Nutrition

What food for the heart?
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The relationship between food intake and cardiovascular disease is discussed with particular reference to the consumption of saturated fats. The education of the general public on this and related matters is vitally important.

Atherosclerosis, in particular coronary heart disease, is related to a number of risk factors such as obesity and lack of exercise. The importance of all the risk factors is related to their effects on increasing the levels of blood cholesterol. In 1–2% of the population high blood cholesterol levels are caused by genetic abnormalities. But in developed countries, high blood cholesterol is caused mainly by an inadequate diet. Epidemiological studies have shown that in populations with diets low in cholesterol and fats, coronary heart disease and thrombosis are less frequent than in other populations with high fat and cholesterol consumption.

Deaths from coronary heart disease were reduced by 35.8% in the USA between 1970 and 1980. In the same period, consumption of animal fats was reduced by 40% and consumption of polyunsaturated fats increased by 60% (1). Such studies indicate that dietary change can be useful in the prevention of coronary heart disease.

Total dietary fats should not provide more than 30–35% of caloric intake.

Cholesterol-LDL

Increased levels of cholesterol-LDL (low-density lipoprotein) are related to increased frequency of coronary heart disease. Saturated fats in the diet increase blood levels of cholesterol, which suppresses the activity of LDL receptors and thereby interferes with LDL clearance, resulting in an increase in the concentration of cholesterol-LDL.

Not all saturated fatty acids have the same effect on serum cholesterol levels. Palmitic acid and myristic acid raise the level of cholesterol-LDL more than do stearic acid and oleic acid. This partly explains why people who consume large quantities of pork and other fats containing much stearic acid, as in the rural population of Spain, have lower blood cholesterol levels than might be expected. The reverse is true of people who consume large amounts of butter, which is richer in myristic and palmitic acids (see box on next page).

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A diet that is low in fat and rich in carbohydrates reduces cholesterol-LDL. Carbohydrates do not in themselves reduce cholesterol levels, but this effect is achieved because they take the place of fats. Obesity as such can lead to increased blood cholesterol, and obese people tend to consume excessive amounts of saturated fats and cholesterol, thus depressing the activity of the LDL receptors.

**Cholesterol-HDL**

High levels of cholesterol-HDL (high-density lipoprotein) reduce the risk for coronary heart disease: it has the opposite effect of cholesterol-LDL. The ratio of cholesterol-LDL to cholesterol-HDL is a reliable indicator of atherogenic risk. In populations where both LDL and HDL levels are high, individuals with lower concentrations of HDL are at increased risk of coronary heart disease. Although HDL levels can be genetically conditioned, diet is a determining factor. HDL particles facilitate the transportation of cholesterol from peripheral tissue to the liver for excretion. Saturated fatty acids do not reduce the levels of cholesterol-HDL but they increase the concentration of cholesterol-LDL considerably.

Mono-unsaturated fatty acids do not affect levels of cholesterol-HDL but they reduce cholesterol-LDL when used to substitute saturated fats, thus reducing the risk of coronary heart disease and improving the LDL/HDL ratio. Polyunsaturated fatty acids reduce the levels of both LDL and HDL and they could be considered as substitutes for other fatty acids.

If carbohydrates are used to substitute saturated or mono-unsaturated fats they reduce the levels of cholesterol-HDL. Obesity is commonly associated with reduced concentrations of HDL.

Lauric acid also induces hypercholesterolaemia, although to a lesser degree than palmitic and myristic acids. Fatty acids with chains of medium length do not increase blood cholesterol and could serve as good substitutes for those fatty acids that do. Variations in individual responses to different fatty acids have to be taken into account.

Carbohydrates and mono-unsaturated fats such as oleic acid are considered to have no effect on cholesterol levels. There is evidence suggesting that elaidic acid, produced by the hydrogenation of vegetable oils, can induce hypercholesterolaemia. If this is confirmed, new technology will have to be developed for the hardening of these oils and the production of margarine. Among the polyunsaturated fats, linoleic acid reduces blood levels of cholesterol-LDL.
Triglycerides

Most epidemiological research indicates a positive correlation between serum triglyceride concentrations and coronary heart disease. Saturated fats, carbohydrates and alcohol increase blood cholesterol levels. In obese patients, besides a rise in the availability of triglycerides from fat deposits there is increased production of triglycerides.

