

Dietary intake and stress in patients with acute coronary syndrome

Consumo alimentar e estresse em pacientes com síndrome coronariana aguda

Consumo de alimentos y estrés en pacientes con síndrome coronario agudo

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ABSTRACT

Objective: to assess whether dietary intake of patients with acute coronary syndrome (ACS) meets national and international recommendations and whether there is a relationship with the levels of stress. **Method:** a cross-sectional study with 150 patients with ACS, who were interviewed with the Food Frequency Questionnaire and the Perceived Stress Scale-10. **Results:** daily intake above the recommendations: cholesterol (92%), fiber (42.7%) and protein (68%); intake below the recommendations: potassium (88%) and carbohydrates (68.7%); intake according to the recommendations: sodium (53.3%) and lipids (53.3%). Most patients with inadequate dietary intake (54%) were stressed or highly stressed. There was a significant association between a lower stress level and a higher fiber intake. **Conclusion:** in patients with ACS, dietary intake did not meet the guideline recommendations, and a lower fiber intake occurs concomitantly with higher stress levels. Educational efforts can support patients in dietary intake adequacy and stress control. **Key words:** Feeding; Stress, Psychological; Acute Coronary Syndrome.

RESUMO

Objetivo: Avaliar se o consumo alimentar de pacientes com síndrome coronariana aguda (SCA) segue as recomendações nacionais e internacionais e se existe relação com níveis de estresse **Método:** Estudo transversal com 150 pacientes com SCA que foram entrevistados utilizando-se os Questionários de Frequência Alimentar e Escala de Estresse Percebido-10. **Resultados:** Consumo diário acima das recomendações: colesterol (92%), fibras (42,7%) e proteínas (68%); consumo abaixo das recomendações: potássio (88%) e carboidratos (68,7%); consumo conforme recomendações: sódio (53,3%) e lípidos (53,3%). A maioria (54%) com consumo alimentar inadequado era estressada ou altamente estressada. Houve associação estatisticamente significativa entre menor nível de estresse e maior consumo de fibras. **Conclusão:** Em pacientes com SCA, o consumo alimentar esteve fora do recomendado pelas diretrizes e o menor consumo de fibras ocorre concomitantemente com maior estresse. Esforços educativos podem instrumentalizar os pacientes na adequação do consumo alimentar e no controle do estresse. **Descritores:** Alimentação; Estresse Psicológico; Síndrome Coronariana Aguda.

RESUMEN

Objetivo: evaluar si la ingesta de alimentos de pacientes con síndrome coronario agudo (SCA) sigue las recomendaciones nacionales e internacionales y si hay relación con los niveles de estrés. **Método:** estudio transversal con 150 pacientes con SCA, que fueron entrevistados con los cuestionarios de Frecuencia Alimentar y Escala de Estrés Percibido-10. **Resultados:** consumo diario mayor que las recomendaciones: colesterol (92%), fibra (42,7%) y proteínas (68%); consumo debajo de las recomendaciones: potasio (88%) y carbohidratos (68,7%); consumo recomendado: sodio (53,3%) y lípidos (53,3%). La mayoría (54%) con consumo alimentar inadecuado era estresada o muy estresada. Hubo asociación significativa entre bajo nivel de estrés y mayor ingesta de fibras. **Conclusión:** en pacientes

con SCA, la ingesta de alimentos estaba fuera de la recomendada por las directrices y la menor ingesta de fibra es concomitante con estrés más alto. Esfuerzos educativos pueden ayudar los pacientes en el consumo de alimentos y el control del estrés.

Palabras clave: Alimentación; Estrés Psicológico; Síndrome Coronario Agudo.

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INTRODUCTION

According to the World Health Organization, coronary artery disease (CAD) will be a major cause of mortality worldwide by 2030⁽¹⁾. It currently reaches about 15.4 million Americans over 20 years old, a prevalence of 6.4%⁽²⁾. In Brazil, from January to June of 2014, there were over 121,000 admissions for acute myocardial infarction (AMI) and other ischemic heart diseases, two thousand more than the same period in 2013⁽³⁾.

