

## DIET AND HEART DISEASE

Coronary heart disease (CHD) is a major cause of premature death and is known to be influenced by diet. Dietary advice given by government departments has concentrated on reducing fat intake and blood cholesterol levels. However, recent research suggests that dietary factors such as vitamins may also be important, with implications for the emphasis in health education and disease prevention.

*This briefing note discusses recent research on CHD and diet and the issues raised.*

### HEART DISEASE IN THE UK

Coronary heart disease (CHD) is the leading cause of death in the UK. Around 170,000 people die from it each year (29% and 23% of all deaths of men and women respectively). Though most coronary deaths occur in the elderly, CHD is responsible for a third of all deaths in middle age and is the major cause of premature death in men. Women are at much lower risk than men until the menopause, when their CHD risk starts to increase towards that of men (unless hormone replacement therapy is used when the CHD risk stays low). More people die from CHD in the north than in the south, and death rates are highest in Scotland and Northern Ireland. Manual workers tend to have higher CHD death rates, as do British subjects from the Indian sub-continent.

Since the early 1970s, death rates have declined by 21% in men and about 15% in women. Even so, Scotland and Northern Ireland are second only to the former Soviet states in the world league table for CHD mortality in men. Death rates for England and Wales are somewhat lower, but higher than in any other EC country except Ireland, and about six times higher than those for Japan (Figure 1).

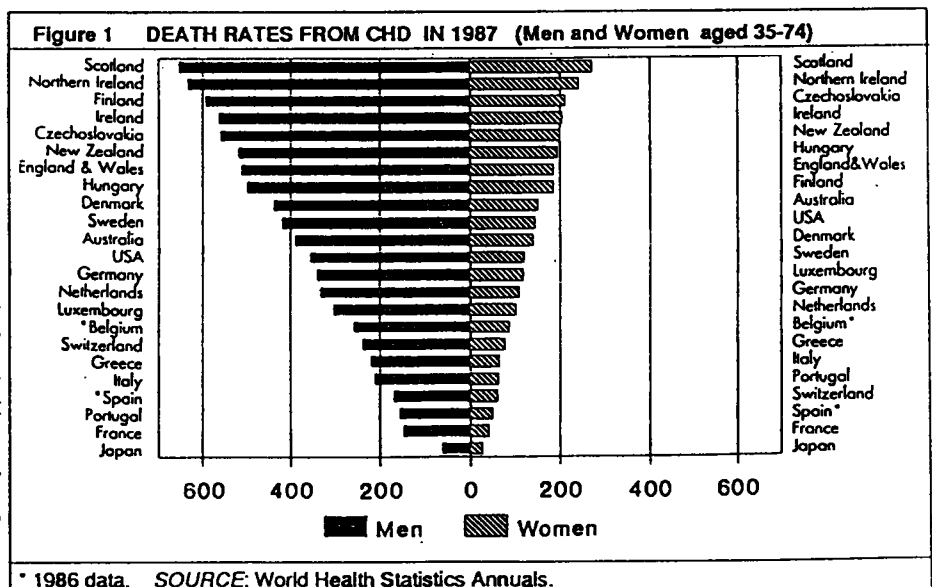
1. As well as influencing blood cholesterol levels, diet affects blood clotting, blood pressure (via salt intake) and obesity (via overall energy intake). Modest consumption of alcohol (2-4 units per day) decreases the risk, as does increased fibre content in the diet. Recent research also links higher risks of CHD with low weight at birth and one year, suggesting that diet in very early life may also affect future CHD risk.

There are a number of known 'risk' factors which increase the chance of a person developing CHD. Some are unalterable (e.g. age, sex, or a genetic predisposition); others may be influenced by a person's behaviour. The 'Health of the Nation' Green Paper (1991) identifies the three main risk factors in adults as cigarette smoking, high blood pressure (hypertension) and high blood cholesterol levels - although obesity, lack of exercise, blood clotting factors and stress also contribute. Diet is believed to be important since there are substantial differences between CHD rates in countries with similar levels of smoking, high blood pressure etc., much of which can be explained by differences in diet.

