

Original

Eating behavior and nutritional status in patients who underwent coronary angioplasty

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Abstract

Introduction: The identification of stages of dietary change and the factors affecting food choices can direct more effective nutritional intervention against coronary heart disease progression.

Objective: Identify the stages of change of eating behavior and its relation with nutritional status, food consumption and previous cardiovascular events in patients who underwent coronary angioplasty.

Methods: A cross-sectional study with 200 hospitalized patients from a specialized cardiology hospital, after elective coronary angioplasty. They were applied an algorithm that identifies the provision of change of eating habits for a healthier pattern. Variables measured were stages of change of eating behavior, nutritional status, food consumption and cardiovascular events (previous myocardial infarction or angioplasty). It was realized comparison of averages by analysis of variance or Student's test and Chi-square test for qualitative variables. Value of significance was taken at 5%.

Results: The patients were classified in the following stages: 36% maintenance, 26% preparation, 17% precontemplation, 12% action and 9% contemplation. It was observed higher cardiovascular events in maintenance/action group ($p = 0.04$), higher consumption of calories ($p = 0.04$), meat/eggs ($p = 0.01$) and sweets ($p = 0.03$) in preparation stage, comparing to maintenance group, and no association between nutritional status and stages of change ($p = 0.13$), although 62% of the individuals in maintenance stage were overweight.

Conclusions: This work contributed to identifying the stages of change and conditions that favor changes in eating pattern. Even patients that classified themselves into the maintenance stage need to adjust their eating habits in order to reach a healthy weight.

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LA CONDUCTA ALIMENTARIA Y ESTADO NUTRICIONAL EN PACIENTES SOMETIDOS A ANGIOPLASTIA CORONARIA

Resumen

Introducción: La identificación de las etapas de cambio en la dieta y los factores que afectan la elección de alimentos puede dirigir una intervención nutricional más eficaz contra la progresión de la enfermedad coronaria.

Objetivos: Identificar las etapas de cambio de la conducta alimentaria y su relación con el estado nutricional, consumo de alimentos y los eventos cardiovasculares anteriores en pacientes sometidos a angioplastia coronaria.

Métodos: Estudio transversal con 200 pacientes de un hospital especializado en cardiología, después de angioplastia coronaria electiva. Se aplicaron un algoritmo que identifica la disposición del cambio de hábitos de alimentación para un patrón más saludable. Las variables medidas fueron las etapas de cambio de la conducta alimentaria, estado nutricional, consumo de alimentos y eventos cardiovasculares (infarto de miocardio o angioplastia previos).

Resultados: los pacientes fueron clasificados en las siguientes etapas: 36% en mantenimiento, 26% en preparación, 17% en precontemplación, 12% en acción y 9% en contemplación. Se observaron más eventos cardiovasculares en mantenimiento/ acción ($p = 0,04$), mayor consumo de calorías ($p = 0,04$), carne y huevos ($p = 0,01$) y dulces ($p = 0,03$) en la etapa de preparación, en comparación con el de mantenimiento, y ninguna asociación entre el estado nutricional y las etapas de cambio ($p = 0,13$), aunque el 62% de los individuos en la etapa de mantenimiento estaban con sobrepeso.

Conclusiones: Este trabajo contribuyó por la identificación de las etapas de cambio y las condiciones que favorecen los cambios en el patrón de alimentación. Mismo los pacientes que se clasificaron a la fase de mantenimiento hay la necesidad de ajustar sus hábitos alimenticios con el fin de lograr un peso saludable.

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Palabras clave: Conducta alimentaria. Consumo de alimentos. Estado nutricional. Angioplastia. Modelos teóricos.

Introduction

The growing use of less invasive coronary revascularization procedures, such as percutaneous transluminal coronary angioplasty (PTCA), does not eliminate the need for lifestyle changes, bringing additional benefits in the reduction of risk factors, cardiovascular morbidity and mortality and improvement in the quality of life.¹

The role of diets has been widely studied in the protection against cardiovascular diseases.² Recommendations regarding the intake of fruits, vegetables, whole grain cereals, lean meats and low-fat dairy products appear as the main dietary requirements to promote health, regardless of other lifestyle factors.

