Artículo Original / Original Article

Dietary patterns of patients with chronic coronary heart disease: a cross-sectional study

Modelos dietéticos de pacientes con enfermedad crónica de las arterias coronarias: un estudio transversal

ABSTRACT

The objective of this study was to identify dietary patterns in an outpatient cohort of coronary heart disease (CHD) patients, to compare these patterns with dietary recommendations of the international cardiology guidelines, and verify associations with cardiovascular risk factors. Dietary intake was assessed through a food frequency questionnaire. Dietary patterns were identified by cluster analysis. The total energy intake, fiber, cholesterol, macro and micronutrients were calculated. Two dietary patterns were identified in 123 patients. Pattern I was characterized by a greater consumption of whole carbohydrates, beans, meats, vegetables, and fruits. Pattern II was rich in refined carbohydrates, fried foods, and sweets. Participants in pattern I had lower values of diastolic blood pressure (DBP) with 77.1 ± 9.9 mmHg ($p=0.002$) and glycated hemoglobin (HbA1c) of 7.83 ± 1.76 % ($p=0.029$) compared to pattern II with 84.1 ± 14.3 mmHg and 9.02 ± 2.29 %, respectively. Therefore, pattern I had a healthier nutritional composition, however, nutritional adequacy was still lacking. Despite this, participants in pattern I had significantly lower values of DBP and HbA1c, in addition to being associated with a better control of DBP.

Keywords: Cluster Analysis, Coronary Heart Disease, Diet, Risk Factors.

RESUMEN

El objetivo de este estudio fue identificar los modelos dietéticos de una cohorte de pacientes ambulatorios con enfermedad de las arterias coronarias (EAC) y compararlos con las recomendaciones dietéticas de las directrices internacionales de cardiología y verificar su asociación con el control de los factores de riesgo cardiovascular. La ingesta dietética se evaluó mediante un cuestionario de frecuencia de consumo. El modelo dietético fue identificado por análisis de conglomerados. Se calculó la ingesta energética total, fibras, colesterol, macro y micronutrientes. Se identificaron dos modelos dietéticos en 123 pacientes. El modelo I se caracterizó por un mayor consumo de carbohidratos enteros, frijoles, carnes, verduras y frutas. El modelo II era rico en carbohidratos refinados, alimentos fritos y dulces.

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Los participantes en el modelo I tuvieron valores más bajos de presión arterial diastólica (PAD) con 77.1 ± 9.9 mmHg ($p=0.002$) y hemoglobina glucosilada (HbA1c) de 7.83 ± 1.76 % ($p=0.029$) en comparación con el modelo II con 84.1 ± 14.3 mmHg y 9.02 ± 2.29 %, respectivamente. Por lo tanto, el modelo I tenía una composición nutricional más saludable, sin embargo, todavía carece de adecuación nutricional. A pesar de esto, los participantes del modelo I

tuvieron valores más bajos de PAD y HbA1c.

Palabras clave: Análisis de conglomerados; Dieta, Enfermedad de las arterias coronarias; Factores de riesgo.

INTRODUCTION

Coronary heart disease (CHD) is a chronic inflammatory disease of multifactorial etiology which occurs in response to endothelial aggression¹. Lifestyle modifications are important to assist in the control of cardiovascular risk factors, including adequate management of comorbidities, such as diabetes mellitus, hypertension, and dyslipidemia. A healthy lifestyle involves body weight control, smoking cessation and adherence to a healthy eating pattern².

Consistent data have shown that healthy dietary patterns characterized by consumption of vegetables, fruits and whole grains are associated with a lower risk of CHD and incidence of major cardiovascular events^{3,4,5,6,7,8}. Similarly, inadequacies in the consumption of diet components, such as carbohydrates, fats, and their subtypes are related to a worse control of risk factors and cardiovascular outcomes^{9,10}. In recent decades, the role of dietary factors in the development of CHD has been studied in epidemiological research. Many studies have been conducted to identify dietary patterns that characterize the combination of the usual intake of food groups, thus providing a more comprehensive understanding of how diet affects the etiology of diseases^{11,12}. This evaluation can be analyzed in two ways: a priori, eating patterns are defined based on a scoring system or a posteriori, when data from dietary surveys are aggregated through specific statistical analysis¹³.

