Sociodemographic and lifestyle characteristics in relation to dietary patterns among young Brazilian adults

Public Health Nutr. Author manuscript; available in PMC 2013 October 10.

Published in final edited form as:
Public Health Nutr. 2011 January ; 14(1): 150–159. doi:10.1017/S136898001000162X.

Sociodemographic and lifestyle characteristics in relation to dietary patterns among young Brazilian adults

Maria Teresa A Olinto[1,*], **Walter C Willett**[2], **Denise P Gigante**[3], and **Cesar G Victora**[3]

[1]Programa de Pós-Graduação em Saúde Coletiva, Universidade do Vale do Rio dos Sinos, Av. Unisinos 950, 91.022-000, São Leopoldo, RS, Brazil

[2]Department of Nutrition, Harvard School of Public Health, Harvard University, Boston, MA, USA

[3]Programa de Pós-Graduação em Epidemiologia, Universidade Federal de Pelotas, Pelotas, RS, Brazil

Abstract

Objective—To identify dietary patterns among young adults and the relationships with socio-economic, demographic and lifestyle characteristics.

Design—Population-based, cross-sectional analysis of a cohort study. Food intake was assessed by a frequency questionnaire, and dietary patterns were identified using principal components analysis.

Setting—Southern Brazil.

Subjects—A total of 4202 men and women aged 23 years, who participated in the 1982 Pelotas Birth Cohort Study.

Results—Five dietary patterns were identified: common Brazilian, processed food, vegetable/fruit, dairy/dessert and tubers/pasta. Subjects who had low own or maternal educational levels, low social position or who were always poor throughout life had high adherence to the common Brazilian dietary pattern. In contrast, the processed food pattern was more likely to be followed by those belonging to middle and high social position and who were never poor. Men and smokers showed high adherence to the processed food and common Brazilian dietary patterns. Vegetable/fruit pattern was more likely to be followed by women and subjects engaged in physical activity. Women also showed high adherence to the dairy/dessert pattern.

Conclusions—Our study among young Brazilian adults has identified distinct dietary patterns that are clearly influenced by socio-economic and lifestyle characteristics, which have important policy implications in a country with marked social and economic inequalities.

Keywords

Food intake; Dietary patterns; Socio-economic factors; Young adults

---

Dietary pattern analysis has become common in nutritional epidemiology. Coherence among findings from studies of dietary patterns and from traditional approaches focusing on individual foods and nutrients has contributed to knowledge about the relation of nutrition

*Corresponding author, Maria Teresa Olinto: mtolinto@unisinos.br.

There are no conflicts of interest.

All authors were involved in analysing the data, reviewing and interpreting the results and writing the manuscript.

Europe PMC Funders Author Manuscripts

and disease. Empirically derived dietary patterns are obtained from the transformation of a large set of correlated food variables into a new smaller set of uncorrelated variables, known as dimensions or patterns. A 2004 global literature review identified over ninety quantitative studies investigating population dietary patterns[1], mostly from developed countries.

During late adulthood, relatively consistent associations between diet and social, economic and lifestyle characteristics have been observed. With few exceptions[2], diets thought to be healthier have been strongly associated with higher socio-economic status (SES) and negatively with lifestyle factors such as smoking and inactivity[3–11]. In addition, better diet quality has been associated with older age[4,7,9]. However, few studies have been conducted on the relationship between dietary patterns and SES and lifestyle factors among young adults. Moreover, in these studies the variables used to assess social and economic characteristics have differed substantially[12–15]. Taken together, it is not possible to discern consistent findings from available studies among young adults.

We identified the major dietary patterns in a cohort of young adults living in southern Brazil, born in 1982, and then examined the association between these dietary patterns and their socio-economic, demographic and lifestyle characteristics. This data set is one of the largest and longest-running birth cohorts from a developing country[16], but dietary patterns have not previously been investigated in this cohort.

Methods

Background

In 1982, a population-based birth cohort study was initiated in Pelotas, a medium-sized city in the extreme south of Brazil, which included all 5914 live-born infants during that year. Since these baseline data were collected, this cohort was followed in 1984, 1986, 1997, 2001 and 2004–2005. Initially, the study centred on perinatal (baseline study), infant and early childhood morbidity and mortality, with a particular focus on breast-feeding patterns and nutritional status. When the cohort members became young adults, the emphasis shifted to risk factors for chronic disease, including diet and physical activity. During the eighth follow-up, from October 2004 to August 2005, 4297 cohort members were located and interviewed. In addition, the mortality monitoring system identified 282 cohort members who had died. The follow-up rate – including those interviewed and those that were known to have died – was 77·4%. The highest follow-up rates were in the upper socio-economic level. The methodological details of the follow-up have been published elsewhere[17].

Study population

We studied 4297 cohort members located in 2004–2005 (average age: 23 years). In the present analysis, we used information collected from the perinatal study in 2004–2005.

The study was approved by the ethics committee of the Medical Faculty of the Federal University of Pelotas. Written informed consent was obtained from all subjects before the interview.

Explanatory variables

Socio-economic and demographic characteristics, smoking and information on physical activity were obtained through standardized questionnaires. Information on sex, skin colour, mother's education and income was collected at baseline in 1982. Variables collected at follow-up in 2004–2005 included family income, family social position, education (cohort members' years of schooling), physical activity and smoking status. In addition, weight was measured using a portable digital electronic scale with a capacity of 150 kg and precision of

Europe PMC Funders Author Manuscripts

0·1 kg (Uniscale; SECA, Copenhagen, Denmark) and height was measured using a locally developed portable aluminium height instrument with a precision of 1 mm. For analysis, the socio-economic and demographic explanatory variables were categorized using conventional cut-off points and/or based on the distribution of responses as follows: sex (men and women), skin colour (white and not white), mother's education (0–4, 5–8, 9–11 and ≥12 years of schooling), cohort members' education (0–4, 5–8, 9–11 and ≥12 years of schooling) and current family social position from low to high (based on domestic assets, presence of servants and level of education of the head of the household, according to the standard Brazilian Economic Classification of social classes A–E)[18]. Income information, collected in 1982 and in 2004–2005, was used to create a variable labelled 'income change'. This variable measures change in the family income throughout life. We used tertiles of family income obtained at the baseline interview and at follow-up in 2004–2005 and combined them into a variable with four categories: always poor (equivalent to the lowest tertile of family income in 1982 and 2004–2005), non-poor→poor (second or third tertile in 1982 and lowest tertile in 2005), poor→non-poor (lowest tertile in 1982 and second and third tertiles in 2004–2005) and never poor (second or third tertile in 1982 and 2004–2005). Leisure-time physical activity was categorized as none or in tertiles of min/week (10–110; 120–299 and ≥300 min/week). Smoking was categorized as current smoker and non-smoker. BMI (kg/m^2) was calculated to describe the nutrition status of the cohort member, but it was not our aim to investigate its association with dietary patterns.