### DIETARY FACTORS FOR CHD

#### Fats and Blood Cholesterol

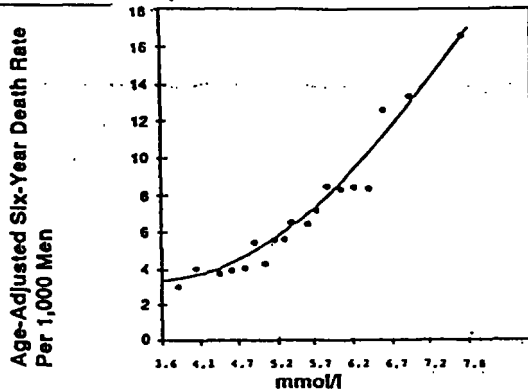
Diet can influence the risk of CHD in a number of ways<sup>1</sup>, but most public and scientific attention has focused on the role of cholesterol in the blood and how it is affected by fat intake. The link between CHD, blood cholesterol levels and fat intake has emerged from



studies which compared the diets of groups of people with low and high rates of CHD in different countries. These revealed a strong association between increased CHD risk and raised blood cholesterol levels (see Figure 2 from a US study involving 361,662 men). Comparing countries, some of the lowest levels (just over 3 mmol/l) are typical of the rural Chinese, whose death rate from CHD is 4% that of the UK with average blood cholesterol levels of ~6 mmol/l. World expert opinion suggests that a level of 5.2 mmol/l or lower is desirable.

Studies also suggest that increasing the intake of certain kinds of fat (the 'saturated' fatty acids - SFA) raises

**Figure 2 THE RELATIONSHIP BETWEEN SERUM CHOLESTEROL LEVEL AND DEATH FROM CARDIOVASCULAR DISEASE IN MEN (35-57 AGE GROUP)**



(SOURCE: MRFIT Study, 1986)

blood cholesterol levels - particularly in the form of 'LDL' cholesterol (most blood cholesterol is carried round the body by low density lipoproteins (LDL) which can be a source of cholesterol deposited in artery walls). Foods rich in SFA include whole milk, butter and other dairy products, meat fats and fats used in hard margarines. In contrast to popular opinion, dietary cholesterol (e.g. in eggs) usually has less of an effect on blood cholesterol levels than SFA.

Replacing saturated fats with 'polyunsaturated' fatty acids (PUFA) and 'monounsaturated' fatty acids (MUFA), tends to lower blood cholesterol levels. Important sources of PUFA<sup>2</sup> are nuts, oily fish, seed and corn oils, although even foods of animal origin contain a mixture of SFA, PUFA and MUFA. Diets with a high proportion of PUFA are typical of less developed economies and most Mediterranean countries (where substantial amounts of MUFA are consumed in olive oil); their populations typically eat less total fat and SFA and proportionately more PUFA/MUFA than we do and have much lower CHD death rates.

### Antioxidants

A growing body of evidence suggests that a diet rich in 'antioxidants' reduces the risk of CHD. Antioxidants (e.g. vitamins C, E and the vitamin A precursor, beta-carotene) neutralise small, highly reactive molecules (known as free radicals) which might otherwise oxidise LDL particles, making them more prone to accumulate in artery walls. European and American studies have demonstrated that low concentrations of antioxidant vitamins (e.g. vitamin E and vitamin C) are associated with an increased risk of CHD. In view of the presumed mechanism involved, the protective effect would be expected to be particularly important in people with higher levels of cholesterol in their blood.

These findings are consistent with some of the variations in CHD in the UK. People in areas with the highest CHD mortality rates (Scotland and N.Ireland) do not have significantly higher blood cholesterol nor SFA intake than those in the low risk areas (South East), but consume only around half the amount of fresh fruit and green vegetables - with a correspondingly lower vitamin C intake. The Ministry of Agriculture, Fisheries and Food (MAFF) is supporting a programme on the role of dietary antioxidants and their possible effects on CHD and cancer.

### GOVERNMENT HEALTH TARGETS

As long ago as 1976, the Royal College of Physicians recommended that intake of SFA be reduced and that of PUFA be increased. The Department of Health's (DH) Committee on Medical Aspects of Food Policy (COMA) recommended in 1984 that the proportion of energy which people derive from dietary fat should be reduced from 42% to 35%, and not more than 15% should be derived from SFA. In 1991, COMA recommended SFA intake be reduced to an average of 10% of total dietary energy. This is in line with guidelines issued by the US National Cholesterol Education Program (NCEP) and the World Health Organisation (WHO).

The COMA (1984) recommendations have been incorporated into heart-health campaigns (e.g. "Heartbeat Wales") and similar programmes in N.Ireland and Glasgow; public education programmes include "Look After Your Heart" (launched in 1987 by the DH and the Health Education Authority-HEA), which aims to contribute to a decrease of 25% in premature deaths from CHD by the year 2000. Around one third of health districts are implementing heart-health programmes.

In the 'Health of the Nation' Green Paper, the Government proposed a target of a 30% reduction in premature deaths from CHD between 1988 and 2000, to be achieved in part through dietary change. The dietary targets are that, by the year 2005, at least half the population should derive less than 35% of food energy from fat, and more than 60% of the population should derive less than 15% of food energy from SFA.

