Chemical food composition: implications for atherosclerosis prevention

Carlos Scherr[1], Jorge Pinto Ribeiro[2]

[1] Ph.D. in Cardiovascular Sciences; Scientific Director, Instituto do Coração e do Diabetes, Rio de Janeiro, RJ, Brazil
[2] Faculty member; Chief, Graphic Methods, Cardiology Service, Hospital Central da Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil

Summary

Objective: To compare the fatty acid and cholesterol content in food acquired in Brazil with the composition found in the most frequently used reference tables in the country. **Methods:** The fatty acid and cholesterol content in 41 food items frequently used in our country and the various directions to prepare them were reviewed by using specific methodology and the information was compared to the tables adopted by Unicamp and UNIFESP. **Results:** According to Unicamp table, the cholesterol content found in parmesan cheese was 100.7 mg/100 g, while it was 68 mg/100 g in UNIFESP table, that is, a 48% ($p < 0.05$), higher content in the former. This study table found a cholesterol content 31% lower (94 mg/100 g vs. 123 mg/100 g, $p < 0.05$) for yellow cheese. For whole milk, we found a 52% difference regarding cholesterol content, while the difference for saturated fat ranged from 1.4 g/100 g in Unicamp table to 2.130 g/100 g in our study table ($p < 0.05$). For some food items, no statistically significant differences were found among the tables. However, when a 1,800-calorie diet was prescribed, the discrepancies among the tables and lack of information resulted in clinically relevant differences in dietary recommendations. **Conclusion:** There are important differences in food fat content between the fatty acid and cholesterol content formally analyzed and the content shown on commonly used tables, and this can compromise our recommendations on preventing atherosclerosis. One possible explanation for the differences would be the fact that the UNIFESP table is American in origin.

Keywords: Diet; dyslipidemias; risk factors; cholesterol; fatty acids.

From Universidade Gama Filho, Instituto do Coração e Diabetes, Rio de Janeiro, RJ; Cardiology Service, Hospital de Clínicas de Porto Alegre and Internal Medicine Department, Medical School, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.

Submitted on: 08/03/2010
Approved on: 12/27/2010

Funding:
This study was funded by the Instituto de Metrologia e Estatística – Ministério do Desenvolvimento, Indústria e Comércio Exterior [Metrology and Statistical Institute – Development, Industry and Foreign Trade Ministry].

Correspondence to:
Carlos Scherr
Rua Visconde de Pirajá, 595/1204 – Ipanema
Rio de Janeiro – RJ
CEP: 22410-003
scherr@all.com.br

Conflicts of interest: None.

Introduction

The World Health Organization projections show a greatly increased mortality from cardiovascular diseases in developing countries, Brazil included, and a relenting behavior in industrialized countries[1]. Risk factors, such as cigarette smoking, low physical activity and unhealthy food are directly linked to these changes. Several authors have shown the advantages of controlling risk factors in studies with thousands of individuals experiencing coronary artery disease or not. In 1990, Ornish *et al.*[2] showed the results of vegetarian diet, smoking quitting, emotional stress control techniques, and moderate physical activity over one year in a small group with 28 patients having coronary artery disease. A coronary angiography performed before the study and repeated one year later revealed the stenosis grade was partially decreased in 82% of the lesions in the group undergoing intervention and mainly for the patients with more severe lesions, while progression was seen in the control group. Therefore, the study by Ornish *et al.*[2] demonstrated a dietary intervention with no medication can result in important effects on the coronary artery disease. The Lyon Diet Heart Study also showed reduced mortality and myocardial infarction in those who adhered to Mediterranean style diet, compared to the usual diet, with no significant change in blood pressure or even in blood lipids for these patients, what makes us believe the very type of food played an independent role in the outcome[3].

To achieve both a food inquiry and a diet prescription, a food content table lookup is required. In Brazil, one of the most used references is the Brazilian Food Composition Table, designed from food industry information based on strict analysis criteria through completing a special form created by the Food and Experimental Nutrition Department, Pharmaceutical Sciences, *Universidade de São Paulo* (USP)[4]. However, this table is limited, as it only provides data on total lipids and cholesterol concerning fatty acids and cholesterol. It does not inform either about different ways of preparing the food in some types of meat. Another common source, the table used by *Escola Paulista de Medicina, Universidade Federal de São Paulo* (UNIFESP)[5], was indeed adapted from a table developed by the United States Department of Agriculture, Agricultural Research Service, 2001, therefore being American. It has information concerning total lipids, cholesterol, saturated, mono- and polyunsaturated fats, but the information about preparation methods is not clear[5].