Dietary assessment variables

Information on diet was collected during interviews carried out in 2004–2005. Usual intake over the past year was assessed by a semi-quantitative, interviewer-administered FFQ. A list of eighty-two food items in the FFQ was used to collect information on the frequency of food intake. Food serving intake (standard portion size) was specified for each food with response options ranging from 0 to 10 times per day, per week, per month or per year. The FFQ was derived from the National Survey on Household Expenses, but was limited to regional eating habits.

We collapsed eighty-two food items into forty-seven groups, by combining foods that were similar in nutrient profile and represented particular dietary habits of the south Brazilian population. Foods that were reported by more than 80% of the subjects remained as separate items (e.g. orange, banana, lettuce, rice and black beans).

From the 4297 subjects, we excluded fifty-two subjects on the basis of FFQ responses that did not appear to be plausible. The majority of these cases were due to clearly over-reported food intake, e.g. eating all food items everyday. In addition, we excluded forty-three men and women reporting energy intake +3 SD over the mean. Because only 0·4% of subjects reported total energy intake <4186 kJ/d, they were not excluded. Thus, our study included 4202 young adults (2041 women and 2161 men).

Statistical analysis

We conducted a principal components factor analysis (PCA) to derive major dietary patterns based on forty-seven food groups. The factors were rotated by an orthogonal (Varimax) transformation. The number of factors retained was based on the following criteria: components with an eigenvalue of >1, scree plot test and the interpretability of the factors. The eigenvalues signify the amount of variance explained by each of the factors. Food items were considered to load on a factor if they had an absolute correlation ≥0·30 with the factor and thus were retained in the calculations of the dietary pattern scores.

Europe PMC Funders Author Manuscripts

Europe PMC Funders Author Manuscripts

Before identifying the dietary patterns, the reliability of the factor analysis procedure was assessed via the Kaiser–Meyer–Olkin (KMO) statistics and the Bartlett test of sphericity. To verify the consistency among subgroups, we performed the PCA stratified by sex.

Each of the five dietary patterns was categorized into tertiles. The highest tertile represented the greatest adherence to the dietary pattern. Poisson regression with robust variance was used in bivariate and multivariate analyses to allow the estimation of the prevalence ratio (PR) and 95% CI for the highest tertile of each pattern compared to the lowest tertile. Variables with a level of significance <20% in the bivariate analysis were included in the multivariable model. The model of multivariate analysis was based on a conceptual framework[19], determined a priori. Two levels were incorporated into the multivariable model: level I included all socio-economic and demographic variables, and level II included lifestyle (physical activity and smoking status) and BMI variables. First-level variables were adjusted for each other and potential confounders ($P<0·20$) were kept for the adjustment of the second level. BMI was included in the second level as a potential confounder due to the close relationship with eating habits. A level of significance <5% was adopted (all tests were two-tailed). PCA was performed by the Statistical Package for Social Sciences statistical software package version 16·0 (SPSS Inc., Chicago, IL, USA) and Poisson regression by the STATA statistical software package version 9·0 (StataCorp., College Station, TX, USA).

Results

Basic characteristics based on sex of the 4202 subjects are presented in Table 1. Men and women had the same mean age (23 years) and distribution of skin colour (24% non-white). The variable assessing change in family income from 1982 to 2004 showed that nearly 52% of the subjects were never poor, in contrast to 16% who were poor throughout their lives. Even though the percentage of poor women at the 2004–2005 follow-up period was higher than for men (35·7% *v.* 30·2%), more women than men had higher education (>12 years of schooling). Men reported higher levels of physical activity and current smoking status than women.

The factor analysis procedure indicated satisfactory reliability, i.e. KMO = 0·79, and the Bartlett test of sphericity was statistically significant ($P<0·001$). We identified five major dietary patterns accounting for 27·6% of total variance. Table 2 illustrates the correlations of the food items with each of the five dietary patterns (rank order of factor loadings >0·30). The two dietary patterns with the largest eigenvalues were labelled as common Brazilian and as processed food dietary patterns. These explained 8·6% and 7·1% of the total variance, respectively. The high factor loadings for rice and black beans, one of the most popular meals across the whole country, led us to label this pattern as common Brazilian. The processed food dietary pattern presented moderately high factor loadings for processed food and red meat items in general. The other three dietary patterns were labelled vegetable/fruit, dairy/dessert and tubers/pasta, also according to the high factor loadings in food items.

The PCA was also performed separately for each sex. The dietary patterns identified in men and women showed high consistency with each other, and with those obtained using the entire data set (presented in Table 2). The only difference noticed was that among women, foods used in preparation, i.e. onion, garlic and bacon, were also correlated with the common Brazilian dietary pattern (data not shown in the tables).

Table 3 illustrates the mean intake frequencies of food servings of all food items retained in the dietary patterns, comparing the lowest and the highest tertiles of the five dietary patterns per year. The high-frequency intake of common Brazilian food items can be clearly observed for both the lowest and highest tertiles of the five dietary patterns. However, the highest tertile of common Brazilian pattern shows the highest intake frequency of servings of sugar, white bread, coffee, rice and black beans. As expected, the largest differences between the extreme tertiles of all food intake frequency items were observed for the corresponding dietary pattern. It is noteworthy that the lowest *v.* highest tertile of vegetable/fruit dietary pattern showed a reduction in the mean of soda intake, respectively, 289 *v.* 189 servings/year.

