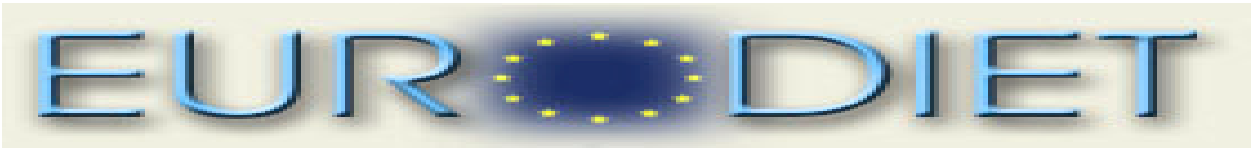

European Diet and Public Health: The Continuing Challenge

Working Party 1: Final Report+

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Chair: Anna Ferro Luzzi[1]

Rapporteur: W. P. T. James[2*]

1. National Institute for Food and Nutrition Research, Via Ardeatina 546, 00178 Rome, Italy
2. Public Health Policy Group and International Obesity Task Force (IOTF), 231 North Gower St., London NW1 2NS, UK

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* Correspondence: E-mail: jeanhjames@aol.com (Philip James)

1. Introduction

1.1. This century's success story

There has been a dramatic improvement in the health of European children and adults since 1900. These improvements were remarkable in the first half of the century, with a progressive fall in the death of children and pregnant women and substantial increases in life expectancy. This century's early health changes were not the result of the provision of medical services, the discovery of drugs and antibiotics, or even the increasing capacity to immunise children against an ever greater range of infectious diseases. They resulted from improvements in the diet, in the housing, occupational and social conditions of workers and their families. Since World War II, with modern living conditions, the general year-around availability of a huge variety of foods, expanding immunisation and improving health care through the health services, with modern therapeutic techniques and new drugs, life expectancy continues to increase in many European countries. These are great public health achievements which should not be overlooked by policy makers and indeed the public.

1.2. Societal dietary concerns

A new dietary perspective is now emerging in Europe. There is already great public concern with the potential hazards associated with comparatively recent developments in a complex and rapidly evolving international food chain. The discovery of BSE and of other new infections, such as E Coli O157 and novel viruses, toxicants such as dioxin and putative health and environmental hazards linked by the public to genetically modified plants and foods – these developments amplify their concern. However, current crises in confidence relating to food safety need to be put into perspective - nutritional imbalances account for over one hundred times more premature deaths and an even greater health burden than food-borne infections in Europe. The public is also becoming both interested in and concerned with the impact of the nutritional quality of the diet on their own health and that of their children. Despite the modest support for dietary and nutritional research, enough has emerged to require a rewriting of the traditional approaches to nutrition from those based on the 1920-1940s' emphasis on deficiency diseases and a "balanced diet" for their avoidance.

In the second half of this century, most of Europe has seen a very substantial increase in a number of major chronic diseases in adult life. These become worst with age and are multifactorial. The principal factors, however, are diet and inactivity, e.g. in coronary heart disease, strokes, obesity, maturity onset diabetes mellitus, gall-stones, osteoporosis and several cancers. Although some European countries have been successful in reducing premature deaths from some of these conditions, there is increasing evidence that the burden of ill health on the public and on European health services is steadily rising. This is particularly true in the expanding elderly population who, unlike the USA, seem to be adding years of ill health rather than wellbeing to their extended lives. There is therefore a need to reconsider the earlier approach to nutrition and food policies, which were based predominantly on analyses of the risk of premature death.