However, eating habits are a complex behavior, and people are not always willing to change, that is why the use of theoretical models in the planning of nutritional interventions can make them more effective.

Prochaska's transtheoretical model,³ or "stages of change", was developed in the psychology area, and it establishes that the behavior change process goes through five stages:

1. *Precontemplation*: the individual has no intention of changing a risk behavior in the near future. The individual may be uninformed about the risks of their behavior or resistant to acknowledging the risk.
2. *Contemplation*: individuals intend to change in the near future. If they are not encouraged, they may indefinitely postpone the decision.
3. *Preparation*: the individual intends to act in the next 30 days and prepares to do something towards this goal.
4. *Action*: individuals have effectively changed their behavior within the past 6 months.
5. *Maintenance*: the individual has already incorporated the intended changes for more than 6 months.

The relation between food consumption and the stages of change has been characterized by lower intake of fats,⁴ higher intake of fruits and vegetables^{5,6} and better eating quality^{7,8} in the action and maintenance stages in relation to the early stages of change. In Brazilian schools, stages of change have been identified for the intake of fruits, vegetables, sweets and fats in teenagers.⁹ Besides these studies with healthy populations, it was observed that most patients with primary diagnoses of coronary artery bypass graft presented lower fat consumption at maintenance stage, but higher intake of fruits and vegetables in the initial stages.¹⁰

The purpose of this study was to identify the stages of change of eating behavior in patients who underwent PTCA and their relation with the nutritional status, food consumption and previous cardiovascular events such as acute myocardial infarction and percutaneous or surgical myocardial revascularization.

Methods

Observational cross-sectional study, conducted with 343 patients with stable coronary artery disease who consecutively became in-patients for elective PTCA, from April 2008 to January 2009, supported by the Brazilian Public Health System (SUS), at the Hemodynamics Unit of a specialized cardiology hospital. All of them were invited to participate in a nutritional protocol, 200 were evaluated in this study.

During their hospital stay, their weight, height and waist circumference were measured, their clinical precedents were verified in their charts and an interview was conducted for the application of an algorithm, adapted from Graaf⁷ (1997), in which individuals report if they have ever changed their eating habits to a healthier pattern, in order to identify the stages of change for healthy eating, according to the transtheoretical model. No healthy eating pattern was informed, so that interviewees were able to give their own opinion regarding this theme.

The information was typed directly into the computer by using the Epidata[®] program, with economy of time and elimination of probability of transcription error.

The food intake of the previous year was obtained by a trained nutritionist, from a semi-quantitative "Food Frequency Questionnaire" (FFQ) adapted from Viebig.¹¹ The FFQs were double typed on the "DietSys" program (HHHQ-DietSys Analysis Software, 1999), of the USA National Cancer Institute.

A pilot study was conducted with 82 post-PTCA patients at the same location, one year earlier, to pre-test the questionnaires. The original FFQ was applied to 27 patients and the foods with "never or less than 1 time/month" frequency in more than 60% of interviewees were excluded, provided that without evidence of their nutrients with coronary artery disease, in order to reduce the number of items in the questionnaire. Therefore, the following items were excluded: passion fruit, acerola and cashew juice, pancake, strogonoff, persimmon, peach, fig, plum, white beans/peas/lentil, *cachaça* and vegetable oil, the latter because it is already considered in the preparations in the calculation of the FFQ, and olive oil and diet sodas were included. Milk and yogurt were divided into skim, low fat and whole, the vegetables carrot, pumpkin, *gilo*, eggplant, cucumber, courgette and beet were grouped, just like lettuce, escarole, Chinese cabbage, cabbage, water-cress and wild chicory, resulting in a list with 80 items. The frequency categories used were: never, less than 1 time/month, 1 to 3 times /month, 1 time/week, 2 to 4 times/week, 1 time/day and 2 or more times/ day.

