Cholesterol and Fats in Brazilian Foods: Implications for Prevention of Atherosclerosis

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Summary

Background: In order to perform food surveys and prescribe diets, food composition tables have to be consulted. However, these tables are limited to the description of fatty acids and cholesterol contents and do not provide information on the different preparation methods.

Objectives: Based on data derived from an extensive analysis of the chemical composition of Brazilian foods, we assessed the impact of certain types of foods on diets recommended for the prevention of coronary disease.

Methods: The fatty acid and cholesterol composition of some types of foods and different preparation methods were analyzed. These results were used according to the recommendations of the American Heart Association for an 1,800 calorie diet.

Results: Cholesterol found in 100g of eggs (400mg) or fried beef liver (453mg) exceeds the amount recommended for secondary prevention, and there is no difference in cholesterol content between factory-farmed eggs and free-range eggs. The eggs had an average of 400mg of cholesterol per 100g, thus exceeding the recommended amount of up to 300mg. Each egg has 50g on average; one egg can be consumed provided that not more than 100mg of cholesterol are consumed per day. As regards saturated fat, butter (55.2g), margarine (19.4g), tilsit cheese (20.4g), Brazilian Dutch Edam cheese (19.9g), yellow (16.8g) and fresh white cheese (15.5g) exceed the 14g recommended if 100g or more are consumed. The same is true for soy oil (17.5g) and corn oil (16.1g).

Conclusions: Better knowledge on fat and cholesterol contents in foods allows the prescription of amounts not exceeding the recommended values for prevention, and this may result in better compliance to diets. (Arq Bras Cardiol 2009;92(3): 180-185)

Key words: Diet; dyslipidemias; risk factors; cholesterol; fats.

Introduction

Economic transitions, urbanization and industrialization bring about changes in lifestyle that can lead to an increased incidence of cardiovascular diseases. Risk factors such as cigarette smoking, sedentary lifestyle and unhealthy eating are directly related to these changes. Several authors have demonstrated the advantages of the control of risk factors in studies including thousands of individuals with or without coronary artery disease. In 1990, Ornish et al[1] studied a small group of 28 patients with coronary artery disease and showed the results of a one-year vegetarian diet, smoking cessation, stress management training, and moderate exercise. Coronary angiography performed prior to the study and repeated one year later revealed partial regression of the degree of stenosis in 82% of the lesions in the experimental group, mainly in those with more severe lesions, whereas progression was observed in the control group. Therefore, Ornish et al's study[1] demonstrated that dietary intervention without the use of medications may result in significant effects on coronary atherosclerosis.

To carry out dietary surveys and prescribe diets, it is necessary to consult food composition tables. In Brazil, the Brazilian Food Composition Table, one of the most frequently used references, was elaborated using information from the food industry, based on strict analysis criteria, by filling out a special form created by the Department of Food and Experimental Nutrition of *Faculdade de Ciências Farmacêuticas da Universidade de São Paulo*[2]. However, this table is limited because, in relation to fatty acids and cholesterol, it only provides data regarding total lipids and total cholesterol. For some types of meat, it does not provide information on the different food preparation methods either. Another frequently used source is the table from *Escola Paulista de Medicina da Universidade Federal de São Paulo*[3], which was actually adapted from a 2001 table of the United States Department of Agriculture, Agricultural Research Service, and is therefore American. It provides information on total lipids, cholesterol,

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saturated fat, monounsaturated and polyunsaturated fat; however, the information related to the preparation method is not clear[3]. Also, the chemical composition of foods may be different according to the table used[4]. Recently, we carried out an extensive evaluation of the chemical composition of a large number of foods used in Brazil to build a food composition table with clinical applicability in our country[5]. In the present study, we used data derived from this food analysis to determine the impact of the inclusion or exclusion of certain types of food on diets recommended for primary and secondary prevention of coronary artery disease.