Inappropriate diets in Europe have such an effect on health that they account for a substantial proportion of the health costs in the EU. Recent preliminary analyses suggest that the disabilities associated with high intakes of saturated fat and inadequate intakes of vegetables and fruit, together with a sedentary lifestyle exceed the costs of tobacco use. The variation in health between countries and between socio-economic groups within EU nations is large; dietary practices, smoking, excess alcohol intake and other life-style issues, particularly diminished physical activity and housing conditions, account for most of these variations. Diet is also fundamentally involved in continuing to produce specific nutritional deficiencies e.g. of iron and iodide. There are further newly recognised deficiencies of folic

acid, vitamin D and n-3 essential fats, and perhaps selenium. Some dietary components are also now readily consumed in excess, e.g. energy and fat in relation to obesity, sodium mostly as salt in relation to high blood pressure, saturated and trans fats in relation to heart disease, and refined dietary sugars which promote dental caries. In addition, a wide range of nutritional factors seems to programme the body's metabolism with effects on the immune system, the ageing process itself, the prevention of cancers and the maintenance of good visual and mental function; the precise nutrients involved are still being investigated. Increasing evidence that poor diets enhance the long-term susceptibility of children and adults to later diseases is also emerging with particular emphasis on the importance of good diets for women before and during pregnancy. Maternal nutrition and breast feeding affects the child's life-long health, and perhaps even that of a subsequent generation.

Given that diet and physical inactivity are the principal causes of so many diseases, the expectation is that particular individuals can be readily targeted to rectify their specific dietary problem. Unfortunately, simple dietary analyses are difficult to undertake, inaccurate and of only modest use in allowing a dietary "abnormality" to be rectified. The individuals who succumb to a disease are usually on a similar diet and activity pattern to their neighbours. The disease emerges because of the individuals' particular susceptibility which is determined by a complex array of genetic factors and other features of body size and organ function which reflect previous stresses, illnesses and dietary practices. Thus, it is the interaction between diet and other environmental conditions with the individual's susceptibility that usually determines the age of onset and the severity of the disease in a particular individual. On an European basis, however, it is the population's dietary and activity patterns which make the substantial contribution to the national burden of ill health and the demand for health care services.

1.3. Genetic screening?

Recently, simplified screening techniques for a range of molecular markers have raised the question of whether the health of Europeans could be improved by instituting a screening procedure for those genetic traits that predispose individuals to the major public health problems of Europe. Whilst genetic screening has proved valuable in providing reproductive advice and monitoring, the usefulness of this approach on a population basis is as yet doubtful. Single major gene defects leading to classic genetic diseases, e.g. haemochromatosis, Wilson's disease, or phenylketonuria, are all rare, albeit linked to diet. Only recently have more subtle effects of gene variation emerged where, for example, small changes in a hormone receptor affecting about a third of French individuals seem to make them more prone to obesity on a relatively energy dense high-fat diet if they are also physically inactive. In relation to most common illnesses, however, there are several, if not many, different genes usually contributing to a person's susceptibility to a particular disease, with the genes interacting either with each other or with different dietary components at different stages in the processes by which a disease develops. Thus, three gene markers of the risk of coronary heart disease e.g. apo E4 lipoprotein, Lpa and the Va/Va methylenetetrahydrofolate reductase gene, each affecting 10 to 30 % of the population, may act on different processes to promote heart disease and have different dietary inducers. Furthermore, for many other diseases, such as the vast majority of cancers, any genetic predisposition is usually modest in its impact, and long term environmental effects, such as diet, are much more important. Genetic screening therefore is only likely to be of value in a public health approach aimed at improving the well being of Europeans if readily definable groups within society could be identified as more or less susceptible to particular diets. The potential for using genetic screening as an aid to dietary advice therefore needs careful monitoring.

1.4. Population burdens of disease

Traditionally, doctors identify individuals with a marked abnormality in a major risk factor for

such conditions as diabetes, high blood pressure and heart disease, but these individuals are usually a small minority of those who succumb to the disease, despite the minority being individually at much greater risk. The majority of cases of the principal diseases in Europe occur amongst the majority of the population with modest individual risks around the average level for the population, (Figure 1). Reducing their risk will result in a much greater reduction in the number of deaths than if the small fraction of the high risk group were successfully treated. In the example displayed in Figure 1, the high-risk approach might target the 3% of the population that has a serum cholesterol above 7.2 mmol. (280 mg/dl), and would save, if successful, only 10 attributable cardiovascular disease deaths per 1000 over a decade, while reducing the risk in only those with around average cholesterol levels and with very modest risk has the potential to save 24 premature deaths. The population approach therefore involves shifting the whole population towards the lower risk values rather than concentrating on high risk groups. This applies to many other conditions such as blood pressure, body weight and alcohol intake and is a fundamental feature of public health strategies which even some scientists have not understood.