Considering the high prevalence, severity and mortality associated with CAD, risk factors should be identified and monitored with a focus on education to collaborate in primary and secondary prevention.

Since 2005, Brazil has been undergoing a multifactorial food and nutritional transition process. This process is characterized by changes in the diet pattern and body composition, resulting from social, economic, demographic, technological and cultural factors that directly affected the lifestyle and the health profile of the population⁽⁴⁾.

Dietary intake is a complex exposure variable, several nutrients interfering in the risk of cardiovascular disease (CVD) and others that can protect the individual from developing it⁽²⁾. It has been well established in the literature that the amount and type of consumed fat directly influence cardiovascular risk factors, such as the concentration of plasma lipids and lipoproteins. In the population following a high-fat diet, an increased risk of acute myocardial infarction (AMI) of approximately 30% occurs⁽⁵⁾.

Daily intake recommended by the Guidelines on Dyslipidemia and Prevention of Atherosclerosis⁽⁶⁾, the Brazilian Hypertension Guideline⁽⁷⁾ and the Dietary Reference Intake-DRI⁽⁸⁾ is: carbohydrates: 50-60%; protein 15-20%; lipids: 25-35% of total energy value/day; Cholesterol: <200 mg/day, potassium: up to 5000mg/day, sodium: up to 2000 mg/day and fiber: 20 - 30 g/day⁽⁶⁻⁸⁾.

In order to measure dietary intake, the Food Frequency Questionnaire (FFQ) has been used⁽⁹⁾, which captures the frequency of consumption of most foods over a preceding period of time and not only 24 hours prior to the interview. This feature allows for detailing the usual diet of an individual or a population group⁽⁹⁾. The FFQ was validated for the adult population by Ribeiro and colleagues in a study with 69 subjects in Brasília, DF, with significant correlation coefficients for some nutrients. These results indicated that the FFQ is a research instrument for epidemiological studies in adult populations which allows for the assessment of eating habits and provides important information for the implementation of actions in the health & nutrition field⁽¹⁰⁾.

The link between stress and dietary intake has received significant attention because of the considerable overlap among

the physiological systems that regulate dietary intake and mediate stress response⁽¹¹⁾.

With an intimate relationship with dietary intake, stress is considered a very common disorder. It is associated with both increased and decreased dietary intake. At least temporarily, stress leads to biological changes and can decrease dietary intake and slow down gastric emptying. It can lead to other behavioral changes, such as the preference for certain high-energy foods, such as fats and sweets, and can also cause individuals to consume these foods as a tool to manage temper, tension and stress. It also contributes to increased blood pressure and heart rate, increased oxygen demand by the myocardium, and increased platelet aggregation, which facilitates the process of arterial obstruction, which is a major risk factor for CAD⁽¹²⁾.

The instrument used to measure stress has been the Perceived Stress Scale (PSS-10). The PSS-10 is a general scale that can be used in various age groups, from adolescents to elders, because it contains no specific questions for these populations. In the Brazilian validation study, the scale was found to be a clear and reliable tool to measure perceived stress, with adequate psychometric performance⁽¹³⁾.

Given this context, the objectives of the present study were: to assess whether dietary intake of patients with acute coronary syndrome (ACS) is within the recommended national and international guidelines; to identify the levels of stress of patients with ACS; and to assess whether dietary intake is associated with the levels of stress in patients with ACS.

METHOD

Ethical aspects: the study was approved by the Ethics Committee on Research of the Federal University of São Paulo, protocol number 1511/10, and was preceded by signing of the Terms of Free and Informed Consent.

Study design, period and setting: a cross-sectional analytical study was performed in the cardiology units of a large tertiary teaching hospital in the metropolitan area of São Paulo, SP, Brazil, from September 2011 to November 2014.

Population and sample: a minimum sample size of 138 patients was calculated, with a level of significance of 5% and a sample power of 90%, by estimating a proportion of the population of interest with the Z statistical test.

Inclusion criteria: patients over 18 admitted for their first ACS event.

Exclusion criteria: in order to avoid discomfort/fatigue of patients during data collection, those with acute pain, dyspnea or symptomatic hypotension were excluded during the interview.