However, the relationship between healthy dietary patterns and their diet components with cardiovascular risk factors should be better established. Despite research in recent years, there are still few studies on the dietary pattern of patients with ischemic disease in Brazil. Therefore, the objective of this study was to identify and describe dietary patterns defined a posteriori, in order to compare them with the dietary recommendations from literature, and to verify associations with the control of cardiovascular risk factors in a group of patients with stable CHD.

METHODS

This cross-sectional observational study was conducted in an outpatient tertiary care cardiovascular clinic at a university hospital in the south of Brazil. The study was approved by the hospital research and ethics committee under protocol number 16-0362. All procedures involved in this study was conducted in accordance with the ethical principles of the Declaration of Helsinki of 1975, updated in 2013. All participants signed an informed consent document before entering the study. This study was conducted and described according to STROBE guidance (Strengthening the Reporting of Observational Studies in Epidemiology)¹⁴.

Study Sample

This study was conducted in patients with stable

CHD who had been receiving cardiovascular care for at least 3 months. CHD was defined as a clinical history of at least one of the following documented episodes: 1) a documented episode of acute myocardial infarction (AMI); 2) percutaneous or surgical revascularization; 3) coronary angiography with evidence of lesions $\geq 50\%$ of the left coronary artery, or $\geq 70\%$ in the diagonal, circumflex or right coronary arteries; 4) positive non-invasive testing of ischemia. In addition, patients should have preserved cognitive capacity to respond the data collection questionnaires. The patients were required to have also at least six teeth in the mouth, because this present study is related to a line of study on oral health and nutrition. Exclusion criteria were: no stable CHD diagnosis, outpatient follow-up <3 months, presence of documented neurological sequelae and <6 teeth present in the mouth.

The protocol of cardiovascular care in this outpatient clinic included statins and antiplatelet agents for all patients. Oral hypoglycemic drugs, insulin, β -blockers or angiotensin-converting enzyme inhibitors and other antihypertensive medications were also prescribed when necessary. Non-pharmacological counseling included general guidance about lifestyle modification in relation to diet and physical activity.

The size of the group of subjects to measure the dietary pattern was adequately planned. Ten individuals were included for each food group studied (12 food groups were studied along with 123 subjects)¹⁵.

The medical records of 541 patients were consecutively reviewed from November 2016 to December 2017, in accordance with the inclusion and exclusion criteria of the study. Fifty-three subjects (9.8%) were not diagnosed with stable CHD, 9 (1.6%) had less than 3 months of follow-up at the outpatient clinic, and 6 (1.1%) had documented neurological sequelae. Of the remaining 473 patients, 236 were invited for convenience, depending on the patient's availability to participate in the study on the day of outpatient medical appointment. Forty-three patients (18.2%) refused to participate in the study, 68 (28.8%) did not meet the criteria to perform the oral examination, and 2 (0.8%) were excluded because they had incomplete questionnaires. Thus, the final group of subjects was 123 individuals. Figure 1 illustrates the study flow diagram.

Dietary intake

Dietary intake was assessed by a quantitative food frequency questionnaire (FFQ) previously prepared and validated with individuals from Southern Brazil¹⁶. A trained nutritionist carried out its application in all participants. The FFQ included 135 food items and the retrospective period of the questionnaire comprised the past 12 months of food intake. In addition, a food photo album was used to assist participants in responding to the size of the portion consumed¹⁷. The application of the questionnaire took on average one hour and thirty minutes per participant.

Figure 1: Study flow diagram.

The intake report obtained by the FFQ was converted into daily consumption to estimate the nutritional composition based on the Programa de Apoio à Nutrição (NutWin)¹⁸. The monounsaturated, polyunsaturated and trans fatty acids types were not included in the original validation of the FFQ and their nutritional composition was also estimated based on the NutWin, in addition to Nutribase Nutrition Software. Nutrients intake was compared with the nutritional recommendations of the guidelines of the Brazilian and International Societies of Cardiology^{2,11,19}.

