

Dietary fat, blood cholesterol and CHD prevention

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Dietary change for CHD prevention

There is increasing interest in cholesterol and how it causes heart disease. Recent results of large-scale, clinical cholesterol lowering trials and observational studies have demonstrated that cholesterol is much more important than previously believed.

Differences in blood cholesterol, together with blood pressure and smoking habits, explain most of the excess mortality from coronary heart disease (CHD). About one in three males and one in five females in Ireland die before 70 years of age, and about half of these deaths are due to cardiovascular diseases. Guidelines for the prevention of CHD recommend use of drug therapy to lower blood cholesterol for those with prior CHD, or those at high absolute risk of cardiovascular disease (as estimated by the levels of cholesterol and blood pressure, and smoking status) rather than for individuals with elevated blood levels of cholesterol. The recent British Recommendations on Prevention of CHD in Clinical Practice recommend use of lipid lowering therapy for individuals with prior CHD or with a 10 year absolute risk of CHD of 15% or greater, if blood total cholesterol is sustained above 5mmol/l on repeated measurement.¹

This “high risk” approach yields substantial benefits for

the individual patients treated. However, the majority of CHD events occur among those below these risk thresholds for initiating treatment. Consequently, in order to reduce the total number of CHD deaths it is also necessary to reduce the overall mean cholesterol concentration in the population. The Report of the Cardiovascular Health Strategy Group in Ireland (2000) has identified a strategic goal of reducing the population mean cholesterol concentration to below the present level of 5.6mmol/l.² This strategic target will require a reduction in intake of both total and saturated fat.

Importance of dietary lipids for blood cholesterol levels

Dietary fatty acids can be classified into saturates (having no double bond), monounsaturates (having one double bond) and polyunsaturates (having more than one double bond). Double bonds are said to be trans if the two hydrogen atoms at either end of a double bond are on opposite sides (and cis if otherwise). Thus small differences in the structure of fatty acids alter their properties and effects on cholesterol.

The most reliable evidence for the effects of individual

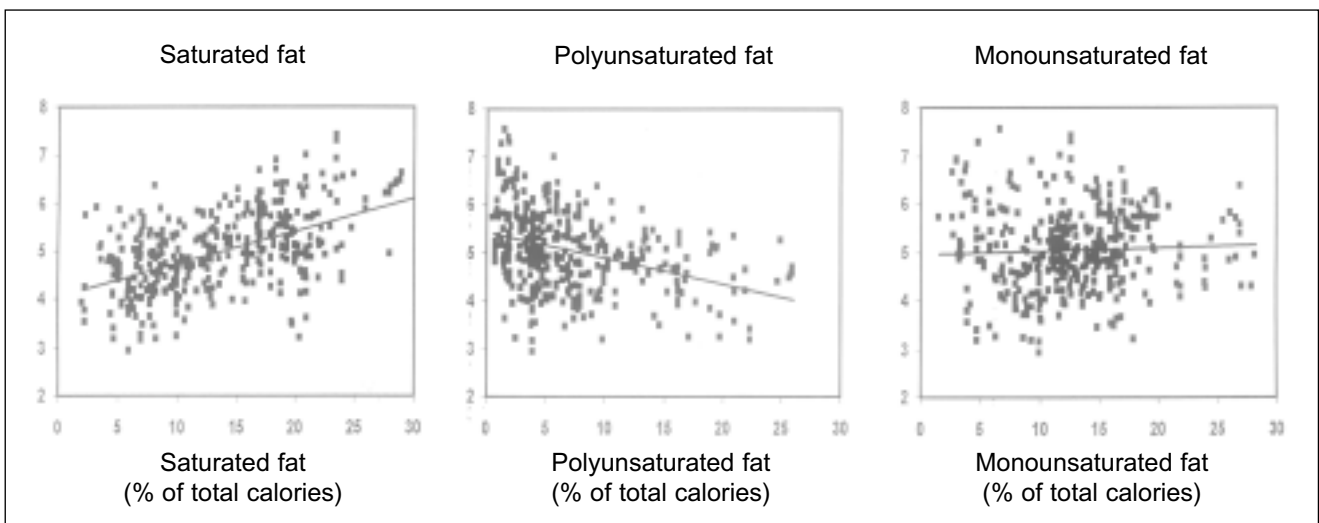


Figure 1. Blood total cholesterol versus dietary intake of saturated fat, polyunsaturated fat, and monounsaturated fat in 395 experimental diets.

