Fat Content of Dairy Products, Eggs, Margarines and Oils: Implications for Atherosclerosis

Carlos Scherr and Jorge Pinto Ribeiro

Instituto do Coração e do Diabetes - ICORD; Universidade Gama Filho; Serviço de Cardiologia do Hospital de Clínicas de Porto Alegre; Medicina da Universidade Federal do Rio Grande do Sul

Abstract

Background: For appropriate advising on a meal plan aimed at the prevention of ischemic heart disease, it is necessary to know the chemical composition of foods.

Objective: To analyze the composition of fats, fatty acids and cholesterol in some Brazilian specimens of edible oils, butters, margarines, dairy products and eggs, using the limits of a diet to prevent coronary artery disease.

Methods: We analyzed the composition of edible oils, butters, margarines, dairy products and eggs. The findings were used as recommended by the American Heart Association for a 1,800 calorie diet.

Results: Comparing the edible oils, the canola oil was found to be the best.Among the milks, the skimmed milk is most advisable one, but no advantages were found over the semi-skimmed milk. For the eggs, no differences were found in the types of milk found in the market. For cheeses, the "minas" cheese had the lowest content of cholesterol and saturated fat. Comparing margarine and butter, the former was found to be better when trans fats do not exceed the recommended levels.

Conclusion: The composition of foods used in Brazil indicates that diets designed to enable primary and secondary prevention of ischemic heart disease can prioritize the use of semi-skimmed milk, sunflower oil, margarines with low content of trans fats and "minas" cheese. (Arq Bras Cardiol. 2010; [online]. ahead print, PP.0-0)

Key words: Food composition; dairy products; fats; primary prevention, secondary; myocardial ischemia; atherosclerosis.

Introduction

Mortality from coronary disease declined in the United States between 1980 and 2000, by approximately 50.0% and 44.0% of such decline was due to the control of some risk factors[1]. This represented a reduction of 150,000 deaths, and the decrease of as little as 6.1 mg/dl of total cholesterol was the most important action, responsible for 82,830 deaths prevented or postponed[1]. In 1990, Ornish had found that interventions in lifestyle could be related with the decrease in atherosclerotic plaque, which may have an impact on cardiovascular mortality, and have major repercussions on population[2]. In this vein, diet plays a major role, as found in many observational studies. Since Anitschlow's studies, which reported the development of atherosclerosis in rabbits after high-cholesterol diet, and Lagen's in 1916, who noted that cholesterol of Indonesian natives, which had a predominantly vegetarian diet, was considerably lower than the Dutch's[3]. Five natives were fed for three months with meat and eggs, and after this period, the serum cholesterol level increased by 27.0%[3]. One of the most striking reports was that of the Seven Countries study, correlating cholesterol and mortality from acute myocardial infarction[4]. This study revealed that the diet in Finland, champion of deaths, included over 20.0% of total caloric content in saturated fat, with average total cholesterol of 260 mg/dl. These data contrasted with the findings in Japan, with lower mortality from acute myocardial infarction, whose intake is 2.5% of total caloric content in saturated fat and cholesterol averaging 160 mg/dl[4].

Randomized clinical trials have also shown that adopting a diet with very little saturated fat reduces cholesterol levels and cardiovascular events. The Oslo Diet-Heart Study found a lower incidence of acute myocardial infarction in individuals who followed a diet with low saturated fat and cholesterol and rich in polyunsaturated fat[5]. Hinderliter presented the findings of Encore study during the annual meeting of the American College of Cardiology of 2009, showing that the Mediterranean-style diet (DASH) was associated with decreased blood pressure when compared with controls[6]. Even more striking were the findings of a meta-analysis with 1,574,299 individuals monitored from 3 to 18 years, which revealed a decline in overall mortality, cardiovascular, cancer and lower incidence of Alzheimer's and Parkinson's disease,

Mailing address: Carlos Scherr •
Rua Visconde de Pirajá, 595 Sl. 1204 - Ipanema - 22410-003 - Rio de Janeiro, RJ - Brazil
E-mail: cscherr@cardiol.br, scherr@all.com.br
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among those with greater adherence to this kind of diet when compared with those with lower adherence[7].

For the implementation of a diet targeted at reducing cardiovascular events, it is necessary to know the chemical composition of foods. However, the chemical composition tables of foods available in Brazil are limited to the contents of fat and cholesterol of various foods used in Brazil[8-10]. We have recently conducted an extensive evaluation of the chemical composition of many foods used in Brazil to build a table of food composition with clinical applicability in our country[11-13].

In this report, we analyzed the composition of fats, fatty acids and cholesterol in some Brazilian specimens of edible oils, butters, margarines, dairy products and eggs, using the limits of a 1,800 kcal diet, in order to provide a nutritional intervention to prevent coronary artery disease.