Cardiovascular risk factors and therapeutic targets

Biochemical exams of cardiovascular risk factors were reviewed in the medical records and if there were no results referring to the month prior to the date of the interview, a request was made for the participant to have blood tests done. Triglycerides (TG), total cholesterol (TC), and high-density lipoprotein cholesterol (HDL-C) were measured by automated enzymatic calorimetry methods. Low-density lipoprotein cholesterol (LDL-C) was calculated using the Friedewald formula [$LDL-C = \text{total cholesterol} - (\text{HDL-C} + \text{TG}/5)$] for individuals with $\text{TG} < 400 \text{ mg/dL}$ ¹⁹. Glycated hemoglobin (HbA1C) was collected only from diabetic patients and its measurement was carried out by the high-precision chromatography method.

The therapeutic targets for the control of cardiovascular risk factors established by the Brazilian Society of Cardiology Guidelines are: $\text{TC} < 190 \text{ mg/dL}$, $\text{HDL-C} > 40 \text{ mg/dL}$, $\text{TG} < 150 \text{ mg/dL}$, $\text{LDL-C} < 100 \text{ mg/dL}$, blood pressure (BP) $< 130/80 \text{ mmHg}$, $\text{HbA1C} < 7\%$, body mass index (BMI) $< 25 \text{ kg/m}^2$, waist circumference (WC) $\leq 102 \text{ cm}$ for men and $\leq 88.0 \text{ cm}$ for women^{2,19,20}.

Statistical analysis

FFQ foods were aggregated into 12 groups and the amount consumed from each food group was converted into a percentage of total daily caloric intake. We performed a cluster analysis based on food groups to derive two non-overlapping groups (dietary patterns) using the K-means method. Median and interquartile range were calculated for each of the 12 food groups and two clusters were selected because they were best interpretable because of the number of individuals in each group.

The assumption of normality was examined for all evaluated variables by Shapiro-Wilk test. The Student's t test, Mann-Whitney test, and chi-square test for independent samples were used to test differences across the dietary patterns in comparisons of parametric, nonparametric, and categorical variables, respectively. Energy and nutrient intake data were adjusted before analyses for energy intake according with the residual method²¹.

To investigate the associations between dietary patterns and achieve therapeutic targets, the Poisson regression with robust variance analysis was carried out. Thus, in the analysis the effect of dietary patterns on each therapeutic target (dependent variable) was estimated.

Analyses were performed using the SPSS version 22.0 and type I error rate was fixed at $P < 0.050$ (2-tailed).

RESULTS

Our sample consisted of 123 patients with CHD. Two dietary patterns were identified by cluster analysis, as shown in table 1. The first cluster, defined as Pattern I was characterized by a high intake of whole carbohydrates, beans/oilseeds, white and red meats, vegetables and fruits. The second cluster identified was defined as Pattern II and showed a higher intake of refined carbohydrates, fried foods, and sweets/sugars.

Clinical characteristics of the patients according to the dietary pattern are shown in table 2. Most clinical characteristics did not differ between groups, but the participants of Pattern I were older and had a longer outpatient follow-up time. Considering smoking, a significantly amount of individuals from pattern II were current smokers (or had stopped < 1 year). Use of medication was similar between both groups. Individuals who had previously had a nutritional counseling, specifically with a nutritionist, were significantly associated with pattern I.

Nutrient intake reflected food groups' intake. Pattern I presented significantly higher amounts of fiber, protein, cholesterol, iron, zinc, folate, magnesium, potassium, and vitamins A and C. Pattern II had a significantly higher intake of calories, trans fatty acids, and sodium. Table 3 shows the differences in energy, macro and micronutrients between dietary patterns.

Table 4 shows the consumption of the total sample and of the individuals categorized in the two dietary patterns, which take under consideration nutritional recommendations of the guidelines for CHD and prevention of atherosclerosis^{2,11,19}. Carbohydrate intake was within the recommended percentage range of total energy intake (TEI), however, fiber intake of the subjects in both dietary patterns was below the minimum recommended amount of 25 g/day. Among all subjects, only 18.7% (23 individuals) reached the daily recommended intake of fiber.

Considering total lipid intake, the amount consumed was close to the maximum value recommended of 35% of TEI. Regarding their subtypes, the intake of monounsaturated fatty acids was below the minimum value recommended of 15% of TEI. Only 13% (16 individuals) reached this recommendation. Consumption of polyunsaturated fatty acids was found to be similar for the entire sample and the two patterns identified, with its consumption being within the recommended range. Nevertheless, saturated fatty acids had an intake greater than 7% of TEI, with only 9 subjects (7.3%) reaching this target.

