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Full Length Research Paper

Association of dietary patterns with metabolic syndrome components in low-income, free-living Brazilian adults

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This study investigated the association of dietary patterns with sociodemographic markers and components of metabolic syndrome in free-living adults. A descriptive, cross-sectional study was done with a sample of 237 individuals registered at one Family Health Strategy Unit. Biochemical, clinical, socioeconomic and dietary data were collected. Multiple and logistic linear regression were used and the significance level was set at 5%. Three dietary patterns were found and named western pattern, healthy pattern and traditional pattern upon recommendations found in the literature. People with the traditional dietary pattern were older, those with the western dietary pattern had higher education levels and those with the healthy pattern had the lowest income in minimum wages. The healthy pattern presented the lowest odds ratio for abdominal obesity (0.60; CI: 0.44-0.82; p<0.05). High blood glucose was positively associated with the western pattern. The odds ratio for hypertriglyceridemia was highest for those in the highest quartile of processed food intake. The Western dietary pattern and high percentage of processed foods in the diet must be avoided if hyperglycemia and hypertriglyceridemia are to be prevented or treated; in analogy, the healthy pattern must be promoted to reduce the risk of abdominal obesity.

Key words: Nutrition, metabolic syndrome, diet pattern, low-income.

INTRODUCTION

Changes in epidemiologic patterns and the growing rates of non-communicable chronic diseases lead to an increase in the number of studies that investigate how lifestyle influences the etiology of these diseases. There is a confluence of risks for many chronic diseases associated with similar dietary and lifestyle patterns.

The greatest limitation of epidemiologic studies that investigate the relationship between diet and disease has been the difficulty of identifying an individual's habitual diet accurately and exactly (Beaton, 1994). The World Health Organization (WHO) suggests that assessments of populations' food intake should be based on dietary patterns rather than on nutrients (WHO, 1998), since the consumption of different foods results in a complex combination of chemical compounds that can be antagonistic, compete with each other or change the bioavailability of other chemical compounds or nutrients (Willett, 2000).

Diet also plays an important role in high risk groups, such as those of low socioeconomic level. A better understanding of the heterogeneity of food intake and the features that can predict risky dietary patterns with regard to chronic diseases contributes to increase the efficiency of nutritional interventions that aim these groups (Hamer and Mishra, 2010).

Lifestyle is directly associated with the incidence of the metabolic syndrome (McLellan et al., 2007). Some

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studies have shown that the consumption of whole grains (McKeomn et al., 2004; Esmaillzadeh et al., 2005; Sahyoun et al., 2006), fruits and non-starchy vegetables (Esmaillzadeh et al., 2006) is associated with a smaller risk for the metabolic syndrome. Other studies have shown that dietary fats increase the risk of Asian populations to develop the metabolic syndrome (Freire et al., 2005; Chen et al., 2009). And yet other studies assessed how dietary patterns (Williams et al., 2000; Esmaillzadeh et al., 2007; Panagiotakos et al., 2007; Lutsey et al., 2008) generally affect the incidence of the metabolic syndrome, but few assessed their effects on low-income populations (Sodjinou et al., 2009; Hamer and Mishra, 2010).

Identifying great changes in dietary patterns and exploring their relationships with economic, social, demographic and health factors will allow better understanding of their causes and consequences which could then lead to the development of proposals that promote healthy dietary changes. The purpose of this study was to identify dietary patterns, assess the sociodemographic characteristics associated with these patterns and assess the associations between these patterns and components of the metabolic syndrome.

MATERIALS AND METHODS

Study design

A descriptive and analytical cross-sectional study was done at the Family Health Strategy Unit of the Rubião Junior district of the city of Botucatu, SP, from September 2008 to May 2009. This Family Health Strategy Unit has the records and follows 1300 individuals aged 35 years and older. Considering prevalence of the metabolic syndrome (21%) among this population according to the NCEP-ATP III (2001) diagnostic criteria, a representative sample was identified (Dean, 2007) to be 216; thus, 216 individuals were to be assessed, divided by gender into two groups of 108, with a significance level of 5%. The individuals were selected randomly at the waiting room of the Family Health Strategy Unit. The project was approved by the School of Medicine of Botucatu/UNESP research ethics committee, under protocol number 322/08.