Methods

Analysis of food chemical composition

All the food analyses listed here were carried out in the laboratories of the *Instituto de Tecnologia de Alimentos da Secretaria de Agricultura e Abastecimento do Governo do Estado de São Paulo* and financed by the *Instituto Nacional de Metrologia, Normalização e Qualidade Industrial* (INMETRO) of the Ministry of Development, Industry and Foreign Commerce of Brazil. Specific methodologies were used for the assessment of food composition in relation to total lipids[6,7], cholesterol[8,9], fatty acid composition[10], determination of sodium chloride content[11] and moisture[12,13]. The full description of the methodology of analysis of food chemical composition has been previously described elsewhere[5]. For the analysis of meat, fish and variety meats, three whole pieces were acquired and a sample was removed from each piece for each preparation method (roasted, grilled, cooked, and fried). Fried meat was cooked by immersing the meat in hot soy oil. For the analysis of milk, two to five different brands of low-fat, nonfat, whole, and omega-3-enriched milk were acquired. Six brands of white and Brazilian Dutch Edam cheese, as well as five brands of butter and margarine were analyzed. Eggs whose cartons labeled them as factory-farmed eggs, free-range eggs or low-fat egg were also analyzed. Each sample was comprised of six eggs boiled for 10 minutes, homogenized and weighted, and the yolks were separated. Finally, for canola, corn, soy and sunflower oils, each sample was comprised of one can of oil of four different brands. Information on the chemical composition of these foods was evaluated in function of the limits of fat consumption proposed for diets of primary and secondary prevention of coronary artery disease.

Simulation of diet prescription

1800 kcal per day menus were simulated for individuals in primary prevention according to phase I recommendations of the American Heart Association[14]. The fat composition in this diet includes: 35% of the total caloric value in fats, with less than 7% saturated fats, less than 10% polyunsaturated fats, less than 20% monounsaturated fats; and cholesterol content must be lower than 300 mg. Therefore, for the primary prevention diet with a total daily caloric value of 1800 kcal, up to 630 Kcal or 70 g of fats would be acceptable per day, with up to 126 kcal or 14 g of saturated, 180 kcal or 20 g of polyunsaturated and 360 kcal or 40 g of monounsaturated fat.

In the secondary prevention simulations, we followed the recommendations of the ATP III for dyslipidemic patients[15], which are also validated by the Guideline of the Department of Atherosclerosis of the Brazilian Society of Cardiology[16], the American Heart Association, and the American College of Cardiology[17]. The fat composition of this diet includes less than 30% of the caloric value in lipids, with less than 7% of saturated fats, less than 10% of polyunsaturated fats, 10 to 15% of monounsaturated fats; cholesterol content should be lower than 200 mg. Therefore, for the secondary prevention diet, with a total daily caloric value of 1800 kcal, up to 540 kcal or 60 g of fats per day, with up to 126 kcal or 14 g of saturated fat, 180 kcal or 20 g of polyunsaturated fat and 270 kcal or 30 g of monounsaturated fat would be accepted.

Results

The cholesterol content in meats, variety meats, eggs and butters are shown in Table 1, in descending order. On the left side of Table 1 are the limits established for daily consumption of these foods according to recommendations for primary and secondary prevention. According to the last revision of the American Heart Association's recommendation for nutrition in primary prevention, considering the cholesterol content, we can observe that fried beef liver, chicken eggs (one egg weights 50g on average), cooked chicken heart, and possibly grilled shrimp should not be consumed in the amount of 100g, because the maximum recommended value for cholesterol would be exceeded. Cooked tripe, grilled or fried shrimp, butter, and possibly cooked chicken heart, in turn, practically reach the limit recommended for the same amount, but exceed the recommendations for secondary prevention, and should not be consumed in this amount. We should only observe that the amount of 100g of butter per day is hardly ever consumed in our midst.

Table 2 shows the saturated fat content in butters, cheeses, and cold cuts in descending order. On the left side of Table 2 are the limits established for daily consumption of these foods, according to recommendations for primary and secondary prevention. If butter, margarine (less) and some types of cheese such as yellow cheese and fresh white cheese are consumed in the amount of 100g, the maximum levels recommended for healthy or dyslipidemic patients will be exceeded. Pork cold cuts, beef cold cuts, and possibly also roaster and chicken cold cuts, in turn, are a little further below the limit, but should be consumed with caution, and we should observe that cold cuts are hardly ever consumed in daily amounts of 100g.

In the analysis of polyunsaturated fats (Table 3), some margarines exceeded the maximum amounts recommended in the simulation performed both for primary and secondary prevention, when used in amounts equal to or greater than 100g per day (salted margarines 25mg/100g; unsalted 24mg/100mg).