Methods

To perform the biochemical analysis of milk, were purchased the following items to prepare the samples: semi-skimmed milk - each sample consisted of one container of three different brands; skimmed milk - each sample consisted of one container of five different brands; full fat milk - each sample consisted of one container of four different brands; and Omega 3 milk - each sample consisted of one container of two different brands found in the market. Six brands of *"minas"* cheese and yellow cheese, and 5 brands of butter and margarine were analyzed. Factory-farmed, free-range or light eggs were also analyzed. Each sample consisted of 6 eggs boiled for 10 minutes, homogenized and weighed, after which the yolks were separated.

Finally, for cooking oils, each sample consisted of an oil bottle from 4 different brands. The result of each type of oil (canola, corn, soybean and sunflower) represents the average of 4 different brands. The chemical composition data of these food items were evaluated according to the limits of fat consumption proposed for diets of primary and secondary prevention of coronary artery disease.

The general methodology of analysis of food items was presented earlier[13]. Briefly, specific methodologies were used to assess the composition of food items in relation to total lipids[14,15], cholesterol[16,17], fatty acid composition[18], determination of sodium chloride content[19] and humidity[20,21]. The uncertainties of analyses are consistent with the criteria established by the ITAL (NBR-ISO 9001) quality system and were not included in the calculation of the findings produced, but are available for consultation. Analyses were performed both for wet and dry basis, but only the wet basis analyses were considered because they represent the food item as it is consumed. According to Decree 27 of January 13, 1998, the Board of Health, under the Ministry of Health, trans fatty acids were added to the calculation of saturated fats.

To simulate dietary prescription, we used the recommendations from the American Heart Association phase I for primary prevention[22], from ATPIII[23] and the 4th Guideline of the Department of Atherosclerosis of the Brazilian Society of Cardiology[24], for secondary prevention, based on a diet of 1,800 kcal. For primary prevention, we considered an intake of up to 70 g of fat per day, with less than 14 g saturated fats, 20 g of polyunsaturated fats and 40 g of monounsaturated fats and total cholesterol of up to 300 mg. For secondary prevention, we considered an intake of 60 g of fats per day, divided into 14 g of saturated fats, 20 g of polyunsaturated fats, 30 g of monounsaturated fats and 200 mg of cholesterol.

Statistical analysis

Statistical analysis was performed by Mann-Whitney test (nonparametric test) to compare the contents of fats, fatty acids and cholesterol in the different types of food items analyzed. The criterion for determining significance was the level of 5.0%.

Results

Table 1 shows the comparison between canola, soybean, sunflower and corn oils. Canola oil compared to soybean, corn and sunflower revealed lower amounts of saturated fat and palmitic acid. Hence, it is more recommended in an increasing order, as compared to sunflower oil and soybean oil. Corn oil was the least recommended one among the three oils. Sunflower oil was also better than that of soybeans and corn, following the same proportion above and on the same topics. Finally, the soybean oil was considered better than corn because it contains more Omega 3. When we analyzed the polyunsaturated fats/saturated fats ratio, sunflower oil revealed a significantly higher ratio as compared to the other three. As for Omega 3/6, this ratio is much better in canola oils, followed by soybean oil Therefore, based on this data, the oil with the most suitable composition for consumption in low-fat diets is the canola oil, followed by sunflower, soybean and corn.

Table 2 shows the findings of the comparisons between butters and margarines. The data revealed the presence of cholesterol in butters and absence in the margarines analyzed. A significant difference indicates higher content of saturated fat: myristic and palmitic acid in butters, while margarines had more polyunsaturated fats, linoleic acid and Omega 3. The omega 3/6 ratio favored the butters, but, considering the limits of diets for primary and secondary prevention, margarines should be recommended provided that the levels of trans fats in margarines do not exceed the recommended levels, which did not occur in the margarines analyzed in this study.

Table 3 presents comparisons between the yellow and *"minas"* cheeses. The *"minas"* cheese contains lower levels of cholesterol, saturated fat and palmitic acid. The comparison between the different types of milk (Table 4) revealed that the full-fat milk type was worse than the semi-skimmed and skimmed milk for saturated fats, as well as the content of myristic acid and palmitic acid. Skimmed milk also presented smaller cholesterol contents than the full-fat milk. Another important fact is that, when we compared skimmed milk with semi-skimmed milk, the only benefit was in terms of cholesterol, benefiting the former. Nevertheless, although significant, this small difference would not have any major impact on moderate consumption. As for milk enriched with Omega 3, because of the smaller number of samples, it was not possible to compare with others, however, according to the values found, we can say that a person would need to take 1.5 to 4.5 liters per day of this type of milk to achieve