Associations of common Brazilian and processed food dietary patterns with sociodemographic and lifestyle variables are presented in Table 4. After adjustment in the multivariable analysis, the common Brazilian dietary pattern was more likely followed by subjects who had low own or maternal educational levels, with low social position or who were always poor. In contrast, the processed food pattern was more likely to be consumed by wealthier subjects; i.e. of middle and high social position, who were never poor, or who were poor at birth and became wealthier by 2004–2005. Both the main dietary patterns were more prevalent in men and current smokers.

Table 5 shows associations with the vegetable/fruit, dairy/dessert and tubers/pasta dietary patterns. After controlling for potential confounders, subjects with high education (≥12 years of schooling), higher social position (A and B) and who were never poor had higher adherence to the dairy/dessert dietary pattern (adjusted PR of 1·71 (95% CI 1·31, 2·23; $P<0·001$), 1·37 (95% CI 1·22, 1·54; $P<0·001$) and 1·74 (95% CI 1·43, 2·12; $P<0·001$), respectively). The dairy/dessert and vegetable/fruit dietary patterns were more likely to be followed by women and by non-smokers, in contrast to all other patterns. Vegetable/fruit was the only dietary pattern that did not show a significant association with socio-economic variables after adjustment in the multivariable model. A higher adherence to the vegetable/fruit dietary pattern was found in subjects with high leisure-time physical activity (PR = 1·44; 95% CI 1·31, 1·59). Similar to the common Brazilian pattern, the tuber/pasta dietary pattern was associated with lower levels of the socio-economic variables, but associated positively with physical activity.

Discussion

We identified five major dietary patterns among 4202 men and women aged 23 years, who participated in the Pelotas Birth Cohort Study in southern Brazil. The dietary patterns were labelled as common Brazilian, processed food, vegetable/fruit, dairy/dessert and tubers/pasta. All patterns were strongly associated with SES, except for vegetable/fruit. Dietary patterns show different adherence for men and women. Regarding lifestyle characteristics (smoking, physical activity and dietary patterns), we identified two behavioural trends: health-conscious and unhealthy, as described below.

The first pattern, the common Brazilian pattern, included sugar, white bread, coffee, butter/margarine, rice and black beans. A similar dietary pattern was identified in another study of adults in the north-east and south-east of Brazil[(20)]. The highest tertile (T3) of food items of the common Brazilian pattern presented higher means of food intake servings per year than any other food item in the whole table, except for onion/garlic. The second pattern, processed food, reflects a mix of foods contained in Western-type diets in studies carried out in different cultures[(9,21,22)]. Red meat, processed meat, soda and mayonnaise show marked differences between the highest and lowest tertiles of this pattern. The third pattern, vegetable/fruit, resembles a healthier dietary pattern commonly identified in other populations[(7,9,23)], except that in our study this pattern lacked foods such as fish, olive oil or wine. The fourth pattern, the dairy/dessert pattern, was mainly composed of milk, cheese, yoghurt, chocolate and desserts/sweets. The fifth dietary pattern, tubers/pasta, was also found in a previous study in southern Brazil, although that study also included beans in this pattern[4].

Our findings showed notable socio-economic differences in young adults' dietary patterns. Adjusted analyses of the four socio-economic variables (mother's and own education, social position and income change) should be interpreted with some caution due to multi-collinearity between these variables. The common Brazilian pattern was popular among subjects who had low own or maternal education, low social position or who were always poor. Composed of low-priced foods – such as white bread, sugar, rice and black beans – this dietary pattern may express the lack of variability in the diets of the poor. On the other hand, wealthier subjects were more likely to follow the processed foods and dairy/dessert dietary patterns. The vegetable/fruit dietary pattern was associated with the subject's educational level in the crude analyses, but not after adjustment for other social covariates. Associations of socio-economic characteristics and dietary patterns have been observed in several earlier studies. In a multi-ethnic cohort study in Hawaii and Los Angeles[24] of adults aged 45–75 years, higher level of education was positively associated with fruit and milk dietary pattern, and negatively with 'fat and meat' dietary pattern. Consumption of unhealthy diets was associated with low employment grade among middle-aged men in London[15]. In a study of women living in southern Brazil[4], dietary choices were strongly influenced by SES and were not dependent only on food prices.

Although the association of processed food and tubers/pasta dietary patterns with the subject's education disappeared in the adjusted analysis, the association with mother's education persisted. These findings suggest the existence of early life influences, with mother's education having a stronger role than the subject's own education. More studies should be conducted to investigate the relationship between early life factors and dietary patterns.

We identified two main behavioural trends regarding lifestyle: health-conscious and unhealthy. The health-conscious behaviours were manifested in the strong and positive association of adherence to the vegetable/fruit dietary pattern and physical activity during leisure time. Similar findings were observed in a Greek study[25]. In addition, this finding is coherent with the reduction in soda intake for subjects with high adherence to the vegetable/fruit dietary pattern (Table 3). These results may be showing young adults making positive decisions with regard to their health, e.g. reducing intake of not healthy foods. In our study, non-smokers and physically active subjects showed high adherence to the dairy/dessert pattern. This 'conscious' behaviour could be based on guidelines promoting dairy diets as being healthy, although this beneficial effect has been recently called into question[26,27]. On the other hand, physical activity was associated with the tubers/pasta dietary pattern, which might suggest a balance between energy expenditure and intake or even socio-economic residual confounding due to the relatively low cost of this pattern.

On the other hand, unhealthy behaviour trends were observed in subjects who smoked and reported high adherence to the processed food dietary pattern. Regarding the similarities of our processed food pattern with the Western-type diets, Sánchez-Villegas *et al.*[9] pointed to the existence of dangerous behaviour clustering (smoking, sedentary lifestyle and unhealthy diets) in adults. Unhealthy lifestyle behaviour – including unhealthy eating habits, lower physical activity and smoking – has also been observed in studies of adolescents[25,28].