The calculation of the food intake was performed in the "DietSys" program, which generated data of total calories, quantity of nutrients and number of servings per group of foods. In order to eliminate the effect of the total energy in the analysis of the nutrients, an adjustment was made for total energy by using the method of residual adjustment.¹²

For analysis, the dietary recommendations used were from Brazilian guidelines on dislipidemy and prevention of atherosclerosis.¹³ The quantities of sodium and the groups of foods were evaluated by the Food Guide for the Brazilian Population.¹⁴

The anthropometric measurements were obtained by a trained nutritionist. The Body Mass Index (BMI) was calculated to verify the nutritional status according to the classification recommended for adults¹⁵ and the elderly¹⁶ and the cardiovascular risk according to the circumference of the waist.¹⁷

For concomitant comparison of quantitative variable averages, the Analysis of Variance (ANOVA) was applied, to evaluate the existence of at least one significant difference among the stages of change, followed by the Tukey's Test or Dunnett's Test of multiple comparison, such as post hoc analysis, to identify among which stages there was difference. The Tukey's Test was applied, when the Test of Homogeneity of Variances showed $p \geq 0.05$, and Dunnett's Test was applied when $p < 0.05$. In the case of comparison of two averages, we applied the Student's t Test, adjusted by Levene's Test for the Equality of Variances.

The associations among the qualitative variables were analyzed by the Chi-Square Test. The value of significance adopted was of 5%. The analyses were conducted in SPSS statistics program for Windows (SPSS version 13.0, SPSS Inc., Chicago, IL, 2005).

This study is a sub-project of the research protocol "Nutritional Education of Patients Who Underwent Coronary Transluminal Angioplasty: Randomized Study", which followed the ethical principles for research involving human beings, and it was approved by the Ethics Commission for Analysis of Research Projects of the Institution. All participants were informed of the study and signed the Free Informed Consent Form.

Results

The sample was formed by 200 patients, in that the majority were males (70%), with mean age of 60 years old and 7.5 years of study.

Systemic arterial hypertension was the most prevalent clinical history (86%), followed by dyslipidemia (76%) and acute myocardial infarction (43%). Positive family history for coronary artery disease was present in 40% of patients, diabetes mellitus in 39%, angina in 30% and smoking in 23%, in that 46% affirmed that they were former smokers. Previous angioplasty was conducted in 22% and myocardial revascularization in 11% of the patients.

Regarding the stages of change of the eating behavior, it was verified the predominance of individuals in maintenance, followed by the preparation stage and fewer individuals in contemplation (table I).

There was no difference between genders in the stages of change ($p = 0.569$). The mean age in the precontemplation stage was the oldest one (64.6 years

Table I
Distribution of stages of change of eating behavior in patients who underwent PTCA. InCor, São Paulo, 2009

| Stages of change | Number of patients | % |
|------------------|--------------------|-----|
| Precontemplation | 35 | 17 |
| Contemplation | 18 | 9 |
| Preparation | 53 | 26 |
| Action | 23 | 12 |
| Maintenance | 71 | 36 |
| Total | 200 | 100 |

old), followed by maintenance (58.3 years old) and contemplation (55.3 years old). We observed significant difference in the mean ages between precontemplation with contemplation ($p = 0.008$) and maintenance ($p = 0.013$).

School education, in general, was low, with prevalence of individuals with 0 to 4 years of study (43%). We observed 20% with 5 to 8 years of study, 18% with 9 to 11 years of study and 19% with 12 or more years of study. Individuals with more school education (more than 4 years of study) were mainly in the maintenance stage (75%) and those with lower school education in preparation and precontemplation, both with 57%. The school education degree reflected the level of readiness to change the eating behavior ($p = 0.003$).

Regarding the nutritional status (table II), 64% of the sample were overweight individuals (with pre-obesity or risk of obesity). Due to the low prevalence of individuals with low weight, they were included with individuals in eutrophia for analysis purposes. The mean BMI was 28.4 kg/m² (SD = 4.4).

Obesity was more frequent in the contemplation stage (50%), followed by preparation (34%) and action (31%). The overweight predominated in the action stage (52%), followed by precontemplation and maintenance stages with 34% each and eutrophia and/or low weight was higher in the precontemplation stage (43%), followed by preparation (40%) and maintenance (38%). We observed 28% of obese individuals in maintenance, in a total of 62% overweight in this stage (fig. 1).

The circumference of the waist was altered in 73% of the cases, being significantly higher in women, 88%, than in men, 66% ($p = 0.001$).