There is some way to go before these targets are met. In 1990, only 7% of adults met the Government's 2005 dietary targets for both total and saturated fats. Change in the last 25 years has increased the amounts of PUFA relative to SFA (e.g. whole milk consumption fell by over half, over a third of milk intake is now in the form of reduced fat milk, butter consumption has fallen by 70% since 1976, while the intake of PUFA has increased). However, partly because overall energy intake has fallen, fat continues to provide around 40 to 41% of our total dietary energy - well above the recom-

2. Certain types of PUFA ('omega-3' PUFA) in fish oils reduce blood clotting and thus protect against coronary thrombosis. Eskimos (Inuit) have a high intake of omega-3 PUFA and a very low incidence of CHD; UK clinical trials also suggest that eating oily fish protects against blood clotting and reduces the risk of a heart attack recurring.

3. One problem is that the 'control' groups may change their diet during the course of the trials, reducing the sensitivity of the study.

mended level of 35%. To meet the Government Health Targets, this level would have to fall more in the next 13 years than it has in the last 25.

## ISSUES

### *How important are Blood Cholesterol Levels?*

Reducing SFA intake to reduce blood cholesterol has been regarded world-wide as a key component of policies to reduce CHD risk in the general population. As already mentioned, this has been based on extensive studies which a) relate CHD to blood cholesterol levels and b) show that the latter are affected by consumption of SFAs. The nature of both links has been subjected to public scrutiny as a result of new scientific results.

There is little dispute that drugs, diet or surgery can control cholesterol concentrations, cause a reduction of fatty deposits in the arteries (atheroma) and reduce CHD. However, the reduction in CHD deaths in population studies, though roughly in line with that expected from the relationship in Figure 2, has not been statistically significant in most studies. Moreover, some studies show that total mortality is not reduced even though CHD-related deaths may fall. Some medical scientists thus question whether raised blood cholesterol is as important a risk factor as had been indicated, while others maintain that trials to date have not been sufficiently sensitive to reveal the true extent of the effect of lowering cholesterol<sup>3</sup>.

Much publicity has been given recently to the results of studies showing a slight increase in deaths from suicide, accidents and violence in groups subject to regimes involving cholesterol-lowering drugs supplemented in some cases by dietary change. Some scientists point out that these effects are at the limits of statistical significance and may thus not be real. Others see them as raising serious questions over whether such effects result from lowering blood cholesterol or from the drugs or diets used to achieve the reduction. The specific role of cholesterol-lowering drugs may be resolved by clinical trials due to be completed in 1995.

The link between consumption of SFAs and blood cholesterol levels has been reliably established, although (as with most biological factors) there are wide differences between the responses of individuals. However, the relationship between SFA intake and the actual incidence of CHD is clearer between populations from different countries than between individuals of the same country, and within the UK, the marked regional differences in CHD are not strongly related to blood cholesterol levels nor to the intake of total fat or SFA<sup>4</sup>.

Particularly in view of the questions over the importance of the SFA/blood cholesterol/CHD link, some scientists see the recent findings on the role of antioxi-

dants as identifying an important new factor affecting CHD risk. They believe that in order to reduce the risk of CHD, it is important to encourage the protective role of vitamins in the diet independently of any steps to reduce blood cholesterol levels. Some have suggested that part of the decline in CHD rates in the USA, UK and other western countries could be due, for example, to increased use of vitamins in food products.

### *Dietary Targets and CHD*

It is not known whether the dietary targets in the 'Health of the Nation' Green Paper will be retained in the White Paper due for release in July, but the extent to which these or modified targets are met depends on how far people respond to dietary guidance and the resulting effects of reduced SFA intake on CHD.

The DH's Standing Medical Advisory Committee (SMAC) analysed 20 clinical trials and concluded that a 10% reduction in blood cholesterol would reduce CHD by 20% or more. There is however, some uncertainty over whether such predictions would apply to the whole population, since most clinical studies have involved men at relatively high risk of CHD and the response of women or men at lower risk remains poorly understood. Furthermore, people from South Asia have elevated levels of CHD which are thought not to be related to cholesterol level, but to insulin resistance.

Since the War, people have tended to consume around 40% of dietary energy in the form of fat, so how easy would it be for them to meet the lower targets in the Green Paper? A British study of health-conscious groups (meat eaters, fish eaters, vegetarians and vegans) confirmed that SFA intake can be reduced voluntarily to less than 15% of dietary energy, but only vegans met the proposed target to derive less than 35% of food energy from fat: the others largely replaced dietary SFA by PUFA. However, in the USA over the past 25 years, total fat intake fell from 40% to 36% of dietary energy, mainly through a reduced intake of butter and milk and an increased consumption of low-fat dairy products.