The inclusion criteria were: individuals visiting the Health Care Unit for treatment or for accompanying someone undergoing treatment, having records at the Unit, aged 35 years or older, and having no symptoms or disease that requires dietary changes and/or changes body composition. A total of 237 individuals were assessed of which 23 were excluded for the following reasons: 12 had a daily energy intake below 500 kcal or above 5000 kcal, 7 had incomplete records, 2 had no records at the Health Care Unit, 1 was pregnant, and 1was undergoing cancer treatment. Hence, 214 individuals were included, of which 56.1% were females.

The variables age, gender, education level (in years) and income (in minimum wages per month) were recorded for the sociodemographic and economic characterization of the sample.

Food intake assessment

Food intake was assessed by two methods: the 24 h dietary recall and the food frequency questionnaire (FFQ). The nutritional composition of the diet, specifically macronutrients, dietary fat, cholesterol and fibers, was determined by the software NutWin version 1.5 (Anção et al., 2002). The percentage of the total calories from processed foods was assessed by the 24 h recall. This was achieved by adding all the calories in the processed foods, multiplying the result by 100 and dividing this number by the total calories of the diet. The following foods were considered processed: sugars (refined sugar, powdered drink mix, soda, chocolate powder mix and candy), sweets (ice cream, chocolate, cake and homemade sweets), refined flours and preparations (refined flours in general, corn meal, white bread and pasta), cookies (sandwich or plain), processed meats (sausages, ham, Bologna sausage and hot dogs), fats (margarine, mayonnaise, butter, lard and bacon), canned foods (tomato sauce, corn, peas, palm heart and stew of black beans with beef and pork) and extruded snacks.

Blood pressure determination

Blood pressure was measured indirectly by auscultation using a mercury sphygmomanometer. The measurements were taken from both upper limbs while the individual was sitting down. If the pressures differed, the subsequent measurements were taken from the arm with the highest pressure. At least three measurements were made at 1 min intervals, and the mean of the two last measurements was considered the blood pressure of the individual (VI Diretrizes Brasileiras de Hipertensão Arterial, 2010).

Body composition

Anthropometric assessment was done with the individuals using light clothes and barefoot, standing up with the feet together (Heyward, 2000). Weight was determined by a digital scale with an accuracy of 100 g and height by a portable stadiometer with an accuracy of 0.1 cm. The body mass index (BMI) was then calculated and the nutritional status of the individual was classified according to the WHO's criteria (WHO, 1995). Waist circumference (WC) was measured with an inelastic tape measure at the midpoint between the lowest rib and the iliac crest.

Biochemical tests

A blood sample after a 12 h overnight fast was taken by venipuncture using the standard vacuum-tube system. The serum was obtained by centrifuging the samples at 3000 rpm for 5 min. Glucose, total cholesterol, HDL-cholesterol and triacylglycerides were quantified within 4 h of blood collection with a semi-automatic spectrophotometer (Labquest®, Labtest Diagnóstica) and commercial kits (Labtest Diagnóstica) by enzymatic colorimetric assay.

Diagnosis of the metabolic syndrome

The metabolic syndrome was diagnosed as recommended by the National Cholesterol Education Program – Adult Treatment Panel III (NCEP ATP-III, 2001), which includes five components: waist circumference > 88 cm for women or >102 cm for men, HDL-c < 50 mg/dL for women or < 40 mg/dL for men, TG ≥ 150 mg/dL, blood pressure ≥ 130/85 mmHg. A more recent threshold was considered for glucose: the individual was considered hyperglycemic if fasting glucose was > 100 mg/dL. The metabolic syndrome was diagnosed

Table 1. Matrix of the rotated correlation with the respective foods and the identification of the dietary patterns.

Food	Factor 1	Factor 2	Factor 3	
Pizza/ instant pasta/ sandwich	0.78			Western pattern
Sandwich cookies	0.57			Western pattern
Plain cookies	0.53			Western pattern
High-sugar and high-fat sweets	0.47			Western pattern
Mayonnaise, butter, margarine	0.46			Western pattern
Beverages with added sugar	0.44			Western pattern
Beans		0.78		Traditional pattern
Rice		0.78		Traditional pattern
Flour		0.50		Traditional pattern
Pasta		0.44		Traditional pattern
Whole dairy products			0.61	Healthy pattern
Fresh juices			0.60	Healthy pattern
Whole wheat breads			0.54	Healthy pattern
Fruits			0.50	Healthy pattern
Vegetables			0.47	Healthy pattern
Popcorn			0.44	Healthy pattern
Fish			0.43	Healthy pattern

if three or more of the aforementioned components were present.