Table II
Absolut and relative frequencies of nutritional status in patients who underwent PTCA. InCor, São Paulo, 2009

| Nutritional status | Number of patients | % |
|-------------------------------|--------------------|-----|
| Obesity | 62 | 31 |
| Preobesity or risk of obesity | 66 | 33 |
| Eutrofy | 65 | 33 |
| Low Weight | 7 | 3 |
| Total | 200 | 100 |

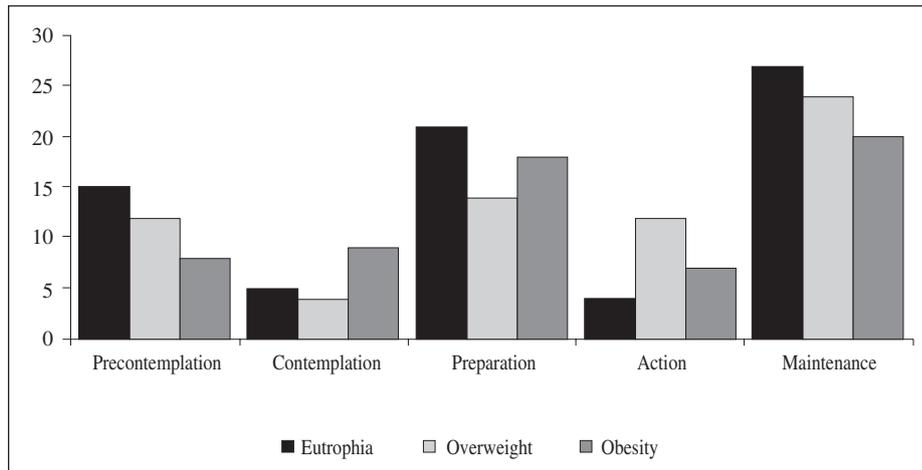


Fig. 1.—Distribution of nutritional status among stages of change of eating behavior. InCor, São Paulo, 2009.

There was not observed an association between the stages of change and the nutritional status ($p = 0.130$) or with the circumference of the waist ($p = 0.646$); however, 50 (75%) overweight individuals and 45 (73%) obese individuals were more willing to change, that is to say, in the stages of preparation, action and maintenance.

Calorie intake varied between 1,171 kcal and 6,555 kcal, with average of 2,534.5 kcal, SD = 752.5 kcal and median of 2,404 kcal.

In the analysis of average of calories consumed, individuals whose intake exceeded 4,600 kcal ($n = 4$) were excluded. It was verified a higher calorie intake in the preparation stage in relation to the maintenance stage (table III).

The distribution of macronutrients among the stages of change was appropriate, as well as the intake of

fibers and cholesterol within the recommended range. Saturated fat represented 8% of total calories in preparation and action and 9% in the other stages, whereas monounsaturated fat contributed with 8% of total calories in all stages except for maintenance, in which it was 9%.

Among individuals in maintenance, 13% had excessive fat in their diets (more than 35% of total calories), 39% had more than 20% of calories coming from protein and 34% exceed 60% of calories coming from carbohydrates, showing that there is no nutritional adequacy in this stage.

In relation to food groups (table IV), there was difference in the number of portions among the stages of change in the groups of meats/eggs and sweets ($p < 0.05$ in the last column). A significantly higher intake of meats and eggs was observed by individuals in

Table III
Distribution of average of calories and adjusted nutrients to energy among stages of change of eating behavior. InCor, São Paulo, 2009