We observed that women were more likely to follow the vegetable/fruit and dairy/dessert dietary patterns than men. Similar preferences for vegetables, fruit and dairy diets were found in other studies among women[24,29]. On the other hand, the common Brazilian, processed food and tuber/pasta dietary patterns were more likely followed by men.

Considering the types of foods included in those three dietary patterns, similar preferences were reported in men from another study[9,24]. Differences in diet quality between the sexes have been reported and diet quality reaches its lowest level for women in their mid-20s and for men in their mid-30s in developed countries[5]. This leads us to hypothesize that the differences in adherence according to sex in our findings will get stronger in mid-adulthood of our cohort. Another observation, perhaps related to gender roles, was that women were more likely than men to report foods such as onions, garlic and bacon that are used in preparation. Alternatively, this may indicate the existence of recall bias based on the different knowledge of men and women about food preparation details. After adjustment for covariates, the vegetable/fruit and the common Brazilian patterns presented borderline associations with skin colour. Black or mixed-colour subjects were 9% more likely to follow both of these patterns. Regarding the common Brazilian pattern, this could reflect a cultural behaviour; i.e. black beans were originally a diet for slaves in Brazil's colonial period. In the north-east and south-east of Brazil, rice and beans showed higher intake among blacks[20]. Our findings on the vegetable/fruit pattern showed a consistent trend with a North American study showing that African Americans consumed more servings of fruit than European Americans[14]. In contrast, in another US study, African Americans showed lower diet quality compared with other racial groups[5]. We believe that conclusions regarding the relationship of race/ethnicity to diet types are not straightforward, especially for young adults among whom further studies are needed.

Finally, some methodological considerations should be addressed. This is a large-scale community-based birth cohort study, but it cannot be considered as representative of Brazil. In addition, there are inherent problems in dietary assessment, such as self-report bias, and frequency of food servings, rather than amount in grams, was used in this analysis. Furthermore, the PCA method is considered an a posteriori approach, because eating patterns are derived through statistical modelling of an available empirical data set[30]. Several subjective decisions are made in this process of analyses, such as the FFQ items definition, collapsing foods, defining the factor loading cut-off and number of factors and the labelling of the identified dietary patterns[1,31]. Those subjective decisions, however, are based on previous scientific knowledge and on our experience in nutritional epidemiological research.

In summary, our study among young Brazilian adults has identified distinct dietary patterns that are clearly influenced by socio-economic and lifestyle characteristics. Our investigation provided the opportunity to understand how cohort member characteristics might influence dietary patterns in early adulthood, which has important policy implications in a country with marked social and economic inequalities.

Acknowledgments

The 1982 birth cohort study is currently supported by the Wellcome Trust Initiative entitled 'Major Awards for Latin America on Health Consequences of Population Change'. Previous phases of the study were supported by the International Development Research Center, WHO, Overseas Development Administration, European Union, National Support Program for Centers of Excellence (PRONEX), the Brazilian National Research Council (CNPq) and Brazilian Ministry of Health. M.T.O. was supported by CAPES – Brazilian Government (process no. 434307-7).

References

1. Newby PK, Tucker KL. Empirically derived eating patterns using factor or cluster analysis: a review. Nutr Rev. 2004; 62:177–203. [PubMed: 15212319]
2. Rodrigues S, Caraher M, Trichopoulou A, et al. Portuguese households' diet quality (adherence to Mediterranean food patterns and compliance with WHO population dietary goals): trends, regional

Europe PMC Funders Author Manuscripts

disparities and socioeconomic determinants. Eur J Clin Nutr. 2008; 62:1263–1272. [PubMed: 17671445]

3. Pryer JA, Cook A, Shetty P. Identification of groups who report similar patterns of diet among a representative national sample of British aged 65 years of age or more. Public Health Nutr. 2001; 4:787–795. [PubMed: 11415486]
4. Lenz A, Olinto MT, Dias-da-Costa JS, et al. Socioeconomic, demographic, and lifestyle factors associated with dietary patterns of women living in Southern Brazil. Cad Saude Publica. 2009; 25:1297–1306. [PubMed: 19503960]
5. Forshee RA, Storey ML. Demographics, not beverage consumption, is associated with diet quality. Int J Food Sci Nutr. 2006; 57:494–511. [PubMed: 17162328]
6. Sadakane A, Tsutsumi A, Gotoh T, et al. Dietary patterns and levels of blood pressure and serum lipids in Japanese population. J Epidemiol. 2008; 18:58–67. [PubMed: 18403855]
7. Costacou T, Bamia C, Ferrari P, et al. Tracing the Mediterranean diet through principal components and cluster analyses in the Greek population. Eur J Clin Nutr. 2003; 57:1378–1385. [PubMed: 14576750]
8. Schulze M, Hoffmann K, Kroke A, et al. Dietary patterns and their association with food and nutrient intake in the European Prospective Investigation into Cancer and Nutrition (EPIC) – Postdam study. Br J Nutr. 2001; 85:363–373. [PubMed: 11299082]
9. Sánchez-Villegas A, Delgado-Rodríguez M, Martínez-González MA, et al. Gender, age, socio-economic and lifestyle factors associated with major dietary patterns in the Spanish Project SUN (Seguimiento Universidad de Navarra). Eur J Clin Nutr. 2003; 57:285–292. [PubMed: 12571661]
10. Quatromoni PA, Copenhafer DL, Demissie S, et al. The internal validity of a dietary patterns analysis. The Framingham Nutrition Studies. J Epidemiol Community Health. 2002; 56:381–388. [PubMed: 11964437]
11. Brunner E, Mosdøl A, Whitte DR, et al. Dietary patterns and 15-y risks of major coronary events, diabetes, and mortality. Am J Clin Nutr. 2008; 87:1414–1421. [PubMed: 18469266]
12. Nelson M, Gordon-Larsen P, North K, et al. Body mass index gain, fast food, and physical activity: effects of shared environments over time. Obesity. 2006; 14:701–709. [PubMed: 16741273]
13. Mikkilä V, Räsänen L, Raitakari O, et al. Major dietary patterns and cardiovascular risk factors from childhood to adulthood. The Cardiovascular Risk in Young Finns Study. Br J Nutr. 2007; 98:218–225. [PubMed: 17367571]
14. Deshmukh-Taskar P, Nicklas T, Yang S, et al. Does food group consumption vary by differences in socio-economic, demographic, and lifestyle factors in young adults? The Bogalusa Heart Study. J Am Diet Assoc. 2007; 107:223–234. [PubMed: 17258958]
15. Martikainen P, Brunner E, Marmot M. Socioeconomic differences in dietary patterns among middle-aged men and women. Soc Sci Med. 2003; 56:1397–1410. [PubMed: 12614692]
16. Harpham T, Huttly SR, Wilson I, et al. Linking public issues with private troubles: panel studies in developing countries. J Int Dev. 2003; 15:353–363.
17. Victora CG, Barros AJ. Cohort profile: The 1982 Pelotas (Brazil) Birth Cohort Study. Int J Epidemiol. 2006; 35:237–242. [PubMed: 16373375]
18. ABEP. Criterion of Brazilian Economic Classification. Brazilian Association of Research Institutes; São Paulo: 2003.
19. Victora CG, Huttly SR, Fuchs SC, et al. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. Int J Epidemiol. 1997; 26:224–227. [PubMed: 9126524]
20. Sichieri R, Castro JFG, Moura AS. Fatores associados ao padrão de consumo alimentar da população brasileira urbana. Cad Saude Publica. 2003; 19(Suppl. 1):S47–S53. [PubMed: 12886435]
21. van Dam RM, Rimm EB, Willett WC, et al. Dietary patterns and risk for type 2 diabetes mellitus in US men. Ann Intern Med. 2002; 136:201–209. [PubMed: 11827496]
22. Carrera PM, Gao X, Tucker KL. A study of dietary patterns in the Mexican–American population and their association with obesity. J Am Diet Assoc. 2007; 107:1735–1742. [PubMed: 17904933]
23. Gao X, Chen H, Fung T, et al. Prospective study of dietary pattern and risk of Parkinson disease. Am J Clin Nutr. 2007; 86:1486–1494. [PubMed: 17991663]