The Brazilian most complete food composition reference is likely the Brazilian Food Composition Table, designed by the Food Study and Research Nucleus from *Universidade Estadual de Campinas* (NEPA/Unicamp)[6]. The content of total lipids, cholesterol, saturated, poly- and monounsaturated fats is found in it, as well as all the fatty acid chain. However, fish is only presented as raw fish; beef strip loin can be found only grilled or raw, chicken breast is only presented raw; skim milk can only be found powdered and there is no semi. Finally, data about cheese, butter, margarines, sausage meat groups, edible oils and others are not available[6].

In addition, the food chemical composition can be different according to the reference table[7]. Ribeiro *et al.*[7], in 2003, had already shown differences in lipids when they compared the values provided by the tables with those obtained in laboratory. Recently we carried out an extensive evaluation on the chemical composition of a large number of foods used in Brazil to build a food composition table which could be clinically applied in our country[8]. In this current report, we analyze the fatty acid and cholesterol chemical composition in some foods that can be formally bought in Brazil and compare the contents found with those in the most commonly used tables in our country.

Methods

In this cross-sectional study, foods that had comparable matches in other tables, such as tilsit and yellow cheese, farm eggs, low-fat chicken and turkey sausage, whole, semi and skim milk were analyzed.

Food chemical composition analysis — All the food analyses listed below were carried out in the laboratories of *Instituto de Tecnologia de Alimentos* (Food Technology Institute – ITAL), Agriculture and Supply Secretary, São Paulo State Government and funded by *Instituto Nacional de Metrologia, Normalização e Qualidade Industrial* (National Metrology, Normalization and Industrial Quality Institute – INMETRO), subordinated to Brazilian Development, Industry and Foreign Trade Ministry. Specific methodology was used to assess the food composition regarding total lipids[9,10], cholesterol[11,12], fatty acid composition[13], sodium chloride content measurement[14] and moisture[15,16].

All the analyses were conducted using calibrated glassware and equipment. Their uncertainties follow acceptance criteria by ITAL quality system (NBR-ISO 9001) and they were not taken into account for the result calculation, but they are available for consultation. The analyses were carried out both on a wet basis and on a dry basis, but only the measurements on a wet basis were considered, since they represent the manner the food is usually consumed. According to the governmental regulation 27 of January 13, 1998 by the Health Surveillance Secretary of the Health Ministry, trans fatty acids should be computed into the saturated fat calculation.

Sample preparation

Two to five different brands of semi, skim, whole, and omega 3-containing milks were acquired to be analyzed. Six brands of Minas e yellow cheeses, as well as five brands of butter and margarine were analyzed. Eggs whose package indicated factory-farmed, free-range or low-fat types

were also evaluated. Each sample consisted of six eggs boiled for 10 minutes and then homogenized and weighed, being the egg white finally separated.

The statistical analysis of the Scherr Table to validate the fat content in foods acquired and produced in Brazil was conducted by the Mann-Whitney test (non-parametric test) to compare acid, lipid, and cholesterol measurements among different foods analyzed. The significance criterion adopted was the 5% level.

Results

Forty-one different food products were analyzed and a total of 733 comparisons were made among them. Only those present in at least one of the reference tables are shown.

Differences between this study table and the UNIFESP table were observed for parmesan cheese fat content, ranging from 100.7 mg/100 g to 68 mg/100 g ($p < 0.05$), that is, 48% higher difference. In the case of saturated fat, the difference was lower – from 8.00 g/100 g to 16.77 g/100 g ($p < 0.05$), respectively. Making the same comparison for yellow cheese, this study table showed a 31% lower cholesterol measurement (94 mg/100 g vs 123 mg/100 g, $p < 0.05$). As demonstrated in Table 1, for whole milk the variation is of 52% regarding cholesterol, while saturated fat changed from 1.4 g/100 g in Unicamp table to 2.130 g/100 g in our study table ($p < 0.05$). Regarding 1% fat skim milk, the cholesterol content variation was 71.6% (2.91 mg/100 g in the study table and 5 mg/100 g in UNIFESP table, $p < 0.05$).

For some of the foods, no statistically significant differences were found among the analyzed tables. As an example, Table 2 shows this study table compared to UNIFESP table for chicken sausage, demonstrating similar composition. However, when we proposed a 1,800-calorie menu based on American Heart Association recommendations, the great lack of information and the discrepancies in cholesterol and fatty acid contents, depending on the table applied, became evident. For a similar menu, total lipid contents of 35.87, 29.94, and 208.3 and a cholesterol content of 299.58, 14.0 and 247.0 were found, depending on the query being performed on our study table, TACO study table or UNIFESP table, respectively.