Statistical analysis

Frequencies and percentages were calculated for the general categorical variables and stratified by gender. The chi-square test was used to compare these proportions. Descriptive statistics (mean, standard deviation, minimum, maximum and median) were calculated for the continuous variables for the entire sample and by gender. The Wilcoxon test was used to compare these variables between the genders.

Pearson's correlation between macronutrient intake (in grams and the percentage) between the FFQ and the 24 h recall was used for validation of the food frequency questionnaire. The dietary patterns were identified by varimax rotation. The objective of varimax rotation is to maximize the greater and minimize the smaller factor loadings to ease interpretation. The empiric criterion was used for choosing the number of factors (patterns) (Thurstone, 1947), selecting 3. Each factor was given loadings (weights) for all the foods/food groups. Those that received a loading greater than 0.4 were considered foods/food groups that represented the factor (dietary pattern). The dietary patterns were named according to the food items with the greatest loadings and by using the names given to similar patterns by other studies (Sichieri, 2002; Esmaillzadeh et al., 2007).

Logistic regression was used to verify the relationship between the components of the metabolic syndrome (dependent variables) and dietary patterns (independent variables). This analysis was adjusted for gender, age, BMI and total calories. Multiple linear regression was used to verify the relationship between the components of the metabolic syndrome (dependent and continuous variables) and dietary patterns (independent variables), adjusted for gender, age, BMI and total calories. In the processed food analysis, logistic regression was used to verify the relationship between the components of the metabolic syndrome and the first and last quartile of the percentage of energy coming from processed foods. The level of significance was set at 5% for all tests or the corresponding p-value was used. All analyses were done by the software SAS for Windows, version 9.1.3.

RESULTS

Table 1 shows the matrix of the rotated correlation with the respective foods, illustrating the identification of the dietary patterns. Each food item contains loadings of each extracted factor. Foods whose factor loading exceeded 0.40 were maintained in the matrix. The dietary patterns were named according to the characteristics of the foods they contained (western, traditional, and healthy).

The western dietary pattern is characterized by the highest consumption of pizza, small meals, instant pasta, sandwich cookies, plain cookies, sweets high in sugars and fats (cake, pudding and ice cream), mayonnaise, butter, margarine and sugary beverages (sodas and powdered drink mixes with added sugar). In the traditional pattern, the most common foods are rice, beans, flours (especially those added to rice and beans in addition to corn meal) and pasta. The most common foods in the healthy pattern are whole dairy items, fresh juices, whole breads, fruits, non-starchy vegetables, homemade popcorn and fish.

The sociodemographic and dietary characteristics of the individuals are presented in Table 2. The traditional dietary pattern was typical of older individuals, the western pattern of those with higher education level and those who spent more on food "per capita" and the healthy pattern of those who had the lowest income in minimum wages. The dietary patterns were not different

Table 2. Sociodemographic characteristics and nutrient intake in 24 h of the individuals studied in their dietary patterns.

	Western pattern	Traditional pattern	Healthy pattern
Age (years)	50.0±11.2[a]	58.2±10.0[b]	48.8±10.2[a]
Educational level (years)	5.3±3.5[a]	4.2±3.8[a,b]	3.3±2.7[b]
Income (in minimum wages)	0.9±0.7[a]	0.8±0.5[a]	0.5±0.3[b]
Expenses with food (U$)	82.6±44.3[a]	75.8±37.4[a,b]	54.9±33.6[b]
Energy (kcal)	2256±1296[a]	1899±856[a]	1946±854[a]
Carbohydrates (g)	309±199[a]	269±129[a]	278±127[a]
Carbohydrates (%TEI)	53.4±8.6[a]	56.7±6.9[a]	57.6±7.6[a]
Protein (g)	85.6±42.7[a]	73.9±22.7[a]	73.1±35.9[a]
Protein (% TEI)	16.3±4.1[a]	15.8±2.1[a]	15.3±3.4[a]
Total Fat (g)	74.4±44.9[a]	59.1±30.3[a]	59.2±31.2[a]
Total Fat (% TEI)	29.3±6.4[a]	27.4±5.2[a]	27.1±5.9[a]
SFA (% TEI)	9.6±3.1 [a]	9.3±2.8[a,b]	8.1±2.8[b]
MUFA (% TEI)	9.4±2.6[a]	8.7±2.2[a]	10.0±9.5[a]
PUFA (% TEI)	6.4±1.6[a,b]	6.0±1.4[a]	7.1±2.1[b]
Fiber (g)	18.3±11.3[a]	20.9±20.2[a]	19.8±8.8[a]
Cholesterol (mg)	285±185[a]	229±152[a,b]	206±125[b]

TEI = Total energy intake; SFA: saturated fatty acids; MUFA: monounsaturated fatty acids; PUFA: polyunsaturated fatty acids; chi-square test: different letters indicate significant differences (p< 0.05)

with regard to total energy intake, carbohydrates in grams and percentage of carbohydrates, proteins, fats, monounsaturated fats and fibers in relation to total energy intake. However, the percentages of saturated fat and cholesterol were higher in the western pattern while the healthy pattern had higher mean percentages of polyunsaturated fats.