Europe PMC Funders Author Manuscripts

24. Park S, Murphy S, Wilkens LR, et al. Dietary patterns using the Food Guide Pyramid groups are associated with sociodemographic and lifestyle factors: the multi-ethnic cohort study. J Nutr. 2005; 135:843–849. [PubMed: 15795445]
25. Kourlaba G, Panagiotakos D, Mihas K, et al. Dietary patterns in relation to socio-economic and lifestyle characteristics among Greek adolescents: a multivariate analysis. Public Health Nutr. 2009; 12:1366–1372. [PubMed: 19063765]
26. Chan JM, Wang F, Holly EA. Pancreatic cancer, animal protein and dietary fat in a population-based study, San Francisco Bay Area, California. Cancer Causes Control. 2007; 18:1153–1167. [PubMed: 17805983]
27. Willett WC. Overview and perspective in human nutrition. Asia Pac J Clin Nutr. 2008; 17(Suppl. 1):1–4. [PubMed: 18296289]
28. Larson NI, Story M, Perry CL, et al. Are diet and physical activity patterns related to cigarette smoking in adolescents? Findings from project EAT. Prev Chronic Dis. 2007; 4:1–12.
29. Milligan RA, Burke V, Bielin LJ, et al. Influence of gender and socio-economic status on dietary patterns and nutrient intakes in 18-year-old Australians. Aust N Z J Public Health. 1998; 22:485–493. [PubMed: 9659778]
30. Hu FB. Dietary pattern analysis: a new direction in nutritional epidemiology. Curr Opin Lipidol. 2002; 13:3–9. [PubMed: 11790957]
31. Martinez ME, Marshall JR, Sechrest L. Invited Commentary: factor analysis and the search for objectivity. Am J Epidemiol. 1998; 148:17–19. [PubMed: 9663398]

Table 1

Socio-economic, demographic, anthropometric and behavioural characteristics according to gender in the 1982 Pelotas Birth Cohort Study (follow-up 2004–2005; *n* 4202)

	Male (*n* 2161)		Female (*n* 2041)		Total	
Characteristic	**%**		**%**		***n***	**%**
Mother's education (years of schooling)***						
0–4	33·2		32·1		1960	33·2
5–8	42·5		40·6		2454	41·6
9–11	10·9		11·3		654	654·0
≥12	13·4		15·0		838	838·0
Skin colour						
White	75·5		76·0		3182	75·7
Black/mixed	24·5		24·0		1020	24·3
Social position						
D+E (poorer)	44·9		46·9		1922	45·9
C	35·4		36·1		1496	35·7
A+B (richer)	19·7		17·1		773	18·4
Education (years of schooling)***						
0–4	9·3		6·9		341	8·1
5–8	31·8		22·8		1154	27·5
9–11	46·2		51·2		2043	48·6
≥12	12·7		19·1		664	15·8
Income change (from birth to 2004–2005)**						
Always poor	14·9		17·7		683	16·3
Non-poor→poor	15·3		18·0		698	16·6
Poor-non→poor	16·1		14·5		644	15·4
Never poor	53·7		49·8		2176	51·8
BMI (kg/m^2)*						
<18·5	4·8		7·1		248	5·9
18·5–24·9	64·1		65·7		2721	64·9
25·0–29·9	23·4		18·0		872	20·8
≥30·0	7·7		9·2		353	8·4
Physical activity during leisure time***						
None	28·9		64·9		1950	46·4
10 to 110 min/week	19·0		13·0		675	16·1
120 to 299 min/week	25·8		13·1		813	19·3
≥300 min/week	26·9		9·0		764	18·2
Current smoking**						
No	72·8		76·6		3137	74·5
Yes	27·2		23·4		1065	25·3
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age (years)	22·70	0·37	22·70	0·37	–	–
Physical activity during leisure time (min/week)*	216·90	301·20	79·70	185·60	150·00	260·90

P values based on comparison of cohort members' characteristics between sexes using χ^2 tests (Pearson's or trend) for categorical variables and *t* test for continuous variables:

