</td>
<td>0:065</td>
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<tr>
<td>Number of household members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤6</td>
<td>16:8</td>
<td>54:5</td>
<td>39:2</td>
</tr>
<tr>
<td>Presence of children/adolescents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28:6</td>
<td>48:6</td>
<td>56:0</td>
</tr>
<tr>
<td>No</td>
<td>71:4</td>
<td>50:7</td>
<td>49:2</td>
</tr>
<tr>
<td>Sex of the household head</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Male</td>
<td>74:3</td>
<td>48:6</td>
<td>52:2</td>
</tr>
<tr>
<td>Female</td>
<td>25:7</td>
<td>54:4</td>
<td>47:9</td>
</tr>
<tr>
<td>Family food insecurity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>31:2</td>
<td>50:4</td>
<td>63:1</td>
</tr>
<tr>
<td>No</td>
<td>68:8</td>
<td>52:2</td>
<td>43:0</td>
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<tr>
<td>Marital status</td>
<td></td>
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</tr>
<tr>
<td>Single</td>
<td>17:6</td>
<td>45:5</td>
<td>55:1</td>
</tr>
<tr>
<td>Married</td>
<td>70:9</td>
<td>51:5</td>
<td>48:5</td>
</tr>
<tr>
<td>Divorced or widow(er)</td>
<td>11:5</td>
<td>48:7</td>
<td>50:4</td>
</tr>
<tr>
<td>Group 3: Variables related to lifestyle</td>
<td>&lt;0:005</td>
<td>&lt;0:005</td>
<td>0:153</td>
</tr>
<tr>
<td>Smoking habits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never smoked</td>
<td>63:5</td>
<td>61:3</td>
<td>40:2</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>17:1</td>
<td>55:9</td>
<td>43:5</td>
</tr>
<tr>
<td>Current smoker</td>
<td>19:5</td>
<td>45:4</td>
<td>54:6</td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>3:5</td>
<td>48:6</td>
<td>37:1</td>
</tr>
<tr>
<td>Mild</td>
<td>53:5</td>
<td>46:1</td>
<td>50:9</td>
</tr>
<tr>
<td>Moderate</td>
<td>29:0</td>
<td>52:6</td>
<td>50:9</td>
</tr>
<tr>
<td>Severe</td>
<td>13:4</td>
<td>61:9</td>
<td>46:3</td>
</tr>
<tr>
<td>Alcoholic beverage consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None reported</td>
<td>59:6</td>
<td>48:6</td>
<td>50:7</td>
</tr>
<tr>
<td>&lt;1 time/week</td>
<td>5:2</td>
<td>44:2</td>
<td>48:1</td>
</tr>
<tr>
<td>1–3 times/week</td>
<td>15:3</td>
<td>47:9</td>
<td>51:9</td>
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### Table 2 Continued

<table>
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<th>Control variables</th>
<th>4–5 times/week</th>
<th>6+ times/week</th>
<th>P value ((\chi^2))†</th>
<th>4–5 times/week</th>
<th>6+ times/week</th>
<th>P value ((\chi^2))†</th>
<th>4–5 times/week</th>
<th>6+ times/week</th>
<th>P value ((\chi^2))†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group (years old)</td>
<td>Total (%)</td>
<td>Adherence (%)*</td>
<td></td>
<td>Total (%)</td>
<td>Adherence (%)*</td>
<td></td>
<td>Total (%)</td>
<td>Adherence (%)*</td>
<td></td>
</tr>
<tr>
<td>19–30</td>
<td>29.3</td>
<td>40.5</td>
<td>&lt;0.005</td>
<td>29.0</td>
<td>45.6</td>
<td>&lt;0.005</td>
<td>34.7</td>
<td>49.4</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>31–40</td>
<td>22.0</td>
<td>56.3</td>
<td></td>
<td>18.7</td>
<td>48.7</td>
<td></td>
<td>35.6</td>
<td>44.7</td>
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</tr>
<tr>
<td>41–50</td>
<td>18.7</td>
<td>50.2</td>
<td>0.018</td>
<td>15.0</td>
<td>49.0</td>
<td>0.018</td>
<td>22.0</td>
<td>46.4</td>
<td>0.018</td>
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<td>51–65</td>
<td>17.7</td>
<td>58.9</td>
<td></td>
<td>16.7</td>
<td>57.5</td>
<td></td>
<td>23.8</td>
<td>51.1</td>
<td></td>
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<tr>
<td>Sex of the respondent</td>
<td>Male</td>
<td>33.6</td>
<td>52.2</td>
<td>0.351</td>
<td>51.0</td>
<td>68.1</td>
<td>&lt;0.005</td>
<td>40.9</td>
<td>68.1</td>
</tr>
<tr>
<td>Female</td>
<td>66.4</td>
<td>49.0</td>
<td></td>
<td>49.6</td>
<td>31.9</td>
<td>&lt;0.005</td>
<td>59.1</td>
<td>31.9</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Skin colour</td>
<td>White</td>
<td>31.8</td>
<td>50.2</td>
<td>0.018</td>
<td>57.5</td>
<td>45.1</td>
<td>0.087</td>
<td>50.2</td>
<td>45.1</td>
</tr>
<tr>
<td>Brown</td>
<td>50.5</td>
<td>46.4</td>
<td></td>
<td>47.8</td>
<td>52.4</td>
<td></td>
<td>50.2</td>
<td>52.4</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>17.7</td>
<td>58.9</td>
<td></td>
<td>41.1</td>
<td></td>
<td></td>
<td>50.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Indicates with factor scores above the median for the factor.
†\(\chi^2\) test for homogeneity.
which is more frequent among those families living in the poorest areas. Since prior analysis showed that there were no variations in dietary patterns according to sex10, it is unexpected that these differences could bias our results.

The adoption of an unhealthy eating pattern by economically deprived individuals may be related to the cultural devaluation of foods that compose the traditional Brazilian diet. In contrast, the improvement in purchasing power could signify the possibility of acquiring foods that are socially valued, such as highly processed foods. Unfortunately, some of those items, e.g. sugar-added beverages and cookies, are considered to present risk for the development of non-transmissible chronic diseases.

The epidemiological importance of these findings resides in their contribution to the rationale of intervention programmes and strategies, especially considering the limiting factors to the adoption of healthier eating patterns, such as the high cost of foods like vegetables, fruits, and milk and dairy. Another factor is the need to rescue the cultural and social status of the traditional Brazilian diet and incentivize inclusion of the rice-and-beans combination in the diet of all socio-economic groups.

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