| Calories and nutrients | Total average* | Averages among stages of change | | | | | Sig (p) |
|---------------------------------|----------------|---------------------------------|-------|--------------------|-------|--------------------|---------|
| | | PC | CP | PP | AC | MA | |
| Calories (kcal) | 2,478 | 2,399 | 2,348 | 2,700 [‡] | 2,510 | 2,369 [‡] | 0.04 |
| Carbohydrates (g) | 348 | 343 | 321 | 374 | 349 | 335 | 0.19 |
| Calories from carbohydrates (%) | 55 | 57 | 55 | 56 | 56 | 57 | 0.06 |
| Protein (g) | 102 | 97 | 96 | 107 | 112 | 98 | 0.09 |
| Calories from protein (%) | 16 | 17 | 17 | 16 | 18 | 17 | 0.16 |
| Total fat (g) | 79 | 79 | 82 | 82 | 78 | 77 | 0.60 |
| Calories from fat (%) | 28 | 28 | 30 | 29 | 27 | 28 | 0.48 |
| Saturated fat (g) | 24 | 24 | 26 | 25 | 24 | 23 | 0.31 |
| Monounsaturated fat (g) | 23 | 24 | 24 | 24 | 24 | 23 | 0.99 |
| Fiber (g) | 28 | 30 | 25 | 28 | 31 | 28 | 0.09 |
| Cholesterol (mg) | 276 | 274 | 273 | 292.4 | 283 | 263 | 0.45 |
| Sodium (mg) | 3,194 | 3,113 | 3,210 | 3,232 | 3,444 | 3,122 | 0.27 |

*Individuals with caloric consumption above 4,600 kcal were excluded; [‡] $p = 0.032$; PC = precontemplation; CP = Contemplation; PP = Preparation; AC = Action; MA = Maintenance.

Table IV
Distribution of average number of portions among stages of change of eating behavior according to food groups.
InCor, São Paulo, 2009

| Food Groups | Recommendation (portions/day) ¹⁴ | Number of portions | Number of portions average among stages of change | | | | | Sig (p) |
|---------------------|---|--------------------|---|-----|------------------|------------------|------------------|---------|
| | | | PC | CP | PP | AC | MA | |
| Fruits | 3 | 4.0 | 4.2 | 2.8 | 3.9 | 4.4 | 4.0 | 0.089 |
| Vegetables | 3 | 3.4 | 3.5 | 3.0 | 3.1 | 4.0 | 3.6 | 0.090 |
| Bread and grains | 6 | 5.0 | 5.0 | 5.0 | 5.2 | 5.0 | 4.8 | 0.588 |
| Meat /eggs | 1 | 3.3 | 3.3 | 3.4 | 3.6* | 3.8 [‡] | 2.9** | 0.006 |
| Milk /milk products | 3 | 2.2 | 1.9 | 2.1 | 2.2 | 2.3 | 2.3 | 0.394 |
| Fats | 1 | 3.6 | 2.8 | 3.5 | 3.6 | 3.6 | 3.2 | 0.157 |
| Sweets | 1 | 2.9 | 2.6 | 4.0 | 3.5 [†] | 2.8 | 2.3 [†] | 0.026 |

PC = Precontemplation; CP = Contemplation; PP = Preparation; AC = Action; MA = Maintenance.

*p = 0.017; [†]p = 0.017; [‡]p = 0.040.

action (p = 0.017) and preparation (p = 0.017) in relation to maintenance, and of sweets by individuals in preparation (p = 0.040) in relation to maintenance.

In relation to previous cardiovascular events (acute myocardial infarction, angioplasty and/or myocardial revascularization), there was association (p = 0.042) among those with previous events, 52% of the sample, and the most advanced stages of change. The stages were grouped into two categories: action and maintenance (n = 94), and the three other stages (n = 106). We observed the presence of previous cardiovascular events in 59% of the individuals in action and maintenance and in 45% in the other stages.

Discussion

The characteristics of the population studied were similar to the information of the National Center of Cardiovascular Interventions, an agency belonging to the Brazilian Society of Intervention Cardiology and Hemodynamics, whose mean age was of 62 ± 11.2 years old, 67% of males with percutaneous treatment, 19% with previous percutaneous revascularization and 10% surgical revascularization. The national information indicates lower prevalence of individuals with diabetes (21%), hypertension (25.5%) and dyslipidemia (45%) and more frequent smoking (41%).¹⁸ Since it is a sample from a hospital specialized in cardiology, a higher number of risk factors is expected.