Table 3 shows the main results of the odds ratio for the presence of the metabolic syndrome and its components, according to dietary patterns. The healthy dietary pattern protected against abdominal fat (0.60; CI: 0.44-0.82; p<0.05).

High blood glucose was positively associated with the western pattern according to multiple logistic regression (Table 4).

A significant odd ratio was found for hypertriglyceridemia among individuals in the highest intake quartile (59.04±10.9% of the total calorie intake) compared with the lowest quartile (8.83±6.78% of the total calorie intake) (Table 5).

DISCUSSION

The present study found an association between dietary patterns and the socioeconomic, anthropometric and biochemical characteristics of adults. However there was no significant association among diets with the presence of metabolic syndrome. The fact that dietary patterns are associated with the components and risk factors of the metabolic syndrome but not with its presence shows that this disease has a multifactorial character.

Three dietary patterns were identified in this study. The healthy dietary pattern was similar to many dietary patterns mentioned in various studies (Wirfalt et al., 2001; Martikainen et al., 2003; Perrin et al., 2005; Mishra et al., 2006; Kesse et al., 2006; Esmaillzadeh et al., 2007; Kim et al., 2008; Sodjinou et al., 2009; Deshmukh-Taskar et al., 2009; Kesse-Guyot et al., 2009; Rezazadeh et al., 2010; Hamer and Mishra, 2010), as well as the western pattern (Kesse et al., 2006; Esmaillzadeh et al., 2007; Kim et al., 2008; McNaughton et al., 2008; Sodjinou et al., 2009; Rezazadeh et al., 2010; Hamer and Mishra, 2010).

In the present study, the difference in education level between individuals consuming a healthy versus a western diet was of two years, and neither group had completed elementary school. The difference in income was smaller than 0.5 minimum wages, both groups presenting a “per capita” income below one minimum wage. The differences between these variables are small, since these individuals are all from a low socioeconomic level, characterizing a homogeneous sample with regard to income and education level. Yet, the neighborhood in which they live allows them to plant some of their own food (foods found in the healthy dietary pattern, that is, fruits and non-starchy vegetables) and most of them do plant their own food. Hence, a higher income may not mean a greater consumption of these foods. Furthermore, individuals with higher income made less healthy food choices (western diet), indicating that reducing the price of healthy foods, in addition to increasing their

Table 3. Logistic regression and odds ratio for the presence of the metabolic syndrome and its components according to dietary patterns.

	Dietary patterns	Estimated	SE	p-value	OR (CI 95%)
Hypertention	Western	-0.04	0.17	0.80	0.96 (0.69-1.33)
	Adjusted¹	0.16	0.21	0.46	1.17 (0.77-1.79)
	Traditional	0.12	0.15	0.44	1.12 (0.84-1.51)
	Adjusted¹	0.09	0.16	0.55	1.10 (0.80-1.50)
	Healthy	-0.08	0.15	0.59	0.92 (0.70-1.23)
	Adjusted¹	0.02	0.19	0.91	1.02 (0.70-1.49)
WC	Western	-0.17	0.15	0.27	0.85 (0.63-1.13)
	Adjusted²	-0.13	0.19	0.50	0.88 (0.60-1.28)
	Traditional	-0.10	0.14	0.48	0.90 (0.68-1.20)
	Adjusted²	-0.10	0.16	0.54	0.91 (0.66-1.24)
	Healthy	-0.50	0.16	0.001	0.60 (0.44-0.82)
	Adjusted²	-0.49	0.20	0.01	0.61 (0.42-0.89)*
HDL-c	Western	0.08	0.23	0.74	1.08 (0.69-1.68)
	Adjusted¹	-0.11	0.27	0.68	0.89 (0.53-1.51)
	Traditional	-0.35	0.24	0.14	0.70 (0.44-1.12)
	Adjusted¹	-0.32	0.27	0.23	0.73 (0.43-1.23)
	Healthy	-0.23	0.17	0.17	0.79 (0.57-1.11)
	Adjusted¹	-0.27	0.23	0.24	0.76 (0.48-1.21)
TG	Western	0.33	0.23	0.15	1.40 (0.88-2.20)
	Adjusted¹	0.26	0.26	0.32	1.29 (0.77-2.16)
	Traditional	-0.04	0.23	0.87	0.96 (0.61-1.51)
	Adjusted¹	-0.001	0.26	0.99	1.00 (0.60-1.65)
	Healthy	-0.08	0.16	0.61	0.92 (0.67-1.26)
	Adjusted¹	0.005	0.21	0.98	1.00 (0.67-1.51)
GLU	Western	0.37	0.25	0.14	1.45 (0.88-2.39)
	Adjusted¹	0.45	0.30	0.14	1.57 (0.87-2.86)
	Traditional	-0.12	0.28	0.68	0.89 (0.52-1.53)
	Adjusted¹	-0.22	0.30	0.46	0.80 (0.45-1.44)
	Healthy	-0.44	0.23	0.06	0.64 (0.41-1.02)
	Adjusted¹	-0.33	0.31	0.30	0.72 (0.39-1.34)
MS	Western	0.21	0.23	0.35	1.23 (0.79-1.93)
	Adjusted¹	0.26	0.27	0.33	1.30 (0.77-2.18)
	Traditional	-0.24	0.24	0.32	0.79 (0.49-1.26)
	Adjusted¹	-0.31	0.26	0.24	0.73 (0.44-123)
	Healthy	-0.29	0.17	0.09	0.75 (0.54-1.04)
	Adjusted¹	-0.20	0.18	0.27	0.82 (0.57-1.16)