Table 1 - Content of fats, fatty acids and cholesterol in edible oils

	Canola	Soybean	Sunflower	Corn
Fats				
Saturated fats (%)	8.4 ± 0.4	17.5 ± 0.5*	10.3 ± 0.3*¶	16.1 ± 1.1*§
Monounsaturated fats (%)	63.6 ± 3.8	24.0 ± 1.8*	28.2 ± 2.0*¶	35.6 ± 1.0*¶§
Polyunsaturated fats (%)	28.0 ± 3.5	58.5 ± 1.6*	61.6 ± 1.9*	48.3 ± 0.2*§
Fatty acids				
Palmitic acid (%)	5.0 ± 0.3	14.1 ± 0.4*	6.5 ± 0.4*¶	13.5 ± 0.5 *§
Oleic acid (g/100g)	62.2 ± 3.9	23.4 ± 1.7	28.0 ± 2.0	35.3 ± 1.0
Linoleic acid (g/100g)	21.4 ± 3.1	53.3 ± 1.1*	61.5 ± 1.9*¶	47.6 ± 1.3*¶§
Omega 3 (%)	6.2 ± 0.8	4.9 ± 0.9	-	0.7 ± 0.2*¶
Cholesterol	-	-	-	-

*Data are presented with average ± standard deviation; * = P < 0.05 as for canola oil; ¶ = P < 0.05 as for soybean oil; § = P < 0.05 as for sunflower oil.*

Table 2 - Content of fats, fatty acids and cholesterol in butters and margarines

	Butter with and without salt	Margarine with and without salt
Fats (g/100g)	83 ± 2	59 ± 18*
Saturated fats	55 ± 2	19 ± 8*
Monounsaturated fats	21 ± 1	16 ± 7
Polyunsaturated fats	1.7 ± 0.2	21 ± 4*
Fatty acids (g/100g)		
Palmitic acid	29 ± 1	7 ± 2*
Myristic acid	9 ± 1	0.3 ± 0.3*
Oleic acid	20 ± 1	16 ± 7
Linoleic acid	0.9 ± 0.2	19 ± 4*
Elaidic acid	2.0 ± 0.1	6 ± 5
Trans-linoleic acid	0.2 ± 0.0	0.9 ± 0.5
Omega 3	0.8 ± 0.0	1.7 ± 0.4*
Cholesterol (mg/100g)	222 ± 2	-

*Data are presented with average ± standard deviation; * = P < 0.05 as for butter.*

Table 3 - Content of fats, fatty acids and cholesterol in cheese

	Yellow cheese	"Minas" Cheese
Fats (g/100g)	25 ± 2	18 ± 5*
Saturated fats	17 ± 2	11 ± 3*
Monounsaturated fats	7 ± 1	5 ± 1*
Polyunsaturated fats	0.58 ± 0.06	0.37 ± 0.07*
Fatty acids (g/100g)		
Palmitic acid	8 ± 1	5 ± 2*
Myristic acid	2.5 ± 0.3	1.78 ± 0.58
Oleic acid	6 ± 1	4 ± 1*
Linoleic acid	0.2 ± 0.1	0.22 ± 0.04
Elaidic acid	0.7 ± 0.1	0.4 ± 0.1*
Trans-linoleic acid	0.05 ± 0.02	-
Omega 3	0.23 ± 0.03	0.15 ± 0.05
Cholesterol (mg/100g)	84 ± 5	54 ± 7*

** = P < 0.05 for yellow cheese.*

the international recommendations, which may be excessive for a recommended menu.

In the analysis of eggs (Table 5), there were no differences between the types analyzed. Therefore, it was not possible to make a distinguished recommendation for each of them, except for the limits of daily cholesterol contents, that is, not more than one per day.

Discussion

Despite the progresses found in recent decades in terms of pharmacological management of dyslipidemias, dietary intervention still plays a key role in primary and secondary prevention of ischemic heart disease. The DIRECT clinical trial[25], recently published, has rekindled the controversy about the best composition of diets, demonstrating that an intervention with low contents of carbohydrate can deliver favorable changes in lipid profile, as compared with a low-fat diet or a Mediterranean diet. However, regardless of the diet chosen, knowing the composition of food items used in our country is a prerequisite for a proper dietary prescription, which can enable a greater adherence to a healthier diet for the heart, considering a low level of acceptance to all types of diet in three months[26].