Discussion

Table 2 – Fat content in chicken sausage is compared among different tables

	Measured composition	UNIFESP table[5]
Variable	Mean	
Lipids (g/100 g)	14.70	19.48
Cholesterol (mg/100 g)	80.2	101.0
Saturated (g/100 g)	4.600	5.54
Monounsaturated (g/100 g)	6.40	8.48
Polysaturated (g/100 g)	2.90	4.04
Myristic (g/100 g)	0.1	–
Palmitic (g/100 g)	3.5	–
Alpha-linolenic (g/100 g)	0.2	–
EPA (g/100 g)	0.0	–
Oleic (g/100 g)	5.5	–
Linoleic (g/100 g)	2.4	–
Elaidic (g/100 g)	0.0	–
Trans-linoleic (g/100 g)	0.0	–
Omega 3 (g/100 g)	0.2	–

There were no significant differences between the tables.

Table 1 – Fat content in whole milk is compared among different tables

	Measured composition	UNIFESP table[5]	Unicamp table[6]
Variable	Mean		
Lipids (g/100 g)	3.238 *	3.660	3.000
Cholesterol (mg/100 g)	6.820 * §	14.000	10.000
Saturated (g/100 g)	2.130 §	2.280	1.400
Monounsaturated (g/100 g)	0.853 * §	1.060	0.700
Polysaturated (g/100 g)	0.078 *	0.140	0.100
Myristic (g/100 g)	0.345 §	–	0.250
Palmitic (g/100 g)	0.945	–	0.710
Alpha-linolenic (g/100 g)	0.033	–	–
EPA (g/100 g)		–	–
Oleic (g/100 g)	0.758	–	–
Linoleic (g/100 g)	0.045	–	–
Elaidic (g/100 g)	0.103	–	–
Trans-linoleic (g/100 g)	0.013	–	–
Omega 3 (g/100 g)	0.033	–	–

* significantly different from UNIFESP table ($p < 0.05$); §, significantly different from Unicamp table ($p < 0.05$).

Whether from missing information or from no adaptation to real products delivered to Brazilian population, there is a considerable gap to be filled in the cholesterol and fatty acid chemical composition issue in the tables available to date. Acknowledging this fact, it is possible to deliver more reliable, attractive, and non-punishing menu options, leading to a higher adherence to a heart healthier food intake, considering the low adherence to any kind of diet within three months[17].

The food chemical composition tables most frequently used in our country do not provide information on cholesterol and fatty acids for most foods in the way they are consumed. Although TACO[6], used by Unicamp, is the most complete, listing a number of meats and their different cuts, it does not provide data related to the preparation method and regards only the raw presentation. On the other hand, UNIFESP table[5] is American in origin and although its data are more comprehensive, they do not mirror the national reality, in which the cattle has different breeds and is differently fed. Finally, USP[4] uses data gathered from a well-structured questionnaire completed by the food producers, but it does not include the information on the preparation method either. Our data regards food produced and consumed in our own country, with the samples being collected in the formal market where housewives and dealers buy their products. As many authors have already demonstrated[18-20], there are many different influences on meat cholesterol and chemical composition from cooking methods. Rosa *et al.*[21] came to the same conclusion by comparing the effects of cooking in water, oil, grill, standard oven or microwave oven regarding chicken breast and leg fats, finding differences based on the preparation method. These studies show oil-free cooking brings about lipid loss, whereas fried foods lead to oil absorption, with a cut-dependent absorption[20].

Many studies have proved the food influence on blood lipids and atherosclerosis course[22,23] and other studies show it is difficult to make the population improve their eating habits[17]. If, instead of mentioning what must not be eaten, we show simple solutions that might make adherence easier for the general population and particularly for the patients and are based on clear and reliable information, dietary interventions will likely be more effective. In practice, this study targets to increase the awareness of further information necessity about the cholesterol and fatty acids content under two aspects: the first regards the items used by Brazilian population; the second regards the chemical composition after the food is handled and prepared to be consumed at the table.

This study is only focused on food chemical composition regarding cholesterol and the fatty acid chain and does not reflect all the components in Brazilian food chain or all the usual preparation methods. When it is compared to the available information on the most used tables in our country, the lack of a great deal of information is found in the latter ones or, when available information is compared to the data achieved in this study, great differences are found, mostly when our data is compared to foreign tables.

Conclusion

The current analysis demonstrates great differences between the chemical composition of some foods and the contents shown in national reference tables, suggesting nutritional intervention has possibly been impaired in our country.

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