Most individuals (74%) from this study were motivated themselves to make changes in eating (preparation, action and maintenance). The classification in the stages of change in eating behavior was based on individual answers, that is, according to subjective, spontaneous self-report, for the matter proposed, which may generate a deviation between the perception of individuals and their actual eating behavior.¹⁹ Some people may not consider changes in their eating because they believe that they are healthy enough, when they in fact

are not⁷ or believe that they have correctly changed their diets, when they have not.⁸ The difference between self-classification and the effective food intake in part of the individuals in the maintenance stage in relation to the distribution of macronutrients was also observed in other eating behaviors, suggesting the use of an objective instrument to compare and correct the classification of the stages of change.^{6,9}

The term “healthy eating” is generic and includes a series of concepts. This approach, however, is useful when multiple dimensions of the diet are encouraged, such as in weight control, for example, and one does not wish to focus on the intake of a single food or nutrient.²⁰

When the behavior is more generic, there is a tendency to have a higher number of individuals in maintenance than in more specific behaviors¹⁹. The action stage is the least stable one, so that a lower number of people classified as such is expected, whereas the precontemplation and maintenance stages are the most stable ones.²¹

Studies in cardiac patients in rehabilitation observed more individuals in the most advanced stages of change for reduction of fat. Frame¹⁰ identified in his first sample, numerically similar to our work, 78% in the stages of action and maintenance for reduction of fat and 81% in the stages of precontemplation and contemplation for the increased intake of fruits and vegetables. Two years later, 91.5% were at maintenance stage for reduction of fat, opposed to only 25% for increased intake of fruits and vegetables, suggesting different interventions for these two foods groups.²² McKee²³ observed 68% of individuals in the action and maintenance stages to follow a healthy diet before a cardiac rehabilitation program in another sample, also numerically similar.

The most frequent presence of individuals in maintenance and action among those who have already had any previous cardiovascular event may be explained by the positive repercussion of the event itself in the change of eating habits, in an attempt to restore health.²²

Different from other studies,^{7,8} which suggest that women are more interested in eating healthily than men, we did not observe statistical difference between the gender and the stages of change, with the exception of a higher percentage of men in this study.

The same occurred with age, when we expect the more frequent presence of elders in the maintenance stage, either because of more awareness in relation to health or because of the association with chronic diseases,⁷ we verified that the older age was predominant in the precontemplation stage. This fact was also observed in Spain, and it may be explained by the increased concern about eating habits and openness to messages related to eating and health by younger people.⁸

In relation to school education, the association of individuals with higher school education degree in the maintenance stage was confirmed, similar to other studies.^{7,8}

Although the average distribution of macronutrients is appropriate, the analysis according to group of foods showed that all the stages had intake of dairy products below the recommended range (3 servings/day) and excessive intake of sweets and fats (more than 1 daily serving of each).¹⁴

The intake of fruits is below the minimum recommendation of three daily servings among individuals in contemplation, but when considering fruits and vegetables, we observed more than five daily servings in all stages, which shows a concern about consuming these foods by this population.

Saturated fats are above and monounsaturated fats are below the recommendation for this population.¹³ The average quantity of sodium is appropriate (< 5 g/day),¹⁴ but it exceeds in dietary cholesterol (> 200 mg/day).¹³

We did not find any significant difference of the nutrients or food groups among the stages of change, except for total calories, sweets and meats and eggs. This result is opposed to the literature, where normally there is a linear reduction of fats^{4,10} and increase of fruits and vegetables^{5,6} from the precontemplation stage to maintenance. However, only Frame¹⁰ studied cardiopathies, from which only 7% underwent PTCA. Nothwehr²⁰ did not find a significant tendency regarding the intake of fruits, vegetables and percentage of calories of the diet coming from fat in the progression of the stages in healthy individuals.

The lower intake of sweets, meats and eggs in maintenance, and even regarding energy intake, above only the contemplation stage (in 20 kcal), reinforces the hypothesis of tendency of increased practices of healthy life style in the most advanced stages of change.²⁴

Regarding the dairy group, no studies in literature were found, except for the intake of calcium, in which Zhang²⁵ showed increase among the successive stages. The bread and other sources of carbohydrates group was also little studied. Ling⁶ found increased intake of grains and cereals from the precontemplation to the

maintenance stage. We did not find studies relating the intake of meats and eggs, sodium and cholesterol among the stages.

The fact that most of the population is overweight is a reflex that the calorie intake is above their needs, and it suggests a mistaken perception of eating regarding the total calories consumed, especially among individuals in maintenance, where 62% were overweight.