Study protocol: the collection of demographic data and the interview to apply the FFQ questionnaire⁽⁹⁾ and PSS-10⁽¹³⁾

were performed concurrently, with a mean duration of 90 minutes.

The FFQ is organized into seven food groups: grains and legumes, oils and fats, desserts and snacks, meat and eggs, dairy products, vegetables and fruit and drinks. Each food group has 8 - 10 items, totaling 57⁽⁹⁾.

The tool consists of three basic components: one list of foods, one second list to document the amount of dietary intake, and a space to document the frequency of each dietary intake. Data were arranged in household measures⁽¹⁴⁾ and converted to grams and milliliters by the authors. For each food in the FFQ, the amounts of nutrients (protein, lipids, carbohydrates, dietary fiber, cholesterol, sodium and potassium) were calculated based on the Brazilian Table of Food Composition (TACO), which shows the nutrient composition per 100g or 100mL of an edible portion⁽¹⁵⁾. Individual intake frequencies of the foods in the FFQ were normalized for frequency of daily intake.

The frequency of daily intake of each nutrient, considering all foods, was then calculated for each individual. The distribution of macronutrients, micronutrients and dietary fiber was compared with the cutoff points recommended by the Guidelines on Dyslipidemia and Prevention of Atherosclerosis⁽⁶⁾, the Brazilian Hypertension Guideline⁽⁷⁾ and the Dietary Reference Intake-DRI⁽⁸⁾ which are: carbohydrates: 50-60%; protein 15-20%; lipids: 25-35% of total energy value/day; cholesterol: <200 mg/day, potassium: up to 5000mg/day, sodium: up to 2000 mg/day and fiber: 20 to 30 g/day⁽⁶⁻⁸⁾.

The calculation of the PPS-10 score is made from the sum of all scores obtained, ranging from 0 - 40 points; the higher the score the higher the stress level⁽¹³⁾. The PPS-10 has ten questions with the following response options: 0 = never; 1 = almost never; 2 = sometimes; 3 = almost always; 4 = always. Questions with a negative connotation should have their scores summed directly. Questions with a positive connotation should have their scores summed in reverse.

To evaluate stress, categories for the levels of stress were created from the sample quartiles of the PPS-10, thereby generating four groups: low stress (score <22); moderate stress (score ≥22 and <28); stress (score ≥28 and <32) and high stress (score > 32).

The categorical variables were summarized using descriptive statistics of absolute and relative frequencies. The association between dietary intake and stress level was evaluated by the Pearson's chi-square test or Fisher's exact test. Statistical analyses were performed using the Statistical Package for the Social Sciences software (SPSS), version 19. The differences were considered significant when the descriptive level (p value) of the test was ≤0.05.

RESULTS

The sample consisted of 150 patients with a mean age of 57.5 (11.2) years, 72.7% men and 67.3% white. They were hospitalized for ST elevation AMI (72.7%), unstable angina (14.7%) or non-ST elevation AMI (12.7%). The main comorbidities were: hypertension (66.7%), hyperlipidemia (40%), and diabetes mellitus (28.7%). As an associated risk factor, most were smokers (58.7%).

Table 1 shows the total amount of nutrients consumed by individuals according to the cutoffs of the national and international guidelines. It was found that most patients had daily intake of cholesterol above the recommended amount. High intake of fiber and protein prevailed. Potassium intake was below the recommended levels. In contrast, sodium and lipid

Table 1 - Classification of the daily intake of nutrients of individuals hospitalized for acute coronary syndrome (N = 150) according to national and international recommendations, Cardiology units, São Paulo, São Paulo, Brazil

Daily nutrient intake	n	%	Intake classification
Cholesterol			
<200 mg	12	8.0	In accordance with recommendations
≥200 mg	138	92.0	Above recommendations
Fiber			
<20g	47	31.3	Below recommendations
>20 e ≤30g	39	26.0	In accordance with recommendations
>30g	64	42.7	Above recommendations
Sodium			
<2000 mg	80	53.3	In accordance with recommendations
>2000 mg	70	46.7	Above recommendations
Potassium			
<5000 mg	132	88.0	In accordance with recommendations
>5000 mg	18	12.0	Above recommendations
Protein*			
<15%	18	12.0	Below recommendations
≥15% and ≤20%	30	20.0	In accordance with recommendations
>20%	102	68.0	Above recommendations
Lipids*			
<25%	21	14.0	Below recommendations
≥25% and ≤35%	80	53.3	In accordance with recommendations
>35%	49	32.7	Above recommendations
Carbohydrates*			
<50%	103	68.7	Below recommendations
≥50% and ≤60%	40	26.7	In accordance with recommendations
>60%	7	4.7	Above recommendations