Table 1. Percentage of food energy from different types of fat in children, and middle- and old-aged adults in the UK Diet and Nutrition surveys

Fatty acid (% of food energy)	Children <5 yrs (%)	Adults 16-64 yrs (%)	Elderly 65+ yrs (%)
Saturates	16.2	16.5	14.6
Trans fatty acids	1.7	2.1	1.5
Cis-monounsaturates	11.1	12.4	11.1
Polyunsaturates	3.9	5.4	5.6
Total	35.9	40.4	35.7

Table 2. Main sources of fat in the Irish diet (Irish Nutrition and Dietetic Institute, 1990)

Food type	%
Meat and meat products	25
Milk	17
Spreadable fats	15
Biscuits and cakes	11
Potato (chips)	8
Savouries and chocolates	6
Other sources	18

fats on blood total cholesterol comes from the “metabolic ward studies”. In these experiments, isocaloric diets with a pre-specified fat content were administered to healthy volunteers under controlled conditions for several weeks and blood lipids were measured before and after the intervention. We analysed the data from all published metabolic ward studies in a meta-analysis, which included 72 metabolic ward studies involving 395 solid food experiments.³ Figure 1 shows that increasing intake of saturated fat increases total cholesterol concentrations, and increasing intake of polyunsaturated fat decreases total cholesterol, but monounsaturates have no effect on total cholesterol. Trans fatty acids had the same cholesterol-raising effects as those of saturates.

Importance of replacing saturated fat with other types of fat

The public health importance of different fatty acids depends on the strength of association of fat with cholesterol levels and the proportion of total calories consumed. The percentage of food energy from fatty acids consumed in the metabolic ward studies was similar to those consumed in representative national food surveys of children, adults and the elderly in the UK (Table 1). These surveys show that the combined intake of saturated fatty acids and trans fatty acids account for half of all fats.⁴

Overall, because of the strength of the relationship with blood cholesterol and the large amounts present in the diet, the factor of greatest relevance was the intake of saturated fats. Isocaloric replacement of about 60% of the UK dietary intake of saturates by complex carbohydrates would reduce blood cholesterol by about 0.5mmol/l. Intake of polyunsaturates is also as important — in the opposite direction — as that of saturated fat, with effects that are about half as strong. Intake of monounsaturated fat has no significant effect on total cholesterol or LDL cholesterol despite raising HDL cholesterol to the same degree as polyunsaturates.

Figure 2 shows that the combined effect of a change in the type, but not in the amount, of dietary fat, involving a 10% reduction in total calories from saturated fat, a 5% increase in total calories from monounsaturates, and a 5% increase in total calories from polyunsaturates, together with a 200mg reduction in dietary cholesterol, would be about a 0.8mmol/l reduction in blood cholesterol (with

Figure 2. Mean (SE) changes in blood cholesterol concentration associated with the replacement of dietary saturated fat by polyunsaturated and monounsaturated fats and reducing dietary cholesterol.