These pieces of information are worrying, because even those who classify themselves in maintenance need to adjust their diets. The adoption of "healthy eating habits" usually refers to more than one change in food consumption, so that individuals in maintenance stages may attribute their changes to a certain factor which, however, may be insufficient.

The nutritional status with more than half the sample overweight is higher than the one observed in a study that characterized the nutritional risk of in-patients at a hospital specialized in cardiology, in a three-month period, in the year 2000. At that time, it was verified that from 305 adults and elders, 35% (n = 105) were overweight, and the most frequent medical diagnosis was coronary insufficiency (70%).²⁶

This scenario is understandable considering the evolution of the Brazilian eating pattern in the last decades, whose information of the most recent eating inquiry reveals an unfavorable increase of simple sugar and saturated fat.²⁷

Obesity fell back in 50% of individuals in contemplation, incoherent with the evaluation of usual eating, whose estimated calorie consumption was lower in this stage, which implies a possible flaw of the instrument used or sub-reporting of these individuals. The second stage with higher prevalence of obesity was preparation, consonant with the higher calorie intake.

The presence of a higher number of overweight than obese individuals in the action and maintenance stages suggest that these individuals have been making changes in their eating habits to lose weight and may have migrated from obesity to overweight status.

This study shows limitations, especially regarding the instrument of FFQ, which is subject to memory failure and imprecision. In addition, the study underwent adjustments to become more appropriate to the purpose of the study, without due validation. The 3-day eating recording, considered "gold standard" in estimates of eating consumption, was not used, because of an unsuccessful previous experience, probably related to the low school education of the sample. The FFQ was chosen because of the easy eating consumption calculation, considering the time and human resources. The authors did not raise the time of diagnosis in the stage of change, but events with higher impact, such as previous acute myocardial infarction and myocardial revascularization were considered. Finally, the classification of the stages of change represented the individual perception of eating practices, without verification of what the patients studied considered healthy eating habits.

Conclusion

The majority of the patients who underwent PTCA in this study classified themselves into the maintenance stage for following a healthy diet and were overweight. There was no association of the stages of change with the nutritional status, but lower calorie intake, lower intake of meats and eggs and sweets was observed in maintenance. The presence of cardiovascular event was higher in the action and maintenance stages.

This work contributed to identifying the stages of change and conditions that favor changes in eating as part of the treatment of coronary patients: presence of previous cardiac events, lower age and higher degree of school education. The implications for clinical practice indicate that, even patients that classified themselves into the maintenance stage need to adjust their eating habits in order to reach a healthy weight, creating the need to research strategies of nutritional education that result in a healthier eating pattern and more appropriate weight for this population.