¹Adjusted for gender, age, body mass index and total energy intake; ²Adjusted for age and total energy intake; SE= Standard Error; CI= confidence interval; WC = waist circumference; HDL-c= High Density Lipoprotein cholesterol; TG= triglycerides; GLU = glucose; MS = Metabolic Syndrome. *p<0,05

supply and availability, can be a better public health strategy than providing direct financial assistance to these individuals.

Some studies report that income and education level are positively associated with healthy dietary patterns and negatively associated with the dietary pattern

Table 4. Multiple regression of the components of metabolic syndrome, according to dietary patterns.

	Dietary pattern	B± Standard Error	P-value
SBP	Western	-0.61 ± 1.71	0.72
	Adjusted[1]	1.56 ± 2.57	0.55
	Traditional	0.26 ± 1.46	0.86
	Adjusted[1]	-2.06 ± 2.53	0.42
	Healthy	0.09 ± 1.47	0.95
	Adjusted[1]	2.24 ± 2.14	0.30
DBP	Western	0.99 ± 1.50	0.51
	Adjusted[1]	0.84 ± 1.64	0.61
	Traditional	-1.27 ± 1.55	0.41
	Adjusted[1]	-1.40 ± 1.62	0.39
	Healthy	0.91 ± 1.08	0.40
	Adjusted[1]	1.63 ± 1.37	0.24
WC	Western	1.43 ± 1.37	0.30
	Adjusted[2]	0.88 ± 0.73	0.23
	Traditional	0.28 ± 1.41	0.84
	Adjusted[2]	-0.19 ± 0.71	0.80
	Healthy	-0.15 ± 0.98	0.88
	Adjusted[2]	0.37 ± 0.61	0.54
HDL-c	Western	-1.39 ± 1.17	0.24
	Adjusted[1]	-0.71 ± 1.40	0.61
	Traditional	1.31 ± 1.21	0.28
	Adjusted[1]	0.79 ± 1.35	0.56
	Healthy	-0.38 ± 0.84	0.65
	Adjusted[1]	0.47 ± 1.14	0.69
TG	Western	3.03 ± 11.03	0.78
	Adjusted[1]	1.66 ± 12.61	0.90
	Traditional	1.03 ± 11.40	0.93
	Adjusted[1]	1.70 ± 12.41	0.89
	Healthy	-12.50 ± 7.95	0.12
	Adjusted[1]	-6.09 ± 10.52	0.56
GLU	Western	11.74 ± 4.08	0.005*
	Adjusted[1]	11.28 ± 4.52	0.01*
	Traditional	3.16 ± 4.22	0.46
	Adjusted[1]	2.41 ± 4.45	0.59
	Healthy	-1.26 ± 2.94	0.67
	Adjusted[1]	-2.38 ± 3.77	0.53

[1]Adjusted for gender, age, body mass index and total energy intake; [2]Adjusted for age and total energy intake
SBP= Systolic Blood Pressure; DBP= Diastolic Blood Pressure; WC = waist circumference; HDL-c= High Density Lipoprotein cholesterol; TG= triglycerides; GLU = glucose; MS = Metabolic Syndrome. *p<0,05

characterized as western (unhealthy) (Martikainen et al., 2003; Perrin et al., 2005; Rezazadeh et al., 2010; Hamer and Mishra, 2010). Even though the individuals studied belong to the same low socioeconomic level, we notice that the ones who presented a western dietary pattern in our sample had slightly higher income and education level than those who consumed the healthy pattern, which was also observed in other studies with low-income populations (Sodjinou et al., 2009; Hamer and Mishra, 2010).