Diet and thrombosis

Thrombosis plays a major part in the development of myocardial infarction. If aspirin is used to counteract plaque activity in unstable angina, coronary episodes can be reduced by 50% and total mortality by up to 71%.

Short-chain saturated fats, i.e. lauric and myristic acids, increase plaque reactivity as well as serum cholesterol levels and atherosclerotic lesions; this does not happen with stearic acid. If the consumption of stearic acid is reduced there is a decline in plaque reactivity and in the excretion of thromboxane A2, especially if there is a proper balance with consumption of polyunsaturated fats. This reduces the risk of thrombosis. Some polyunsaturated fats derived from marine phytoplankton and algae and fish fats have an antithrombotic effect and can reduce the atherogenic action of diets rich in saturated fats and cholesterol.

Given the link between diet and coronary heart disease, and especially the importance of eating unsaturated fats, dietary advice and government action to reduce fat consumption in general, and saturated fats – both of animal and plant origin – in particular, are important weapons in the fight against coronary disease.

Diet and the risk of cardiovascular disease in Spain

During the last few years, the “Mediterranean” diet has been changing towards a more “Western” diet, less healthy for the heart as it contains more saturated fatty acids of animal and vegetable origin, especially in the form of palm oil. This dietary change is a prelude to increased frequency of ischaemic heart disease.

In Spain a randomized study was conducted covering 4787 subjects aged 5–59 years in order to determine serum levels of cholesterol and other lipid fractions and their relationships with dietary habits and other cardiovascular risk factors. A semiquantitative questionnaire was used to obtain information on diets.

Mean total serum cholesterol and cholesterol-HDL levels were 191 and 55 mg/dl, respectively (Fig. 1 and 2). Serum cholesterol levels increased with age except for a fall between the 5–12 and 13–19 years age groups, and were higher in males than in females. In females, cholesterol-HDL values increased gradually with age; in males they declined markedly from the 5–12 to the 13–19 years age group.

The contribution of fats to calorie intake was excessive, most notably for the 5–12 years age
group, in which they accounted for over 41% of such intake, which is 30–35% above the recommended value (Fig. 3). The high level of fat consumption is mainly due to the consumption of saturated vegetable fats, mainly from palm oil which is used in the production of cakes, ice-cream and pre-cooked meals. Overall, mono-unsaturated fats accounted for approximately 16% of calorie intake, poly-unsaturated fats for about 6%, and saturated fats for about 15% (Fig. 4). Consequently there were high blood cholesterol levels, especially in the child population.

It remains to be explained why morbidity and mortality from coronary heart disease are low in Spain and other Mediterranean countries where large amounts of fat are consumed and blood cholesterol levels are high. Increasing attention is being given to the role of certain
micronutrients and other elements in the diet, some having antioxidant properties, which may provide protection against atherosclerotic ischaemic heart disease.

**Substitutes for saturated fats**

There can be little doubt that certain saturated fatty acids, especially myristic and palmitic acids, increase cholesterol-LDL levels and thus represent a risk of coronary heart disease. And yet, world consumption of palm oil has increased from 1% to 15% of total fat consumption over the last 10 years. In the same period, consumption of soya oil was reduced from 20% to 15%. Sunflower and olive oil consumption remained stable at 5% and 1% respectively. Spain is a major producer and exporter of healthy oils such as olive and sunflower oils. The entry into the European
Economic Community has led to an increase in the importation of palm oil, which went up from 11,458 tonnes in 1985 to about 100,000 tonnes in 1993. In the same period the importation of pork and other animal fats multiplied by four. Substitution of saturated fats in the diet should therefore be considered, for health reasons. The choice lies between stearic acid, polyunsaturated fats, mono-unsaturated fats and carbohydrates. The use of carbohydrates increases the level of tri-glycerides and reduces that of cholesterol-HDL; however, these may increase the frequency of obesity, certain cancers, arterial hypertension and osteoporosis. This must be taken into account when dietary recommendations are made.