References

1. Rub M, Cremer J, Krian A, Meinertz T, Werdan K, Zerkowski H-R. Different treatment options in chronic coronary artery disease. *Dtsch Arztebl Int* 2009; 106: 253-61.
2. Mente A, Koning L, Shanno HS, Anand SS. A systematic review of the evidence supporting a causal link between dietary factors and coronary heart disease. *Arch Intern Med* 2009; 169: 659-69.
3. Prochaska JO, DiClemente CC, Norcross JC. In search of how people change. Applications to addictive behaviors. *Am Psychol* 1992; 47: 1102-14.
4. McDonnell GE, Roberts DCK, Lee C. Stages of change and reduction of dietary fat: effect of knowledge and attitudes in an Australian university population. *JNE* 1998; 30: 37-44.
5. Di Noia J, Schinke SP, Prochaska JO, Contento IR. Application of the transtheoretical model to fruit and vegetable consumption among economically disadvantaged African-American adolescents: preliminary findings. *Am J Health Promot* 2006; 20: 342-8.
6. Ling AMC, Horwath C. Defining and measuring stages of change for dietary behaviors: readiness to meet fruit, vegetable, and grain guidelines among Chinese Singaporeans. *J Am Diet Assoc* 2000; 100: 898-904.
7. De Graaf C, Van der Gaag M, Kafatos A, Lennernas M, Kearney JM. Stages of dietary change among nationally-representative samples of adults in the European Union. *Eur J Clin Nutr* 1997; 51 (Suppl. 2): 47-56.
8. López-Azpiroz I, Martínez-González MA, León-Mateos A, Kearney J, Gibney M, Martínez JA. Stages of dietary change and nutrition attitudes in the Spanish population. *Public Health* 2000; 114: 183-9.
9. Toral N, Slater B. Perception of eating practices and stages of change among Brazilian adolescents. *Prev Med* 2009; 48: 279-83.
10. Frame CJ, Green CG, Herr DG, Myers JE, Taylor ML. The estages of change for dietary fat and fruit and vegetable intake of patients at the outset of a cardiac rehabilitation program. *Am J Health Promot* 2001; 15: 405-13.
11. Viebig RF, Valero MP. Development of a food frequency questionnaire to study diet and non-communicable diseases in adult population. *Rev Public Health* 2004; 38: 581-4.
12. Willett W, Stampfer M. Implications of total energy intake for epidemiologic analyses. In: Willett W. *Nutritional Epidemiology*. 2nd ed. New York: Oxford University Press; 1998, pp. 273-301.
13. Brazilian Society of Cardiology. IV Brazilian guideline on lipidology and prevention of atherosclerosis. *Arq Bras Cardiol* 2007; 88 (Suppl. 1): 2-19.
14. Brazil. Ministry of Health. Bureau of Health Care/ General Coordination of Food and Nutrition Policy. Food guide for Brazilians: promoting healthy eating. Brasilia: Ministry of Health; 2005.
15. World Health Organization (WHO). Obesity: Preventing and managing the global epidemic: Report of a WHO consultation. WHO Technical Report Series, 894. Geneva: World Health Organization; 2000. 252 p.
16. World Health Organization (WHO). Análises da 36ª Reunião del Comité Asesor de Investigaciones en Salud. Encuesta Multicéntrica: Salud, Bien estar y Envejecimiento (SABE) en América Latina y el Caribe. Washington (DC): World Health Organization; 2001.
17. International Diabetic Federation. The IDF consensus worldwide definition of the metabolic syndrome. Belgium: IDF; 2006. 24p.
18. Mangione JA. Percutaneous coronary intervention in Brazil. Which are our numbers? *Rev Bras Cardiol Invas* 2006; 14: 267-72.
19. Povey R, Conner M, Sparks P, James R, Shepherd R. A critical examination of the application of the transtheoretical model's stages of change to dietary behaviors. *Health Educ Res* 1999; 14: 641-51.
20. Nothwehr F, Snetselaar L, Yang J, Wu H. Stage of change for healthful eating and use of behavioral strategies. *J Am Diet Assoc* 2006; 106: 1035-41.
21. Greene GW, Rossi SR, Rossi JS, Velicer WF, Fava JL, Prochaska JO. Dietary applications of the stages of change model. *J Am Assoc Diet* 1999; 99: 673-8.
22. Frame CJ, Green CG, Herr DG, Taylor ML. A 2-year stage of change evaluation of dietary fat and fruit and vegetables intake behaviours of cardiac rehabilitation patients. *Am J Health Promot* 2003; 17: 361-8.
23. McKee G, Bannon J, Kerins M, FitzGerald G. Changes in diet, exercise and stress behaviours using the stages of change model in cardiac rehabilitation patients. *Eur J Cardiovasc Nurs* 2007; 6: 233-40.
24. Spencer L, Wharton C, Moyle S, Adams T. The transtheoretical model as applied to dietary behaviour and outcomes. *Nutr Res Rev* 2007; 20: 46-73.
25. Zhang Y, Ojima T, Murata C. Calcium intake pattern among Japanese women across five stages of health behaviour change. *J Epidemiol* 2007; 17: 45-53.
26. Oliveira A, Ferreira MFS, Cardoso E, Isosaki M. Nutritional risk of hospitalized patients in a public cardiac hospital of São Paulo. *Rev Soc Cardiol Estado de São Paulo* 2003; 4 (Suppl. A): 36-44.
27. Levy-Costa RB, Sichieri R, Pontes NS, Monteiro CA. Household food availability in Brazil: distribution and trends (1974-2003). *Rev Public Health* 2005; 39: 530-40.