In the regressions between the dietary patterns and the components of the metabolic syndrome, there was a

Table 5. Logistic regression and *odds ratio* for metabolic syndrome and its compounds for the highest intake quartile compared with the lowest quartile of energy intake from processed food.

	Estimated	SE	p-value	OR (CI 95%)
Metabolic syndrome	-0.25	0.29	0.41	1.27 (0.44-1.39)
Blood pressure	0.17	0.16	0.28	1.18 (0.76-2.58)
Waist circumference	-0.001	0.16	0.99	1.0 (0.53-1.87)
HDL-c	-0.18	0.16	0.27	0.83 (0.36-1.33)
Triglycerides	0.35	0.17	0.04	1.42 (1.03-3.91)*
Glucose	-0.16	0.19	0.42	0.85 (0.34-1.56)

SE= Standard Error; OR = odds ratio; CI= confidence interval; HDL-c= High Density Lipoprotein cholesterol. *p<0,05

lower odds ratio for increased waist circumference among individuals with a healthy dietary pattern, in addition to a positive association between the western pattern and high blood glucose. These data are corroborated by many studies in the literature (Esmaillzadeh et al., 2007; Wirfalt et al., 2001; Deshmukh-Taskar et al., 2009; Kesse-Guyot et al., 2009; Mishra et al., 2006; McNaughton 2007, 2008).

The greater percentage of energy coming from processed foods presented a higher odds ratio for hypertriglyceridemia, which was also observed in the 7314 participants of the Whitehall II study, where pattern 1 (consisting mostly of processed foods such as flours, sugar, cold meats, sugary beverages) was positively associated with serum triglycerides (McNaughton et al., 2009).

According to the First Brazilian Guideline for the Diagnosis and Treatment of the Metabolic Syndrome (2005), some foods must be consumed because they promote health, such as non-starchy vegetables, whole breads, fruits and fish. These foods were present in the healthy dietary pattern identified in the present study, and it protected against abdominal obesity.

There is also the recommendation to reduce the consumption of some foods, such as sweets, white breads, deep-fried homemade snacks, margarine, mayonnaise, butter and cold meats (I Diretriz Brasileira de Diagnóstico e Tratamento da Síndrome Metabólica, 2005), foods found in the western dietary pattern of the present study and in the group of processed foods. These foods were positively associated with high blood glucose and triglycerides, components of the metabolic syndrome.

The present study has some limitations, such as the administration of a single 24 h recall, not allowing a better study of the habitual diet of these individuals. Since it is a cross-sectional study, it is impossible to investigate the cause-effect relationship. However, it is the ideal type of study for those wishing to develop hypotheses.

The studied individuals were selected in the waiting room of a single Family Health Strategy Unit of the city of Botucatu/SP. This convenience sample makes it impossible to extend these results to all users of this Family Health Strategy Unit or to other ones in the city, state and country. Furthermore, although the results of the present study agree with those of the literature, the present study did not assess some possibly confounding variables that are very important influencing factors for blood pressure and cholesterol levels, such as smoking status, alcohol consumption, use of antihypertensive drugs, level of physical activity, family history of hypertension and race, but which should be included in future studies.

Conclusion

Three dietary patterns were identified by the present study, each with distinct socioeconomic, demographic and dietary characteristics that can be a useful tool for the development of nutrition interventions. A diet rich in non-starchy vegetables, fruits, fresh juice, whole wheat bread, dairy, fish and homemade popcorn (healthy dietary pattern) can reduce the risk of abdominal obesity. The positive associations of high blood glucose with the Western dietary pattern and high consumption of processed foods with high triglycerides indicate that such foods must be avoided if one wishes to prevent or treat hyperglycemia and hypertriglyceridemia. Policies to reduce the cost and increase the supply and access to healthy foods can be more effective than providing direct financial assistance for people to buy food, since their choices may be inappropriate.

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