

BRIEF REVIEW

Diet

The cornerstone for cardiovascular prevention

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Although cardiovascular diseases still remain the leading cause of death all over the world, in some countries the mortality due to this international scourge has been decreasing in the last years. This is the case in the United States of America where a decrease of about 50% has been shown by Ford et al.¹. The most important fact to be noticed about this decrement is that despite the huge development of new diagnostic and therapeutic procedures, they were responsible for just a half of the decrease while the other half was due to the prevention of atherosclerosis and its complications. Cholesterol reduction, hypertension control, smoking prevalence reduction, physical exercise activities and other coronary risk factor management play relevant roles in this setting. With this in mind it appears obvious that the future of atherosclerosis and its price for health has to be opposed by the improvement of the prevalence of its risk factors. However, the developing countries in general have been behaving in a totally opposite direction. This was pointed out even in the United States by the increase in obesity and diabetes in recent years that decreased the benefits found in the atherosclerosis burden as long as they were responsible for an increased number of deaths of 8% and 10% respectively¹. Sadly the scenario in Latin American countries is following this late pattern with the prevision of a worsening of the already bad numbers. It is expected that these countries will have the world's highest mortality rates in 2020².

One of the most important aspects of human life related to atherogenesis is the dietary pattern. Along the years an exhaustive bunch of evidences has been accumulating that many alimentary items are related positively

or negatively with the prevalence of atherosclerosis and its complications. Nutrients are linked to many atherosclerosis risk factors: hypertension, alteration of the lipid profile, obesity, diabetes, altered coagulation and probably others still not totally understood.

Physicians and other health workers are responsible for the orientation of patients and their families about the understanding that diet is linked to many health threats and the majority of the consequent problems can be avoided by the adoption of good alimentary habits. The same way other deleterious life style components such as smoking and physical inactivity have to be questioned and opposed by health personnel.

Plasma cholesterol and atherosclerosis

At least in experimental animals, hypercholesterolemia or lipoprotein dysfunction is a requisite for the development of atherosclerosis. This is probably also the case in humans, though what is the "normal" plasma cholesterol level still remains a subject for debate³. The early and severe atherosclerosis found in patients diagnosed with homozygous familial hypercholesterolemia reinforces the focus on cholesterol⁴. On the opposite side is the description by Cohen et al.⁵ of mutations in the gene-controlling protease PCSK9 leading to very low LDL-cholesterol levels that are associated with a very low prevalence of coronary heart disease. However, in the general population diet is the most important determinant of cholesterol plasma levels and of atherosclerosis.

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Diet and atherosclerosis

Diet is a multi-component mixture of many nutrients which may interact with one another. We still do not have a definitive study of the impact of nutrients on cardiovascular disease. Many problems exist in the design of the studies: the population being studied is quite often heterogeneous as is the diet that serves as the baseline for interventions. Many approaches have been used to examine the influence of nutrition on atherosclerosis: cross population comparisons, nutritional questionnaires administered to large population groups, and interventional studies. Some of these approaches can be very informative about individual nutrients. However, metabolic ward studies in which the nutrients are varied in a specific fashion without changing total calories or nutrient balance aside from the variable being studied are most likely to yield relatively definitive answers. However, they are not close to the real lives of free living peoples.

The primary dietary determinants of hypercholesterolemia are fats, particularly saturated fats, and dietary cholesterol. Unlike dietary fat which is almost completely absorbed in the intestinal tract, the absorption of cholesterol is incomplete and is regulated at the intestinal epithelium. The evolution of our knowledge about the link between hypercholesterolemia and atherosclerosis has been recently revised by Steinberg in his excellent recent thematic reviews⁶⁻⁸.

Dietary fatty acids

The action of fatty acids on the lipid profile depends mainly on two distinct characteristics:

- if they have double bonds in their carbon chain
- if their isomeric formula is *cis* or *trans*

Saturated fatty acids

Are fatty acids that do not present any double bonds in their carbon chains, only single bonds. Their main representatives in human nutrition are lauric, myristic and palmitic acids. They are present in milk and meat and their derivatives and in Brazilian typical food in palm oil (*dendê* oil) and coconut fat. The regular consumption of foods that contain high amounts of saturated fatty acids lead to an increase in plasma LDL-cholesterol levels accompanied by an increase in HDL-cholesterol levels. However, the first effect prevails, leading to an atherogenic lipid profile. Milk fatty acids present in whole milk and its derivatives are the worst ones for the lipid profile.