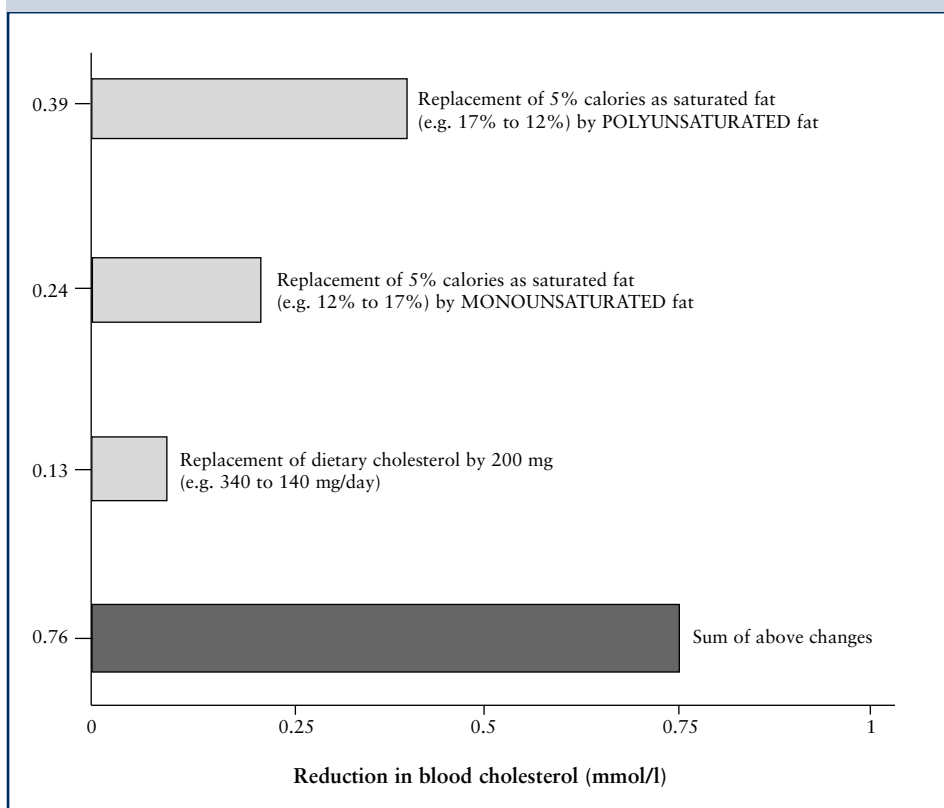


Table 3. Possible exchanges required in the average consumption of food to reduce the combined intake of saturated fatty acids and trans fatty acids by about 10% of total calories. Data obtained from the Dietary and Nutritional Survey of British Adults⁴

Dietary exchange	Reduction in intake of saturated fat (g/day)	% calories saving from loss of intake of saturated fat (%)
Butter & soft margarine with low fat spreads	3.5	1.5
Full fat milk with semi-skimmed milk	2.5	1.1
Cheddar type cheese with cottage cheese	2.9	1.3
Cream with yoghurt	0.6	0.3
Egg & egg dishes reduced by half	0.6	0.3
Average cuts of meat & meat products with lean cuts	5.3	2.3
Poultry & poultry products with poultry without skin	0.3	0.2
Coated or fried fish with grilled or poached fish	0.4	0.2
Chips & roast potatoes with baked potatoes	0.9	0.4
Savoury snacks (crisps) with fruit	0.5	0.2
Puddings & ice cream by yoghurt	1.2	0.5
Cake, biscuits & confectionery intake reduced by half and replaced by fruit	3.1	1.4
TOTAL	21.8	9.7

99% CI: 0.7 to 0.9mmol/l). The reduction in total blood cholesterol produced by these changes in diet chiefly involves a reduction in LDL cholesterol with only a small reduction in HDL cholesterol.

Dietary saturated fat is largely derived from a few food groups

Implementation of a population strategy to reduce the intake of saturated fat is complex and requires a multisectoral approach that extends beyond the traditional medical model. An essential prerequisite for achieving dietary change is recognition that the average consumption of saturated fat and trans fatty acids by the Irish population is too high. The chief sources of fat consumed in the Irish diet are shown in Table 2 and most of this is derived from a limited number of food groups. The sources of fat consumed in the average British diet are similar and also derived from a limited number of food groups.

Within such food groups there is a substantial variability in the amount of fat consumed. Thus, within selected food groups, it is possible to exchange one food type for another to reduce the intake of saturated fat. Table 3 shows the food intake data from the Diet and Nutritional Survey of British Adults, which has been used to estimate the changes in food groups required to reduce the intake of saturated fat by 10% of energy.⁴ This data shows that substantial benefits can be achieved by replacing one type of food with

another in each of four food groups: (i) replacing butter and margarine with low-fat spreads, (ii) replacing full-fat milk with low-fat milk, (iii) replacing cheddar-type cheese with cottage cheese, and (iv) replacing average cuts of meat and meat products with lean cuts of meat.

The reasons why individuals choose to consume some foods rather than others are likely to be influenced by taste, tradition, convenience, availability and cost rather than concerns about whether it is healthy for them. This is the challenge for health promotion as identified in the Report of the Cardiovascular Health Strategy Group in Ireland (2000). Recognition of the importance of cholesterol and the role of health promotion required to reduce population mean levels of cholesterol is an important first step.²

References

1. BMJ 2000; 320: 705-8.
2. Department of Health & Children. Report of the Cardiovascular Health Strategy Group. Dept of Health and Children: Dublin, 2000.
3. BMJ 1997; 314: 112-7.
4. National Diet and Nutritional Survey of British Adults. HMSO: London, 1990.

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