Note:

*The percentages refer to the total energy value/day..

intake of most patients was in accordance with recommendations. Of note, 46.7% and 32.7% of patients had a high intake of sodium and lipids, respectively. The carbohydrate intake was below recommendations for almost 70% of the sample.

Table 2 presents the categories of levels of stress from the sample quartiles of the PSS-10. The mean stress of the subjects was 27.0 ± 6.6 , with a minimum of 8 and a maximum of 40. Most (54%) patients had stress or high stress.

Table 3 shows the dietary intake and the levels of stress of individuals hospitalized for acute coronary syndrome.

Table 2 - Classification of the levels of individuals hospitalized for acute coronary syndrome (N = 150), Cardiology units, São Paulo, São Paulo, Brazil

Stress Classification	n	%
Low stress (Score <22)	32	21.3
Moderate stress (Score ≥ 22 and <28)	37	24.7
Stress (Score ≥ 28 and <32)	41	27.3
High stress (Score >32)	40	26.7

Table 3 - Association between dietary intake and the levels of stress of individuals hospitalized for acute coronary syndrome (N = 150), Cardiology units, São Paulo, São Paulo, Brazil (2011, 2012)

Nutrient	Dietary intake	Level of Stress								p value ^a
		Low stress (n = 32)		Moderate stress (n = 37)		Stress (n = 41)		High stress (n = 40)		
		n	%	n	%	n	%	n	%	
Cholesterol	<200mg	4	11.8	2	5.4	7	17.1	1	2.5	0.114
	≥ 200 mg	30	88.2	35	94.6	34	82.9	39	97.5	
Fiber	<20g	10	29.4	10	27.0	13	31.7	16	40.0	0.038
	≥ 20 e ≤ 30 g	5	14.7	9	24.3	9	22.0	16	40.0	
	>30g	19	55.9	18	48.6	19	46.3	8	20.0	
Sodium	<2000mg	19	55.9	22	59.5	23	56.1	18	45.0	0.602
	>2000mg	15	44.1	15	40.5	18	43.9	22	55.0	
Potassium	<5000 mg	30	88.2	33	89.2	36	87.8	35	87.5	1.000
	>5000 mg	4	11.8	4	10.8	5	12.2	5	12.5	
Protein*	<15%	3	8.8	5	13.5	6	14.6	6	15.0	0.594
	$\geq 15\%$ e $\leq 20\%$	9	26.5	10	27.0	6	14.6	5	12.5	
	>20%	22	64.7	22	59.5	29	70.7	29	72.5	
Lipids*	<25%	8	23.5	7	18.9	5	12.2	3	7.5	0.079
	$\geq 25\%$ e $\leq 35\%$	12	35.3	22	59.5	26	63.4	20	50.0	
	>35%	14	41.2	8	21.6	10	24.4	17	42.5	
Carbohydrates*	<50%	23	67.6	23	62.2	29	70.7	30	75.0	0.904
	$\geq 60\%$ e $\leq 60\%$	10	29.4	12	32.4	10	24.4	8	20.0	
	>60%	1	2.9	2	5.4	2	4.9	2	5.0	

Note:

*Values refer to the total energy value/day.

^aFisher's exact test

There was a significant association between fiber intake and the level of stress. Individuals with high levels of stress consumed less than 20g or between 20 - 30 g/day, whereas individuals categorized with low stress, moderate stress or stress consumed more than 30g of fiber/day.

DISCUSSION

This study investigated whether dietary intake of patients with ACS was within recommendations of the national and international guidelines; identified levels of stress; and investigated whether dietary intake was associated with levels of stress.