The first step when orientating a prudent diet is to reduce the consumption of foods that contain saturated fats.

There is one exception among the saturated fatty ac-

ids. This is stearic acid (18 carbons with no double bonds) that does not increase LDL-cholesterol levels because when it enters the blood stream it is rapidly transformed into oleic acid (18 carbons with one double bond) that has a beneficial action on the lipid profile⁹. Stearic acid is an important component of cocoa butter. With this in mind dark chocolate (with no other kind of fats) can be an option for those people who like this delicatessen.

Unsaturated fatty acids

Monounsaturated fatty acids

Of which the main representative is oleic acid. It has 18 carbons in its molecular chain and only one double bond (C18:1). It is present mainly in olive and canola oils, dry fruits (walnuts, almonds, hazelnuts, cashew nuts, Brazil nuts) and avocado. Its main action on the lipid profile is to decrease LDL-cholesterol levels with no action on HDL-cholesterol levels. When it is used to substitute saturated fats in the diet it can compensate the HDL-cholesterol fall observed with the reduction of these¹⁰. It is noteworthy to remember that olive oil is one of the important components of the Mediterranean diet which has a protecting effect against coronary heart disease¹¹.

Polyunsaturated fatty acids

They can be omega 3 or omega 6 according to the first double bond position in the carbon chain:

OMEGA 6 – The main representative is linoleic acid which is found mainly in plant oils such as safflower, corn and soy oils. Their action on the lipid profile is to decrease LDL-cholesterol levels but they do not counteract the decrease of HDL-cholesterol observed with the reduction of saturated fatty acid consumption. Linoleic acid is an essential fatty acid because it is the precursor of arachidonic acid which in turn is the source of leukotrienes and prostanooids. These molecules have a variety of effects on the cardiovascular system, some beneficial (e.g. prostacyclin) and others not (e.g. thromboxane). Since the unsaturated fatty acids (e.g. linoleic acid) present in the LDL particles are prone to oxidation it can be argued that such moieties enriched in these fatty acids would be proatherogenic⁶. Yet there is no evidence that diets enriched in omega 6 fatty acids promote lipid oxidation.

OMEGA 3 – They can derive from fish oil (eicosapentaenoic acid – EPA and docosahexaenoic acid – DHA) or from some plants and oils (alpha-linolenic acid). Data showing a role in cardiovascular prevention are more robust for fatty acids derived from fish oil. A high consumption of fish oil can lower plasma triglyceride levels, blood pressure, platelet aggregation, and inflammation, and increase vascular relaxation¹². However, the main benefit derived

from fish oil consumption appears to be the decrease of sudden cardiac deaths due to fatal arrhythmias rather than the underlying atherosclerosis¹³. There is a beneficial effect of the use of fish oil supplements after a myocardial infarction as shown by the GISSI-Prevenzione group¹⁴.

Trans fatty acids

Even being unsaturated fatty acids they propitiate bad changes of the lipid profile, worse than those of the saturated ones, leading to an increase in plasma LDL-cholesterol levels accompanied by a decrease in HDL-cholesterol levels and an increase of triglycerides¹⁵. The main representative of this class in human nutrition is elaidic acid which is found in vegetable hydrogenated fats present in many margarines, biscuits, sauces and ice creams. Its consumption must be kept as low as possible.

Dietary cholesterol

Only foods coming from animal sources have cholesterol but it is found in higher concentrations in sea foods, animal viscera, and eggs. The capacity of ingested cholesterol to increase plasma cholesterol is highly dependent on the intestinal absorption that varies enormously among individuals¹⁶. The recommendation of the IV Brazilian Guideline for Dyslipidemias and Prevention of Atherosclerosis is for the intake of less than 200 grams of cholesterol a day¹⁷.

Conclusions

Because lifestyle changes are very difficult to achieve, physicians in general are prone to prescribe many drugs to control cardiovascular risk factors. However, it is very important to remember that healthy food consumption remains a cornerstone in primary and secondary cardiovascular prevention and should be implemented by everyone.

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