** $P<0{\cdot}01$,

*** $P<0{\cdot}001$.

Table 2

Factor loading for the major factors (dietary patterns) in young adults in the 1982 Pelotas Birth Cohort Study (follow-up 2004–2005; *n* 4202)

	Dietary pattern				
Food group	**Common Brazilian**	**Processed food**	**Vegetable/fruit**	**Dairy/dessert**	**Tubers/pasta**
Sugar	0·687				
White bread	0·629				
Coffee	0·618				
Butter/margarine	0·612				
Rice	0·599				
Black beans	0·593				
Hot dog/hamburger/cheeseburger		0·563			
Beer		0·525			
Red meat (steak/ground meat/pork)		0·503			
Processed meat (sausage/salami/ham)		0·494			
Snacks (kibe/filled pastry/empanada)		0·443			
Soda		0·440			
Mayonnaise		0·420			
Pizza		0·403			
Barbecue[†]		0·383			
French fries		0·359			
Canned vegetables/pickles		0·350			
Liver and organ meat		0·314			
Other vegetables and legumes			0·607		
Yellow-dark vegetables			0·603		
Cruciferous vegetables			0·593		
Lettuce			0·560		
Other fruit (other than banana and orange)			0·514		
Tomato			0·507		
Onion/garlic			0·439		
Fruit juice/fruit pulp juice			0·304		
Milk				0·688	
Chocolate (powder/bar)				0·672	
Yoghurt				0·439	
Cheese				0·400	
Banana				0·365	
Cake/puddings/candies/sweet cookies				0·355	
Potato/other tubers					0·644
Manioc flour					0·599
Pasta/polenta					0·389
Eggs					0·310
Variance explained (%)[‡]	8·6	7·1	4·9	3·9	3·2

Food items with absolute loadings ≥0·3 are shown.

[†]Traditional southern Brazilian habit.

[‡]The percentage of total variance accounted by all factors is 27·6.

Europe PMC Funders Author Manuscripts

Table 3

Mean intake frequencies† of each food item comparing the lowest (T1) *v.* the highest (T3) tertiles across the dietary patterns

	Common Brazilian				Processed food				Vegetables/fruit				Dairy products				Tubers/pasta			
	T1		T3		T1		T3		T1		T3		T1		T3		T1		T3	
Dietary pattern/food item	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD
Common Brazilian																				
Sugar	214***	202	756	442	469	393	447	376	493***	420	435	385	445*	345	474	422	439**	390	481	388
White bread	348***	222	858	348	592	431	564	371	612***	422	568	417	507***	350	648	440	517***	352	654	455
Coffee	184***	208	666	477	434*	365	370	393	390*	399	421	399	440***	375	343	406	381*	391	417	403
Butter/margarine	207***	156	584	332	378	284	366	286	370	298	388	293	336***	256	413	305	396***	307	358	276
Rice	365***	157	689	261	546*	248	495	243	513	233	525	278	555***	244	478	225	488***	223	561	286
Black beans	210***	144	570	301	419*	273	346	260	366	271	384	282	438***	291	325	258	333***	260	428	298
Processed food																				
Hot dog/hamburger	84	89	47	65	34***	38	152	143	99***	128	75	85	84***	103	89	95	76***	92	101	129
Beer	48***	65	39	60	13***	24	78	81	42	60	42	64	54***	76	34	49	39**	56	45	68
Red meat	179***	145	147	146	92***	89	243	177	150***	137	178	156	149***	155	180	149	140***	123	193	166
Processed meat	211***	156	268	271	127***	128	357	243	219***	201	263	234	181***	165	307	253	286***	249	219	182
Snacks	69***	95	55	91	25***	43	111	126	68*	102	61	93	54***	91	72	103	54***	85	73	102
Soda	211**	227	246	345	111***	130	371	426	289***	408	189	221	191***	245	275	370	255***	343	212	232
Mayonnaise	98	119	106	208	47***	81	170	225	106***	166	100	177	86***	157	121	168	113*	171	98	167
Pizza	34***	40	19	32	12***	17	42	49	23	33	29	36	18***	30	35	41	22***	28	30	40
Barbecue	22***	47	24	26	17***	18	44	57	26***	32	32	31	26***	43	32	29	27**	29	32	53
French fries	54***	66	75	94	37***	46	95	101	69*	88	62	79	66	87	63	77	42***	50	92	103
Canned vegetables/pickles	52**	71	44	76	24***	37	75	95	30***	52	64	85	41***	66	51	76	52	82	47	66
Liver and organ meat	36	41	26	65	11***	24	39	73	13***	31	34	66	31***	66	19	41	15***	32	36	70
Vegetables/fruit																				
Other vegetables/legumes	187***	209	283	321	222	266	239	272	79***	110	414	327	266***	298	208	254	266***	299	225	253
Yellow-dark vegetables	185***	200	144	171	156	189	161	177	64***	77	277	234	141***	179	176	198	126***	154	198	207

Europe PMC Funders Author Manuscripts

	Common Brazilian				Processed food				Vegetables/fruit				Dairy products				Tubers/pasta			
	T1		T3		T1		T3		T1		T3		T1		T3		T1		T3	
Dietary pattern/food item	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD
Cruciferous vegetables	111	136	110	145	112	136	107	136	43***	57	190	177	110	139	104	130	73***	90	151	163
Lettuce	127**	138	111	162	112	150	121	147	46***	63	205	191	98***	134	135	162	119	160	117	145
Other fruit	344***	395	244	294	267***	359	321	367	142***	162	467	462	187***	243	392	435	248***	327	351	394
Tomato	220***	178	277	272	222***	198	269	237	129***	136	368	272	264*	256	244	217	287***	260	234	219
Onion and garlic	354***	272	272	509	495	390	508	410	300***	294	700	452	584***	410	453	395	646***	462	402	339
Fruit juice	159***	189	193	313	183	329	176	236	104***	177	254	347	126***	214	225	321	134***	243	222	315
Dairy products																				
Milk	231	236	224	301	232	298	225	236	229	281	241	264	68***	105	428	327	242	290	225	255
Chocolate	211***	224	171	287	146***	238	226	270	201**	277	181	239	48***	74	379	320	211***	283	175	224
Yoghurt	100***	136	52	106	55***	110	89	131	59***	110	94	139	24***	48	133	165	77	134	75	114
Cheese	217***	230	102	200	76***	140	237	266	116***	176	193	254	67***	121	249	279	215***	274	117	171
Banana	119***	141	181	281	156	226	150	211	107***	157	214	280	82***	103	233	297	151	232	164	211
Desserts/sweets	285***	250	367	449	238***	271	409	404	327	367	340	370	205***	209	459	457	268***	284	403	420
Tubers/pasta																				
Potato and other tubers	94***	100	110	140	106	144	103	101	81***	101	122	130	92*	114	103	117	52***	50	168	157
Manioc flour	17***	45	10	27	13	41	13	27	8***	31	19	42	10***	28	15	45	3***	8	29	5
Pasta/polenta	116***	94	131	137	102***	95	141	126	116***	112	130	111	124	127	122	100	84***	56	174	153
Eggs	91***	87	130	161	79***	89	153	157	118	131	112	126	113	139	117	120	77***	76	158	170