Table 4 shows the analysis of trans fat content found in some food preparation methods used in this study that had a higher content of these fats. In this context, roaster, chicken breast, and sirloin, all prepared fried, show a higher content of this type of fat in comparison with their respective grilled preparation. We should remember that, in this study, the fried preparation means immersion in hot oil (in this case, we used soy oil), which is a form of production of trans fats,

Table 1 – Cholesterol content in meats, eggs and butters

	Sample description	Nº of samples	Cholesterol (mg/100g)
Primary Prevention	Fried beef liver	3	490.10
	Fried beef liver	1	444.90
	Fried beef liver	2	425.80
	Factory-farmed eggs	6	405.00
	Free-range eggs	5	400.00
	Factory-farmed eggs	6	390.00
	40%-cholesterol eggs	6	390.00
	20%-colesterol eggs	6	378.00
	Raw liver	3	375.70
	Cooked chicken heart	2	335.30
	Cooked chicken heart	1	323.20
Secundary Prevention	Raw liver	2	314.70
	Raw liver	1	306.50
	Grilled shrimp	1	302.00
	Cooked tripe	3	290.30
	Fried shrimp	1	283.20
	Fried shrimp	3	271.80
	Fried shrimp	2	256.50
	Grilled shrimp	2	255.50
	Cooked tripe	1	244.60
	Unsalted butter	2	239.80
	Cooked tripe	2	239.00
	Grilled shrimp	3	234.50
	Salted butter	3	224.80
	Unsalted butter	1	222.00
	Salted butter	2	217.70
	Salted butter	1	207.80
	Cooked chicken heart	3	202.50

Table 2 – Saturated fat content

	Sample description	Sample	Saturated (g/100g)
Primary Prevention	Unsalted butter	2	58.07
	Salted butter	2	56.03
	Salted butter	1	54.56
	Salted butter	3	54.45
	Unsalted butter	1	53.05
	Salted margarines	1	28.59
	Salted margarines	2	23.2
	Unsalted margarines	1	22.93
	Tilsit cheese	1	20.39
	Brazilian Dutch Edam cheese [I]	1	19.9
	Yellow cheese	3	18.19
	Fresh white cheese	2	17.7
Secundary Prevention	Yellow cheese	1	17.53
	Yellow cheese	2	16.94
	White cheese	1	15.84
	Yellow cheese	4	14.48
	Fresh white cheese	1	13.31
	Pork cold cuts	2	8.32
	Beef cold cuts	2	8.17
	Pork cold cuts	3	7.11
	Beef cold cuts	2	5.55
	Roaster cold cuts	1	5.39
	Pork cold cuts	1	4.96

whose maximum recommended levels are of less than 1% of the total calories, corresponding to less than 2g per day in our simulation. Therefore, deep frying is not the most recommendable form of food manipulation. In this simulation, no food exceeded the limits of primary or secondary prevention for the amount of 100g.

In relation to monounsaturated fats, no food exceeded the maximum recommendations whether for primary or secondary prevention, and butters and margarines were those that had the highest contents of this type of fat.

Discussion

This study shows the importance of a real knowledge on the composition of cholesterol and fatty acids in edible products produced in Brazil, and how they behave when undergoing different cooking methods. With this knowledge we can provide patients and the population with menu options that are more attractive and devoid of a punitive connotation. Thus a higher compliance to a healthier diet for the heart can be achieved, considering the low compliance rate to all types of diets in three months[18].

The tables of food chemical composition most frequently used in our country do not provide information regarding cholesterol and fatty acids for most of the foods in the form they are consumed. Despite being more complete and including a series of meats with their different cuts, the TACO table[19] used by *Universidade de Campinas* does not provide data related to the preparation method, but only the contents in the raw form. The table used by *Universidade Federal de São Paulo*[3] is American and its data, albeit more encompassing, do not reflect the reality of our country, where the type of cattle is from different breeds, and the cattle feed is different. Finally, the *Universidade de São Paulo*[2] uses data obtained from a well-structured questionnaire, answered by the producers, and do not include information on the preparation method either. Our data are related to food produced and consumed in our country, and the samples were collected in the formal market where housewives and merchants purchase their goods.

The existence of different influences related to the effects of the cooking methods on the chemical and cholesterol composition of meats has already been demonstrated by

Table 3 – Polyunsaturated fat content (g/100g)