Consumption of large amounts of soluble fibre in beans, lentils, vegetables, fruits and wholemeal bread reduces blood cholesterol levels even in subjects on diets that are low in cholesterol and saturated fats, and should therefore be recommended.

**Dietary recommendations for the prevention of arteriosclerosis**

The following recommendations are made in the light of current knowledge. They will undoubtedly have to be modified as research progresses.

- Cholesterol intake should not exceed 300 mg per day.
- Total dietary fats should not provide more than 30–35% of calorific intake. Saturated fats, mono-unsaturated fats and poly-unsaturated fats should not provide more than 10%, 10–15% and 10%, respectively, of this intake, with a contribution of 0.4–0.6% from n-3 polyunsaturated fats.

- Carbohydrates, i.e. fibre, starch and sugars, should provide 45–50% of calorie intake, preferably in the form of complex carbohydrates, since these seem to have a favourable effect on the number of coronary and thrombotic events. Fibre, which includes cellulose, hemicellulose, lignin, pectin and beta-glucans, helps to reduce blood levels of cholesterol-LDL.

- Proteins, preferably of plant origin, should provide about 15% of calorie intake. There is evidence that plant proteins can reduce blood cholesterol levels.

- Calorie intake should be controlled and obesity avoided in order to combat hypercholesterolaemia and hypertriglyceridaemia. Fasting and weight loss reduce cholesterol-LDL levels, even in patients with hereditary hypercholesterolaemia. Physical exercise is very important in this connection.

- Excessive alcohol consumption should be avoided, since it not only poisons the liver but can also damage the myocardium and increase the risk of hypertension and cerebrovascular accident. Except in persons with hypertriglyceridaemia there is no evidence that moderate alcohol consumption, i.e. up to 30 g per day, increases the risk of arteriosclerosis.

**Information for the general public**

Vegetable oils such as soya, sunflower and maize (which are polyunsaturated) and olive oil (which is mono-unsaturated) do not increase blood cholesterol. But other vegetable oils, such as palm oil and coconut oil, are saturated. They are just as harmful to
health as animal fats because they increase blood cholesterol and contribute to the formation of clots in the blood vessels. Saturated vegetable oils are generally cheaper than the unsaturated, and are easier to use in industrial food production.

For manufacturers there are therefore considerable economic and technological advantages in using saturated fats and oils, especially those of vegetable origin. Meanwhile, consumers remain unaware of this as long as the law requires only a statement on labels indicating whether products contain animal or plant fats, without any distinction between the poly- and mono-unsaturated vegetable oils and the saturated vegetable oils which are just as harmful to health as animal fats. At present, consumers generally consider animal fat to be unhealthy and plant fat or oil to be good for health. An effort is clearly needed to educate and inform people on such matters and to place obligations on manufacturers to make distinctions between saturated and unsaturated fats and oils in their consumer information.

In the countries of the European Union, foodstuff manufacturers are required to provide details of energy values and the quantities of a range of nutrients in their products on the labels accompanying them. Clearly, such information can only be of value if the general public is educated to understand its significance, and is detailed enough to be intelligible. The EEC has adopted a directive on labelling to show the nutritional properties of food products (90/496/EEC) which obliges the food industry to inform consumers about details of the contents of food products. But there is no obligation to indicate the content of different fatty acids, only whether they are of animal or vegetable origin.

Increasing attention is being given to the role of certain micronutrients and other elements in the diet, some having antioxidant properties, which may provide protection against atherosclerotic ischaemic heart disease.

Governments have a role to play in giving information and advice on the prevention of cardiovascular disease, and community education on nutrition is vital. An important contribution could be made by the mass media.

The message is clear. Overeating should be avoided, especially of fats and saturated fatty acids. Low-fat dairy produce and meat with low fat content are desirable, as is the consumption of fruit, vegetables and cereals.

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Reference