P values based on comparison of food frequencies between the lowest and the highest tertiles of dietary patterns using *t* test:

* $P<0·05$

** $P<0·01$

*** $P<0·001$.

† Number of food servings per year (365 d); shade represents the correspondent dietary pattern.

Table 4

Prevalence ratios (PR) and 95% CI comparing the highest *v.* the lowest tertiles of the main dietary patterns according to sociodemographic characteristics and lifestyle in 1982 Pelotas Birth Cohort Study (follow-up 2004–2005)

	Common Brazilian				Processed food			
Level/variable	**Unadjusted PR**	**95% CI**	**Adjusted PR**	**95% CI**	**Unadjusted PR**	**95% CI**	**Adjusted PR**	**95% CI**
Level I[†]								
Sex	0·003		0·016		<0·001		<0·001	
Men	Reference	–	Reference	–	Reference	–	Reference	–
Women	0·89	0·83, 0·96	0·92	0·86, 0·98	0·58	0·54, 0·64	0·60	0·56, 0·65
Skin colour	*P*<0·001		*P*=0·052		*P*=0·06		*P*=0·077	
White	Reference	–	Reference	–	Reference	–	Reference	–
Black/mixed	1·51	1·40, 1·62	1·09	1·02, 1·17	0·91	0·83, 1·00	1·09	0·99, 1·20
Mother's education (years of schooling)	*P*<0·001		*P*<0·001		*P*<0·001		*P*=0·003	
0–4	Reference	–	Reference	–	Reference	–	Reference	–
5–8	0·75	0·70, 0·80	0·94	0·88, 1·01	1·31	1·19, 1·45	1·14	1·03, 1·26
9–11	0·44	0·37, 0·52	0·76	0·64, 0·90	1·47	1·30, 1·67	1·17	1·02, 1·34
≥12	0·23	0·18, 0·28	0·63	0·50, 0·80	1·70	1·53, 1·90	1·22	1·07, 1·40
Education (years of schooling)	*P*<0·001		*P*<0·001		*P*<0·001		*P*=0·381	
0–4	Reference	–	Reference	–	Reference	–	Reference	–
5–8	0·81	0·76, 0·87	0·89	0·83, 0·96	1·53	1·25, 1·88	1·29	1·06, 1·57
9–11	0·54	0·50, 0·58	0·74	0·68, 0·81	1·64	1·35, 2·00	0·21	0·99, 1·48
≥12	0·13	0·10, 0·17	0·27	0·22, 0·38	2·02	1·65, 2·48	1·25	1·01, 1·56
Social position[‡]	*P*<0·001		*P*<0·001		*P*<0·001		*P*<0·001	
D+E (poorer)	Reference	–	Reference	–	Reference	–	Reference	–
C	0·59	0·54, 0·64	0·72	0·72, 0·86	1·44	1·32, 1·57	1·23	1·11, 1·35
A+B (richer)	0·24	0·20, 0·29	0·56	0·46, 0·69	1·87	1·71, 2·04	1·47	1·31, 1·64
Income change (from birth to 2004–2005)	*P*<0·001		*P*=0·027		*P*<0·001		*P*<0·001	
Always poor	Reference	–	Reference	–	Reference	–	Reference	–
Non–poor → poor	0·79	0·73, 0·87	1·00	0·91, 1·10	1·37	1·14, 1·64	1·20	0·99, 1·44
Poor → non-poor	0·86	0·79, 0·94	1·02	0·94, 1·12	1·78	1·51, 2·11	1·54	1·29, 1·81
Never poor	0·43	0·40, 0·47	0·88	0·79, 0·98	2·04	1·76, 2·36	1·43	1·21, 1·69

Europe PMC Funders Author Manuscripts

Level/variable	Common Brazilian				Processed food			
	Unadjusted PR	95% CI	Adjusted PR	95% CI	Unadjusted PR	95% CI	Adjusted PR	95% CI
Level II[§]								
Physical activity in leisure time	*P*<0·001		*P*=0·013		*P*<0·001		*P*=0·004	
None	Reference	–	Reference	–	Reference	–	Reference	–
10–110 min/week	0·91	0·81, 1·07	0·96	0·87, 1·05	1·20	1·08, 1·35	1·04	0·94, 1·16
120–299 min/week	0·83	0·74, 0·92	0·92	0·83, 1·01	1·39	1·26, 1·53	1·09	0·99, 1·20
≥300 min/week	0·79	0·71, 0·88	0·89	0·80, 0·99	1·50	1·36, 1·64	1·14	1·03, 1·24
Current smoking	*P*<0·001		*P*<0·001		*P*<0·001		*P*<0·001	
No	Reference	–	Reference	–	Reference	–	Reference	–
Current	1·50	1·40, 1·61	1·15	1·08, 1·23	1·29	1·20, 1·39	1·40	1·31, 1·51

[†]Adjusted for socio-economic and demographic (Level I) variables with *P* value <0·20 in the bivariable analysis.

[‡]Current family social position.

[§]Adjusted for variables of Level II (physical activity, smoking status and BMI) and potential socio-economic and demographic confounders from Level I (*P* value <0·20 in the multivariable analysis).