Table 1. Daily consumption of food groups according to the dietary patterns identified by cluster analysis.

Food Groups (% TEI)	Dietary Patterns		
	Pattern I (n= 61)	Pattern II (n= 62)	p
Refined carbohydrates	24.1(20.5–27.1)	37.3(33.8–40.4)	< 0.001
Whole carbohydrates	6.52(2.12–10.5)	0.211(0.000–1.72)	< 0.001
Fried foods	0.716(0.063–1.88)	1.61(0.592–2.73)	0.040
Sweets and sugars	5.47(3.97–9.36)	9.68(3.92–14.4)	0.010
Beans/oil/seeds	3.78(2.54–6.59)	3.05(1.79–4.81)	0.006
White meat/egg	7.09(3.18–9.12)	4.62(2.76–5.93)	0.043
Red meat	8.42(5.56–12.7)	5.94(3.88–9.36)	0.015
Processed meats	1.14(0.172–2.59)	1.42(0.527–2.52)	0.195
Vegetables	3.92(2.30–5.76)	2.67(1.32–3.82)	0.001
Fruits	10.6(8.08–13.9)	5.54(3.51–8)	< 0.001
Dairy	6.37(3.77–9.09)	4.52(2.19–9.78)	0.275
Oils/fats	13.7(10.0–18.6)	15.4(10.2–19.7)	0.501

Data are expressed as median (interquartile range). TEI: total energy intake.

Protein intake was above the 15% TEI recommendation and was higher in dietary pattern I. Sodium had an intake higher than recommended; only 17.1% (21 individuals) were within the amount of up to 2,000mg/day. Fruit intake by individuals in dietary pattern II was below the recommended amount of 200g/day. On the other hand, the total sample and dietary pattern I reached the recommended fruit intake. The consumption of vegetables was insufficient in both dietary patterns, only 24.4% (30 individuals) reached the recommended amount of 200g/day in the total sample.

In relation to the control of cardiovascular risks, results are shown in table 5. Diastolic blood pressure (DBP) was significantly lower in subjects from pattern I. Laboratory

tests of TG and HbA1c were above reference values, although diabetic individuals of pattern I had HbA1c with a significantly lower value when compared to individuals from pattern II.

In the total sample, 43.9% of individuals achieved systolic blood pressure (SBP) targets defined by the guidelines, 37.4% of DBP, 12.2% of BMI, 22% of AC, 23.7% of HbA1c, 41.4% of TG, 72.6% of TC, 46.2% of HDL-cholesterol, and 32.4% of LDL-cholesterol. There was no association between achieving therapeutic targets and the two dietary patterns, except for DBP. In Poisson regression analysis, it was observed that pattern I individuals had 73% greater probability of having a DBP within the therapeutic target [PR: 1.73 (95% CI:1.07 to 2.81); $p=0.034$].

Table 2. Clinical characteristics according to dietary pattern.

Characteristics	Dietary Pattern		p
	Pattern I (n = 61)	Pattern II (n = 62)	
Males	42(68.9)	38(61.3)	0.490*
Age (years)	63.5±7.15	57.8±8.31	<0.001†
White race	56 (91.8)	58(93.5)	0.743*
Years of study	8 (5 - 2)	8 (5 - 1)	0.770‡
Smoking			0.032*
• Current	5 (8.2)	14 (22.6)	
• Past	26 (42.6)	29 (46.8)	
• Never	30 (49.2)	19(30.6)	
History of alcoholism	1(1.6)	2(3.2)	0.568*
Family history of CVD	28(45.9)	26(41.9)	0.794*
Diabetes Mellitus	32(52.5)	27(43.5)	0.419*
Systemic hypertension	53(86.9)	54(87.1)	0.972*
Dyslipidemia	44(72.1)	45(72.6)	0.956*
Stroke	2(3.3)	3(4.8)	0.661*
Peripheral vascular disease	12(19.7)	11(17.7)	0.966*
Outpatient follow-up (years)	2 (1 - 6.5)	1.5 (1 - 3)	0.018‡
Previous AMI	39(63.9)	45(72.6)	0.403*
Percutaneous coronary intervention	48(78.7)	50 (80.6)	0.964*
CABG	23(37.7)	14(22.6)	0.103*
Medications in use			
• β -blockers	55(90.2)	60(96.8)	0.163*
• ACE inhibitors	35(57.4)	38(61.3)	0.796*
• Acetylsalicylic acid	61(100)	60(96.8)	0.496*
• Clopidogrel	16 (26.2)	29(46.8)	0.029*
• Calcium channel blockers	11(18)	14(22.6)	0.687*
• Insulin	17(27.9)	16 (25.8)	0.956*
• Oral hypoglycemic	26(42.6)	24(38.7)	0.796*
• Nutritional counseling	22(36.1)	11(17.7)	0.037*