Some argue that targets should be set for changes in food consumption patterns rather than fat intakes, as these are likely to be understood better and acted upon. Within a balanced diet, government targets might be met by using low-fat milk, low-fat spreads and lean meat, and cutting consumption of chips, biscuits, cakes etc. The resulting shortfall in energy could be offset by eating more vegetables, fruit, potatoes and bread. Recent analyses suggest that the diets of the adults who currently meet government fat targets are in line with this pattern. Advice to eat more fruit and vegetables would also serve to promote the protective effect of

4. One complication is that SFAs are a complex class of chemicals, not all of which raise blood cholesterol; the composition of SFAs also varies between different foods. Dietary advice based on treating all SFAs as a class is thus seen by some as too simplistic.

antioxidant vitamins. Current HEA advice on CHD does not take into account the recent work on antioxidants and recommends eating fruit and vegetables only in so far as they are a source of fibre.

### **Cholesterol Testing**

Testing kits are commercially available and offer the potential for widespread screening of the population's cholesterol levels - either via the doctor or via self-testing on instruments in shopping centres, pharmacies and the like. In the USA, there have been calls for all American adults to 'know their cholesterol number' and in the UK, the British Hyperlipidaemic Association (BHA) has advocated cholesterol testing of all adults over 30 to complement strategies to reduce CHD in the general population.

One issue concerns the reliability and accuracy of the results, particularly from self-testing kits. There may be no quality control on the maintenance and use of test instruments in non-clinical settings; difficulties have also been reported in using some self-testing kits and interpreting the results. There are also questions about the follow-up to self-testing; people may be inappropriately reassured by a 'normal' reading or unnecessarily worried by an apparently 'high' reading. SMAC has thus recommended that all cholesterol measurements in non-clinical settings be subject to quality assurance and that testing should preferably be under medical supervision to enable patient management and counselling.

In a medical setting, BHA guidelines suggest that comparatively few patients are likely to require cholesterol-lowering drugs unless their blood cholesterol is above 7.8 mmol/l (6-8% of the population); for those with lower levels but above the 5.2 mmol/l 'desirable' level (about 60% of the UK population), dietary change is advised as the predominant therapy. However, knowing one's 'cholesterol number' may not improve compliance with dietary advice even under medical supervision; surveys in Australia and the US found that about 25% of patients with high levels and 50% with moderately raised values, took no action on their diet.

In the light of these and other factors, the Dutch Health Council concluded in 1990 that the disadvantages of cholesterol screening in the general population outweighed the advantages. A similar conclusion was reached by SMAC (also in 1990) which recommended that blood cholesterol testing and treatment form part of a broad strategy for CHD prevention in the UK, and concluded that "opportunistic" testing of patients by their GPs would prove the most cost-effective approach. Under present NHS contract regulations (1990) therefore, GPs are not obliged to offer blood cholesterol testing as part of their minimum package of services, but use such tests in the context of the patient's overall

risk (based on family history of CHD, smoking, hypertension etc.). However, GPs reportedly have difficulties in deciding the most appropriate advice on risk factors in view of conflicting advice from US (NCEP), UK (BHA) and European Atherosclerosis Society.

### **Food Labelling**

The EC Directive on food labelling came into effect in April, and MAFF have circulated draft regulations to implement the Directive in two stages. From 1993, any nutritional claim will trigger a declaration of the 'big four' nutrients (energy, fat, carbohydrate and protein), while from 1995, the required declaration will include levels of sugars, saturated fat, sodium and fibre. The Directive however precludes MAFF requiring additional declarations (e.g. PUFA, vitamins), although such information may be provided voluntarily. MAFF is encouraging manufacturers to adopt the Directive's requirements ahead of its implementation date.

Food labels containing nutrition claims such as 'low fat' or 'low in saturates' could help consumers to choose a diet aimed at reducing CHD risk, but the Coronary Prevention Group (CPG) have found that claims are often misleading or ambiguous. At the same time, some legitimate claims for low cholesterol foods are confusing because dietary cholesterol generally has less effect on blood cholesterol than dietary fats or SFA - which may nevertheless be present at high levels. Such claims have been regulated since 1984, but some supermarket chains in the UK and the US are re-labelling foods to avoid the use of cholesterol claims altogether.

Even when provided, some consumer groups as well as those concerned with CHD argue that much of the nutritional information provided on food labels is unwieldy, if not unusable. The CPG and other groups have proposed various visual systems of "Nutrition Banding" broadly indicating, from 'high' to 'low', the protein, carbohydrate, fat, salt and fibre content in relation to consensus dietary recommendations. MAFF have sponsored research which shows that supplementing numeric nutrition declarations with verbal or well-designed graphic information helps consumers to make faster and more accurate decisions about foods; MAFF are expected to consult on possible schemes shortly.

### **FURTHER READING**

Additional details and background information are available from POST, 2 Little Smith St., London SW1P 3DL, tel: (071)-222-2688.

The **PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY** has been set up by the Parliamentary and Scientific Committee to inform Parliamentarians on scientific and technological issues. Copyright POST, 1992.