Europe PMC Funders Author Manuscripts

Table 5

Prevalence ratios (PR) and 95% CI comparing the highest *v.* the lowest tertiles of dietary patterns according to sociodemographic characteristics and lifestyle in 1982 Pelotas Birth Cohort Study (follow-up 2004–2005)

	Vegetable/fruit				Dairy/dessert				Tubers/pasta			
Level/variable	**Unadjusted PR**	**95% CI**	**Adjusted PR**	**95% CI**	**Unadjusted PR**	**95% CI**	**Adjusted PR**	**95% CI**	**Unadjusted PR**	**95% CI**	**Adjusted PR**	**95% CI**
Level I[†]												
Sex	*P*<0·001		*P*<0·001		*P*<0·001		*P*<0·001		*P*<0·001		*P*<0·001	
Men	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–
Women	1·77	1·64, 192	1·78	1·64, 1·93	1·19	1·11, 1·30	1·17	1·09, 1·26	0·74	0·68, 0·79	0·73	0·67, 0·79
Skin colour	*P*=0·191		*P*=0·045		*P*<0·001		*P*=0·061		*P*=0·268			
White	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	/	/
Black/mixed	1·06	0·97, 1·15	1·09	1·00, 1·20	0·66	0·60, 0·74	0·90	0·81, 1·00	1·05	0·96, 1·14	–	–
Mother's education (years of schooling)	*P*=0·746		*P*<0·001		*P*=0·008		*P*<0·001		*P*=0·001			
0–4	Reference	–	/	/	Reference	–	Reference	–	Reference	–	Reference	–
5–8	0·99	0·91, 1·08			1·40	1·17, 1·44	1·07	0·95, 1·19	0·88	0·81, 0·96	0·93	0·86, 1·02
9–11	0·97	0·85, 1·06			1·84	1·48, 1·88	1·16	1·01, 1·32	0·74	0·64, 0·85	0·82	0·71, 0·96
≥12	1·03	0·92, 1·16			2·18	1·18, 2·23	1·17	1·03, 1·33	0·66	0·57, 0·76	0·76	0·65, 0·91
Education (years of schooling)	*P*<0·001		*P*=0·681		*P*<0·001		*P*<0·001		*P*<0·001		*P*=0·929	
0–4	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–
5–8	0·99	0·84, 1·16	0·96	0·82, 1·12	1·49	1·02, 1·65	1·19	0·91, 1·54	0·85	0·75, 0·95	0·90	0·80, 1·01
9–11	1·10	0·95, 1·28	0·97	0·84, 1·13	2·58	1·80, 2·81	1·59	1·23, 2·05	0·78	0·70, 0·87	0·95	0·84, 1·07
≥12	1·23	1·04, 1·44	1·01	0·85, 1·22	3·55	2·42, 3·78	1·71	1·31, 2·23	0·64	0·55, 0·74	0·94	0·78, 1·13
Social position[‡]	*P*=0·052		*P*=0·275		*P*<0·001		*P*<0·001		*P*<0·001		*P*=0·02	
D+E (poorer)	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–
C	1·10	1·01, 1·19	1·07	0·98, 1·17	1·71	1·56, 1·89	1·22	1·10, 1·35	0·84	0·77, 0·91	0·90	0·82, 0·99
A+B (richer)	1·08	0·98, 1·20	1·06	0·93, 1·19	2·32	2·12, 2·53	1·37	1·22, 1·54	0·73	0·65, 0·82	0·86	0·75, 0·99
Income change (from birth to 2004–2005)	*P*=0·053		*P*=0·06		*P*<0·001		*P*<0·001		*P*<0·001		*P*=0·056	
Always poor	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–
Non–poor → poor	1·01	0·88, 1·16	1·02	0·89, 1·18	1·60	1·30, 1·98	1·31	1·06, 1·62	0·86	0·77, 0·97	0·94	0·84, 1·07
Poor → non–poor	1·16	1·02, 1·33	1·19	1·04, 1·36	2·00	1·64, 2·45	1·66	1·35, 2·03	0·92	0·82, 1·03	0·95	0·84, 1·06

Level/variable	Vegetable/fruit				Dairy/dessert				Tubers/pasta			
	Unadjusted PR	95% CI	Adjusted PR	95% CI	Unadjusted PR	95% CI	Adjusted PR	95% CI	Unadjusted PR	95% CI	Adjusted PR	95% CI
Never poor	1·10	0·98, 1·23	1·11	0·97, 1·26	2·89	2·43, 3·45	1·74	1·43, 2·12	0·75	0·69, 0·83	0·89	0·79, 1·00
Level II§												
Physical activity in leisure time	P=0·0132		P<0·001		P<0·001		P<0·001		P<0·001		P=0·001	
None	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–
10–110 min/week	0·90	0·81, 1·02	1·09	0·98, 1·21	1·07	0·96, 1·21	1·08	0·91, 1·20	1·23	1·10, 1·36	1·15	1·03, 1·27
120–299 min/week	0·97	0·88, 1·08	1·18	1·07, 1·31	1·21	1·10, 1·34	1·14	1·05, 1·25	1·13	1·02, 1·25	1·08	0·97, 1·20
≥300 min/week	1·10	1·00, 1·21	1·44	1·31, 1·59	1·34	1·22, 1·47	1·26	1·15, 1·38	1·29	1·18, 1·42	1·22	1·10, 1·34
Current smoking	P=0·053		P=0·54		P<0·001		P<0·001		P=0·146		P=0·421	
No	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–	Reference	–
Current	0·91	0·83, 1·00	0·97	0·89, 1·06	0·6	0·54, 0·67	0·76	0·68, 0·84	1·06	0·98, 1·15	0·96	0·89, 1·05

† Adjusted for socio-economic and demographic (Level I) variables with P value <0·20 in the bivariable analysis.

‡ Current family social position.

§ Adjusted for variables of Level II (physical activity, smoking status and BMI) and potential socio-economic and demographic confounders from Level I (P value <0·20 in the multivariable analysis).

‖ Not included in multivariable analysis due to P value ≥0·20 in the bivariable analysis