Data are expressed as means $\pm$ standard deviation, median (interquartile range) or number of patients with the analyzed characteristic (%). *Chi-square test; †Student's t-test; ‡Mann-Whitney U test. CVD: cardiovascular diseases; AMI: acute myocardial infarction; CABG: coronary artery bypass graft surgery; ACE: angiotensin-converting enzyme.

Table 3. Daily intake of energy, macro and micronutrients according dietary pattern.

	Dietary Patterns		p
	Pattern I (n= 61)	Pattern II (n= 62)	
Energy (kcal)	1823±406	2106±648	0.004*
Carbohydrate (g) [†]	241±29.1	250±28.7	0.093*
Fiber (g) [†]	22.4 (19.3–28.2)	16.4 (13.9–20.2)	<0.001‡
Protein(g) [†]	87.5±17.2	75.3±15.2	<0.001*
Total lipids(g) [†]	78.1±12.1	77.2±12.2	0.689*
Saturated fatty acids (g) [†]	21.5±3.79	21.7±3.45	0.729*
Monounsaturated fatty acids(g) [†]	26.8±5.21	25.8±5.67	0.280*
Polyunsaturated fatty acids(g) [†]	21.3±6.41	23.4±6.36	0.072*
Trans fatty acids(g) [†]	0.392 (0.267–0.603)	0.599(0.291–0.951)	0.006‡
Cholesterol(mg) [†]	241 (195–339)	215 (173–263)	0.027‡
Calcium(mg) [†]	686 (550–845)	618 (488–830)	0.321‡
Iron(mg) [†]	14.3±2.15	13.4±1.82	0.010*
Zinc(mg) [†]	10.1 (8.98–12.1)	8.37 (7.12–10.2)	<0.001‡
Vitamin A(mg) [†]	969 (647–1374)	718 (520–923)	0.006‡
Vitamin E(mg) [†]	17.1 (14.9–20.1)	16.8 (15.4–19.2)	0.781‡
Vitamin C(mg) [†]	177±78.8	124±79.2	<0.001*
Folate(mg) [†]	277±68.6	222±62.5	<0.001*
Magnesium (mg) [†]	287±45.8	223±43.1	<0.001*
Potassium(mg) [†]	3233±508	2592±713	<0.001*
Sodium(mg) [†]	2258±300	2456±361	0.001*

Data are expressed as means±standard deviation or median (interquartile range). *Student's t-test for independent samples; †Data adjusted for energy intake according to the residuals method; ‡Mann-Whitney U test.

Table 4. Food consumption according to nutritional recommendations and dietary pattern identified.

Nutritional recommendations	Dietary Patterns			p
	Total (n= 123)	Pattern I (n= 61)	Pattern II (n= 62)	
Carbohydrate (45–60% of TEI)	50±5.96 96(78)*	49.3±6.40	50.7±5.47	0.213 [†]
Fiber (25g/day)	19.9(15.2–23.9) 23(18.7)*	22.4(19.3–28.2)	16.4(13.9–20.2)	<0.001 [†]
Total lipids (25–35% of TEI)	35.6±5.81 55(44.7)*	35.6±6.17	35.6±5.48	0.970 [†]
Monounsaturated fatty acids (15% of TEI)	12.02±2.56 16(13)*	12.15±2.75	11.89±2.38	0.574 [†]
Polyunsaturated fatty acids (5–10% of TEI)	9.78(8.29–12.8) 58(47.2)*	9.41(7.85–12.5)	10.1(8.63–13.6)	0.083 [†]
Saturated fatty acids (< 7% of TEI)	9.78±1.76 9(7.3)*	9.60±1.90	9.95±1.61	0.275 [†]
Protein (15% of TEI)	16.6±3.55 59(48)*	18±3.56	15.2±3	<0.001 [†]
Sodium (up to 2.000mg/day)	2358.±345 21(17.1)*	2258±300	2456±361	0.001 [†]
Fruits (200g/day)	238(141–319) 72(58.5)*	277(233–404)	162(95.4–244)	<0.001 [†]
Vegetables (200g/day)	129(85.7–193) 30(24.4)*	148(105–209)	117(57.5–178)	0.026 [†]

Data are expressed as number of patients with the analyzed characteristic (%), means±standard deviation or median (interquartile range).