Eating habits affect both the well-established cardiovascular risk factors (systolic and diastolic blood pressure, levels of low- and high-density lipoprotein, glucose levels and obesity/weight gain) and new risk factors (e.g., inflammation, cardiac arrhythmias, endothelial cell function)⁽²⁾.

Mente *et al.* state that, although investigations on dietary components can help clarify the benefits of dietary patterns, it is unlikely that modifying the intake of a few nutrients or foods substantially influence coronary outcomes. The authors then suggest that dietary patterns are investigated⁽¹⁶⁾. The data in the current study corroborate this premise, since patients

consumed both nutrients associated with increased risk of CAD and those related to protection from CAD.

A systematic literature review investigating dietary exposure related to CAD published in 2009 concluded that there is strong evidence regarding protective factors, such as consumption of vegetables, nuts, monounsaturated fatty acids, a Mediterranean dietary pattern and a prudent diet. The harmful factors would be consumption of trans-fatty acids, foods with a high glycemic index or a Western dietary pattern. However, only a Mediterranean diet has been related to CAD protection in randomized clinical trials⁽¹⁶⁾.

The Mediterranean diet consists of a high consumption of vegetables, fruits, nuts, whole grains, cheese or yogurt, fish, and monounsaturated fatty acids compared to saturated. Similarly, the prudent diet is characterized by a high consumption of vegetables, fruits, vegetables, whole grains, fish and other seafood. The Western pattern, in turn, is characterized by high consumption of processed meat, beef, butter, dairy products with a high content of fat, eggs and refined grains⁽¹⁶⁾. In the short run, the Mediterranean diet reduces oxidative stress, vascular inflammation and endothelial dysfunction, factors that are related to the establishment of atherosclerotic plaque⁽¹⁷⁾.

Another diet associated with a reduced risk of developing CAD by 21%, according to a meta-analysis published in 2013, is the Dietary Approaches to Stop Hypertension (DASH) diet, designed to normalize blood pressure in patients with hypertension. This diet is also rich in fruits, vegetables and low fat dairy products; it incorporates grains, poultry, fish and nuts and limits saturated fat, beef, sweets and sugar-containing drinks⁽¹⁸⁾.

In the present study, over 50% of the sample consumed fruits, raw leaves, fresh fish, olive oil, braised leaves and white cheese, which would be consistent with the recommendations of the aforementioned protective diets. However, there was also a high consumption of beef, bread, sausages, fried foods, pork and soft drinks, which are not recommended by the DASH and Mediterranean diets.

A daily cholesterol intake above recommendations, by over 90% of individuals, as well as the consumption of lipids by a third of the sample, is consistent with the high prevalence of dyslipidemic individuals and, therefore, ACS pathophysiology⁽¹⁹⁾. In addition, although the majority of patients were hypertensive, nearly half consumed amounts of sodium above the recommended levels, thereby suggesting a lack of knowledge concerning the importance of a low sodium diet or lack of adherence to this diet. Results of a meta-analysis of 14 studies published in 2013 show that the consumption of sodium lower than 2g/day significantly reduced the systolic and diastolic blood pressures compared to consumption greater than 2g/day. Increased sodium intake was not associated with the incidence of CAD, but it was associated with an increased risk of mortality from this disease⁽²⁰⁾. Lack of knowledge about a low-sodium diet also affects pharmacologic treatment, increasing the risk of noncompliance by 2.1-fold⁽²¹⁾.

The effect of high potassium intake on risk factors and CVD has also been investigated in a meta-analysis published in 2013, including 1606 patients. The authors highlight that the levels of potassium in the diet were reduced due to food processing. The increased consumption of this micronutrient

reduced systolic and diastolic blood pressure in hypertensive patients but not in those without hypertension. In addition, there was no association between the consumption of potassium and the incidence of CAD⁽²²⁾.

Despite high cholesterol intake, the patients reported a high fiber intake, which would be protective against CVD. A recent meta-analysis found that fiber intake was inversely associated with the risk of CVD and CAD⁽²³⁾. Increased fiber intake decreases blood pressure and serum cholesterol levels, improves blood glucose levels and sensitivity to insulin in non-diabetic and diabetic subjects. Apparently, the fibers bind to the bile acids in the small intestine, thereby increasing its excretion in the feces. Additionally, the fiber fermentation in the colon can attenuate cholesterol synthesis⁽²⁴⁾.