The analysis presented in this study point out that no food item should be eliminated from a healthy diet due to cholesterol levels, but in some cases, these should be consumed in smaller quantities. Therefore, eggs do not need to be banned, semi-skimmed milk may be sufficient, sunflower oil, because it is cheaper than canola oil, can also be used as an option. The *"minas"* cheese, unavailable in foreign

Table 4 - Content of fats, fatty acids and cholesterol in milk

	Full-fat milk	Semi-skimmed milk	Milk with Omega 3	Skimmed milk
Fats (g/100ml)	3.2 ± 0.2	1.0 ± 0.9*	1.41 ± 0.3	0.4 ± 0.5*
Saturated fats	2.1 ± 0.1	0.6 ± 0.6*	0.64 ± 0.1	0.29 ± 0.3¶
Monounsaturated fats	0.9 ± 0.1	0.3 ± 0.3*	0.45 ± 0.2	0.1 ± 0.1*¶
Polyunsaturated fats	0.08 ± 0.0	0.03 ± 0.0*	0.25 ± 0.3	0.02 ± 0.0*
Fatty acids (g/100ml)				
Palmitic acid	0.9 ± 0.1	0.3 ± 0.3*	0.32 ± 0.0	0.1 ± 0.1*
Oleic acid	0.8 ± 0.1	0.2 ± 0.2*	0.42 ± 0.2	1.02 ± 1.7
Linoleic acid	0.04 ± 0.0	0.02 ± 0.0	0.21 ± 0.3	0.01 ± 0.0*
Elaidic acid	0.10 ± 0.0	0.03 ± 0.0*	0.02 ± 0.0	0.02 ± 0.0*
Myristic acid	0.35 ± 0.0	0.1 ± 0.1	0.09 ± 0.0	0.14 ± 0.1
Trans-linoleic acid	0.01 ± 0.0	-	-	-
Omega 3	0.03 ± 0.0	0.01 ± 0.0*	0.04 ± 0.0*¶	0.02 ± 0.0
Cholesterol (mg/100ml)	6.8 ± 1.7	4.9 ± 1.7*	4.22 ± 0.5	2.9 ± 0.2*¶

** = P < 0.05 for full-fat milk; ¶ = P < 0.05 for semi-skimmed milk; § = P < 0.05 for milk with omega 3.*

Table 5 - Content of fats, fatty acids and cholesterol in eggs

	Free-range eggs	Factory-farmed egg	40%	20%
Fats (g/100g)	8.4	10.2	9.9	9.4
Saturated fats	2.84	3.67	3.34	3.03
Monounsaturated fats	3.47	4.08	3.58	4.05
Polyunsaturated fats	0.61	0.69	1.25	0.73
Fatty acids (g/100g)				
Palmitic acid	2.1	2.72	2.24	2.21
EPA	0.02	0.02	0.08	0.05
Oleic acid	3.1	3.73	3.34	3.66
Linoleic acid	0.47	0.6	0.99	0.54
Elaidic acid	0.01	0.01	-	0.02
Myristic acid	0.02	0.04	0.02	0.02
Trans-linoleic acid	0.01	0.01	0	0.02
Omega 3	0.02	0.02	0.14	0.09
Cholesterol (mg/100g)	400	405	390	378

tables, can be part of the diet, while margarines with low contents of trans fats or, preferably, without these, are most desirable that butters. In relation to eggs, in the literature, we found similar results in an analysis showing no difference in cholesterol contents between common eggs and eggs enriched with omega 3, but no data for comparison, for example, with free-range eggs[27].

As for butters, the only evaluation found in literature is concerned with the quality and compliance with laws[28]. A comprehensive review on databases, such as MedLine and Scielo revealed no comparative studies for different oils, cheeses or margarines.

The need for Brazilian tables is well exemplified from a practical point of view when analyzing milk. Table 6 shows that the content of saturated fats and cholesterol estimated for 200 ml of milk is very different when we apply the analysis of this study, comparing with the composition data derived from UNIFESP Table (an American one).

As in southern and southeastern regions of Brazil the average annual milk consumption per person is 40 liters, or 200 glasses of 200 ml, the estimated annual consumption of saturated fat in skimmed milk would increase from 120

Table 6 - Differences of content of saturated fats and cholesterol for milks, according to the analysis of this study (analysis) and the one presented in Unifesp's Table

	Full-fat milk		Semi-skimmed milk		Skimmed milk	
	Analysis	Unifesp	Analysis	Unifesp	Analysis	Unifesp
Saturated fats (mg/200ml)	4.2	4.6	1.3§	2.5	0.6	1.3
Cholesterol (mg/200ml)	14	28	10	16	6	10

to 260 mg. Likewise, the estimated annual consumption of cholesterol in full-fat milk would increase from 2720 to 5600 mg, using these two sources of information.

In conclusion, our data on food produced and consumed in Brazil indicate that no food item should be banned from a healthy diet in relation to cholesterol levels, but in some cases, these food items should be consumed in smaller quantities. Diets targeted at primary and secondary prevention of ischemic heart diseases may also include semi-skimmed milk, sunflower oil, margarines with low content of trans fats and *"minas"* cheese.

Potential Conflict of Interest

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

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