*number of individuals (%) who reached the nutritional recommendation; †Student's t-test for independent samples; ‡Mann-Whitney U test. TEI: total energy intake.

Table 5. Cardiovascular risk factors control according to dietary pattern.

Cardiovascular risk factors	Dietary Pattern		p
	Pattern I (n= 61)	Pattern II (n= 62)	
Systolic blood pressure (mmHg)	131±20.8	139±27.1	0.073*
Diastolic blood pressure (mmHg)	77.1±9.90	84.1±14.3	0.002*
Body mass index (kg/m ²)	28.4(26.9–31.8)	30.3(27.5–33.9)	0.078†
Waist circumference (cm)			
• Women	102±10	107±13.6	0.261*
• Men	106±11.4	104±11.4	0.604*
Triglycerides (mg/dL) (n= 116)	156(103–201)	173(130–283)	0.080†
Total cholesterol (mg/dL) (n= 117)	159(132–189)	160(136–198)	0.783†
HDL-C(mg/dL) (n= 117)	40.5(34.2–47)	38(31–47.5)	0.274†
LDL-C(mg/dL) (n= 105)	85(64.2–103)	84.1(60.6–107)	0.564†
Glycated hemoglobin (%) (n= 58)	7.83±1.76	9.02±2.29	0.029*

Data are expressed as means ± standard deviation or median (interquartile range). *Student's t-test; †Mann-Whitney U test.

DISCUSSION

Cluster analysis was used to identify two dietary patterns in a sample of individuals with stable CHD. Pattern I was characterized by greater consumption of whole carbohydrates, beans/oilseeds, white and red meats, vegetables and fruits. On the other hand, pattern II had a greater intake of refined carbohydrates, fried foods and sweets. These dietary patterns differed significantly in the amount of fiber, protein, trans fatty acids, cholesterol, and most micronutrients. In both patterns, there was a consumption below the recommended target for fiber, monounsaturated fats and vegetables; however, the intake of sodium and saturated fats was above recommendations. Even so, individuals in dietary pattern I had better control of DBP and HbA1c.

Literature shows that healthy dietary patterns are related to the reduction of CHD risk. Therefore, these are oriented in the clinical practice of patients with ischemic heart disease^{3,22,23}. In a meta-analysis of prospective studies two dietary patterns were identified, the first was called "Healthy" because it contains fruits, vegetables, whole grains, white meats, and low-fat dairy products; which presented an inverse association with CHD risk. The second is denominated "Western" for having the presence of processed/red meats, refined carbohydrates, sweets, and fatty foods³. When compared to our results, the characteristics of the "Healthy" pattern resemble dietary pattern I. Similarly, the "Western" pattern has a composition equivalent to dietary pattern II.

There are several studies on the association between dietary pattern and CHD in international literature, however, there are few Brazilian studies in patients with heart

disease. A Brazilian population-based study showed that the consumption amount of healthful foods, such as fruits and vegetables was below ideal¹⁰. Data that are similar to our results. The patients maintained an insufficient consumption of vegetables in the total sample and in both groups of dietary patterns. Fruit consumption reached the recommended value only in the total sample and in pattern I.

Intake of whole carbohydrates was higher in dietary pattern I. Both dietary patterns had insufficient fiber intake, despite the significant difference found. Fiber consumption is important for adequate glycemic control in diabetic individuals^{24,25}. In the current study, patients following dietary pattern I presented significantly lower levels of HbA1c than the ones from pattern II, even though for both groups the glycated hemoglobin value was outside the target (<7%). This can be explained by the fact that the first pattern has greater amounts of whole carbohydrates, fruits, and vegetables.