The sample also had a low carbohydrate intake associated with a high protein intake. A prospective cohort study with over 43,000 Swedish women followed for 15.7 years showed that a decrease of 20g in the daily carbohydrates intake associated with an increase of 5g in the protein intake would lead to an increase of 5% in the risk of CVD. The authors argue that the results can be due to a decrease in the consumption of vegetables, fruits, cereals and legumes, carbohydrate sources, while increasing the consumption of meat or animal proteins⁽²⁵⁾.

Regarding the second cardiovascular risk factor investigated in this study, stress, there is evidence of population and clinical studies, summarized by an extensive review of the literature, that stress can contribute to CVD in the development of long-term atherosclerosis and acute onset of cardiac events. However, the review emphasizes that stress perception can be a consequence of the disease and not the cause, since people with advanced atherosclerotic disease can experience a higher and more rapid exhaustion than others, thereby considering their environment more stressful than others⁽¹²⁾.

As for the acute onset of cardiac events, psychological stress causes a series of physiological responses that can trigger ACS in patients with CAD. Acute mental stress (through the autonomic nervous system and neuroendocrine response) leads to activation and increase in the number of platelets, development and worsening of the endothelial dysfunction, inflammatory response and pro-thrombotic phenomena, with a potential for disruption of a vulnerable plaque and precipitation of the intraluminal thrombus, resulting in AMI⁽²⁶⁾.

Among 4204 patients with a mean age of 59 years, 67% men and 67% white discharged from 24 hospitals in the United States after AMI, 38.6% reported moderate or high levels of stress in the four weeks prior to the event⁽²⁷⁾. These results coincide with the data in this study, where 54% of subjects had stress or high stress.

It has been previously shown that high levels of stress change dietary patterns, and increased consumption of highly palatable foods such as carbohydrates and lipids. This mechanism would be mediated by a response to stress hormones, such as cortisol, and metabolic factors, such as insulin and leptin, which would influence the dopaminergic transmission. With chronic adaptations related to weight, these factors can lead to high levels of consumption of palatable foods through the enhancement of brain activity reward⁽²⁸⁾.

Indeed, a previous study evaluated possible associations between stress and dietary patterns and found that regardless of energy consumption, BMI and physical activity, stress was associated with a lower intake of protein, fruits, vegetables, fiber and omega 3 fatty acids and higher intake of carbohydrates, salty snacks, candy and food with a high glycemic index⁽²⁹⁾.

High stress, however, was not significantly associated with the consumption of certain nutrients in the current study, except for fiber intake. This result suggests that, in this population, the high level of stress suffers more important influences of factors other than the dietary intake. On the other hand, a high intake of cholesterol, sodium and lipids can be influenced by circumstances other than stress, such as smoking.

Among smokers hospitalized for AMI or coronary artery bypass grafting, followed for one year after discharge, smoking cessation was significantly associated with the largest decrease in perceived stress. These findings support a hypothesis that smoking would not help relieve stress, as believed by some smokers, but could act as a stressor, for example, due to breaks between cigarettes⁽³⁰⁾.

Although the results are based on findings of validated questionnaires, they must be interpreted considering certain

limitations. This is a cross-sectional study, which prevents establishing a causal link between dietary patterns and stress levels. The answers to the questionnaire depended on the memory of the patients. Longitudinal and multicenter studies with larger sample power considering the effect of potential confounders should be performed to confirm whether there is an association between stress and eating patterns currently observed in this clinical situation.

Educational efforts by health care professionals must be made to support patients in dietary intake adequacy and stress management as measures of primary and secondary prevention of CAD.

CONCLUSION

Patients with ACS have a higher than recommended daily intake of cholesterol, protein, fibers and potassium, based on national and international guidelines. The sodium and lipid intake was in accordance with the recommended levels. The carbohydrate intake was lower than recommended. There was a significant association between higher fiber intake and lower stress level.

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