Description	Mean
Margarine (salted and unsalted)	21.00
Calabresa peppery sausage	3.50
Low-fat turkey sausage	3.20
Grilled salmon	3.11
Fried shrimp	3.04
Chicken sausage	2.90
Beef cold cuts	2.85
Cooked salmon	2.81
Hot Dog sausage	2.80
Raw chicken heart	2.45
Roaster cold cuts	2.44
Thin peppery sausage	2.40
Chicken cold cuts	2.22
Raw salmon	2.17
Fried beef liver	2.14
Pork cold cuts	2.07
Fried sirloin with fat	2.05
Cooked chicken heart	1.96
Butter (salted and unsalted)	1.70
Fried chicken breast with skin	1.49
Turkey cold cuts	1.32
Cooked chicken breast with skin	1.31
Grilled chicken breast with skin	1.28
Raw chicken breast with skin	1.26
Fried roaster	1.25
Pork tender loin with fat	0.99
Fried chicken breast without skin	0.95
Grilled pork leg with fat	0.93
Eggs	0.88
Grilled pork leg without fat	0.84
Raw liver	0.84
Roasted pork leg without fat	0.78
Raw pork leg with fat	0.78
Tilsit cheese	0.77
Roasted pork tender loin	0.75
Roasted pork leg with fat	0.74
Grilled pork tender loin	0.71
Grilled roaster	0.64
Grilled shrimp	0.62
Roaster sausage	0.60
Yellow cheese	0.59
Brazilian Dutch Edam cheese [l]	0.56
Grilled chicken breast without skin	0.52
Cooked roaster	0.51
Grilled snapper	0.45
Raw roaster	0.45
Fresh white cheese	0.41
Cooked chicken breast without skin	0.40
Cooked snapper	0.38
White cheese	0.38
Raw pork leg without fat	0.32
Raw chicken breast without skin	0.30
Pork tender loin without fat	0.29
Raw snapper	0.28
Raw shrimp	0.26
Grilled sirloin with fat	0.20
Fried sirloin without fat	0.20
Grilled sirloin without fat	0.20
Raw sirloin with fat	0.14
Raw tripe	0.12
Raw sirloin without fat	0.12
Cooked tripe	0.12
	(%)
Sunflower oil	61.60
Soy oil	58.50
Corn oil	48.30
Canola oil	28.00

several authors[20-22]. Rosa et al[23] came to the same conclusion by comparing the effects of cooking in water, oil, grill, conventional oven, and microwave oven in relation to fats in chicken breast and thigh and finding differences between these methods. These studies show that oil-free cooking methods result in fat loss, whereas frying leads to oil absorption, and there are differences between oil absorption in different cuts[22].

Several studies prove the influence of eating on blood lipids and on the progression of atherosclerosis[24], and others show the difficulty in making the population change their eating habits[18]. If we show simple solutions that increase the compliance of the population in general and of patients in particular based on clear and reliable information instead of listing what cannot be consumed, dietary interventions will likely be more effective. In practice, this study alerts to the need for more information in relation to cholesterol and fatty acid contents under two aspects: the first, in relation to goods used by the Brazilian population; and the second, in relation to this chemical composition after the food is manipulated and prepared for table consumption. Additionally, some myths are debunked, as in the case of pork leg. With this information, physicians, nutritionists and the population are more confident when indicating or evaluating a menu.

This study, which is focused only on the chemical composition of cholesterol and fatty acid chain of some foods, does not include all the components of the food chain of the Brazilian people and not even all the most frequently used preparation methods of these foods. When our findings are compared with the data provided in the most frequently used tables in our midst, we can observe the lack

Table 4 – Trans fatty acid content according to the food preparation method

Less indicated preparation method	Trans Linoleic + Elaidic (mg/100g)		Healthier preparation method
Fried roaster	425.73	16.07	Grilled roaster
Fried roaster	382.54	5.67	Grilled roaster
Fried chicken breast with skin	313.55	0.00	grilled chicken breast with skin
Fried chicken breast without skin	304.29	0.00	grilled chicken breast without skin
Fried chicken breast with skin	271.22	0.00	grilled chicken breast with skin
Fried chicken breast without skin	270.93	0.00	grilled chicken breast without skin
Fried chicken breast without skin	238.14	0.00	grilled chicken breast without skin
Fried chicken breast with skin	186.35	0.00	grilled chicken breast with skin
Fried sirloin with fat	103.05	0.00	Grilled sirloin with fat
Fried sirloin with fat	82.07	0.00	Grilled sirloin with fat
Fried sirloin with fat	56.33	0.00	Grilled sirloin with fat
Fried sirloin without fat	76.21	0.00	Grilled sirloin without fat
Fried sirloin without fat	46.99	0.00	Grilled sirloin without fat
Fried sirloin without fat	36.27	0.00	Grilled sirloin without fat

of this information, and, when compared with foreign tables, significant differences are found.

The data reported here may help achieve greater success in relation to low compliance and improvement of eating habits in patients with heart disease and in the population in general, by bringing more options and eliminating the punitive character that diets usually have. No foods among those studied here should be banned from a healthy diet in relation to cholesterol and saturated fats. What must be done, instead, is to choose more favorable cooking methods and limit the amounts of those foods with more elevated cholesterol or saturated fat contents.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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