There are consolidated dietary patterns in the literature which are used in cardiovascular prevention research¹². The Mediterranean diet has olive oil as the main source of fat, therefore it is a diet rich in monounsaturated fat⁴. The consumption of total lipids by our sample of individuals was close to the upper limit of the recommendation. When the quality of the ingested fat was analyzed, the intake of the monounsaturated fatty acids was observed to be below the recommended by the guidelines and the Mediterranean pattern. On the other hand, the intake of saturated fatty acids is above these recommendations.

The results of the recent Prospective Urban Rural Epidemiology (PURE) cross-sectional study showed that

higher fat intake was associated with increased TC, LDL-cholesterol, and HDL-cholesterol⁹. In this study, blood lipids were within recommended targets, except for triglycerides. This is justified in part by the use of statins in the pharmacological treatment of these patients. However, if there was an improvement in lipid intake, with a decrease in the intake of saturated fat from food groups such as red meat, and an increase in fiber-rich foods, such as whole carbohydrates and vegetable, this could improve lipid profile –including triglycerides– in these patients.

Another protective dietary pattern is the “Dietary approaches to stop hypertension” (DASH), emphasizing a low content of total lipids, saturated fats, cholesterol and sodium. There is a high consumption of fiber, white meat, potassium, calcium, and magnesium⁷. When the DASH diet is compared to the dietary patterns identified in the present study, a higher consumption of total lipids, saturated fatty acids, cholesterol, and sodium is observed in our sample. There is also a decreased intake of fiber and micronutrients. Another study “Optimal macronutrient intake to prevent heart disease (Omniheart)” showed that regardless of the macronutrient predominant in a diet, if a healthy dietary pattern is followed, such as the DASH diet, improvements in lipid profile can be obtained as well as a decrease in CHD risk²⁶.

Regarding the clinical and non-dietary characteristics of the participants, there was a significant difference in age and follow-up time in the outpatient clinic, as well as in smoking and nutritional counseling. Individuals in dietary pattern II, which food composition is less healthy, had a higher prevalence of smoking (22.6%), thus suggesting a lifestyle issue. Similar results were found in a previous study in which a higher proportion of smokers was observed in unhealthy dietary patterns²³.

In the analysis of the proportion of individuals who reached therapeutic goals according to the dietary pattern, we had an association between pattern I and DBP control. This may be influenced by the clinical situation of the patient, since in SBP there was no significant result. However, subjects in dietary pattern I also had significantly lower DBP values. The presence of healthy food groups, such as fruits and vegetables, higher amounts of fiber and lower sodium values present in this pattern may have helped to better control this risk factor.

In this study, few individuals achieved the therapeutic targets for most of the cardiovascular risk factors. The sample size may have impacted our results. On the other hand, it should also be considered that the recommendations used in clinical practice are either not adequate for this population or that there was low adherence in this sample. In the Brazilian population, a CHD secondary prevention study found a patient profile similar to the one in this study and after a 3-month nutritional intervention there were significant reductions

in weight, BMI, AC, and HbA1c²⁷.

In our study, some methodological precautions were also taken into account. We used a FFQ previously constructed and validated in patients from Southern Brazil, and macro and micronutrient data were adjusted for energy using the residual method²¹. However, limitations in this study should be considered. Although FFQ is a well established method for dietary pattern evaluation, one of its limitations is the fact that it relies on the memory of the individual interviewed, which may result in some errors of actual measurements of food consumption^{21,28}. Moreover, the adopted cross-sectional design hinders any causal inferences. Another limitation of our study was that physical activity level was not evaluated, and this is a lifestyle characteristic that may influence the control of cardiovascular risk factors.

To our knowledge, our study was the first to use cluster analysis and to characterize the dietary pattern of Brazilian patients with CHD. Cluster analysis findings are easier to interpret because an individual is in one cluster only, outcomes are specific to individuals within each cluster, and each cluster has a specific food and nutrient composition^{29,30}.

CONCLUSIONS

In conclusion, two dietary patterns were identified. Both differed significantly in food groups and nutrients, pattern I presented a healthier nutritional composition than pattern II, but still needs adjustments according to guidelines of the Societies of Cardiology. Diabetic patients with dietary pattern I had a higher consumption of fiber-rich foods and lower value of HbA1c compared with those on dietary pattern II. In addition, pattern I individuals also had lower values and better control of DBP. Finally, patients who had previously had nutritional counseling, with a nutritionist, were more likely to be in pattern I, showing the importance of a multi-professional team in the non-pharmacological treatment of CHD.

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