2. Promoters of ill-health

2.1. Poverty and poor diets

The original pre-war revolution in thinking on diet and health stemmed from the findings of a clear link between poverty and the ability to afford an adequate and varied diet: the impaired growth of children, their susceptibility to vitamin deficiencies and infections demonstrated that the vulnerable sections of society were not coping on their limited diet. Economic, social, educational and health policies were introduced into most European countries in the 1940s in response to these concerns. Now, however, a new dimension of poverty has emerged, poverty often being defined in economic terms as a low relative purchasing power rather than the ability to afford a minimum range of foods compatible with optimum health. Recent UK [2] and WHO data [3] have displayed a very marked discrepancy between the health status of the wealthy and that of the poor of Europe. The within-society differences are as striking as those national differences displayed across Europe, with 5 year or greater differences in life expectancy between the rich and poor of some societies. The premature deaths of the poor relate to a more sedentary lifestyle, a diet which is comprised of the cheaper foods rich in fats and sugars and with lower vegetable and fruit intakes, together with often greater rates of smoking and of excessive alcohol consumption. Nevertheless, in addition to these well-known risk factors, more subtle issues are emerging of substantial societal significance. The inferior diet of the poor often relates to their lack of private or affordable public transport to out-of-town supermarkets, to the absence of an adequate range of cheap foods in city centres and to an unwillingness to experiment for fear of wasting food. The poor are often also highly stressed by a sense of stigmatisation and exclusion from society and by their recognition that they are unable to control their own lives because of reduced opportunities; these conditions are now clearly linked to high levels of coronary heart disease [4]. These stressful conditions are also known to induce disadvantageous hormonal, metabolic and immunological changes which may contribute substantially to the excessive morbidity and mortality from cardiovascular disease and some cancers, e.g. of the lung. Poorer mothers are also more likely to have children of low birth weight and this is now clearly linked to an enhanced susceptibility to adult chronic diseases (see below).

2.2. Physical inactivity

The importance of physical activity has been underestimated for many years by both doctors and policy-makers, but there is now very substantial evidence to prove that there are four different aspects of physical activity which benefit the health of children and adults. The total amount of general physical activity is the crucial feature determining total energy expenditure which is of importance in limiting weight gain and the development of obesity. Short amounts of more intense activity induce physical fitness which has a substantial influence on people's

sense of well-being; even moderate activity levels may also halve the likelihood of developing maturity onset diabetes, coronary artery disease, stroke and even colon cancer, with substantial effects in reducing high blood pressure, and abnormal blood lipid and glucose levels. Overall morbidity rates are therefore reduced by 30-50% by moderate weekly exercise. Weight bearing physical activity also limits bone loss and reduces the chances of osteoporotic fracture, but this problem is also avoided if older people maintain "eccentric" movement which involves the sudden fixing of large muscle groups when walking downstairs. The preservation of these responses and associated limb control is aided by ball games, some dancing movements or the controlled exercises familiar to Chinese cultures; muscle power and the ability to limit stumbling and falls in the elderly is an important aid, reducing the risk of fractures and preserving the ability of the elderly to function independently into very old age.

In Europe there is excellent evidence for the dramatic fall in physical activity since the war; there is also an age-related decline of over 2 MJ (500 kcal) per day energy output in most adults from the age of 20 to 60 years. Many problems of the elderly are markedly affected by their physical inactivity. Enhancing the overall activity of Europe's children and adults should now therefore become a high priority but this issue does not depend only on individual decision-making - activity is constrained by the inappropriate emphasis on transport and city planning to provide facilities for the motor car rather than for the cyclist or pedestrian. The provision of pedestrian precincts, walkways, cycle paths, school and community facilities and appropriate building design have been neglected at the expense of people's health needs in favour of appealing to an almost evolutionary drive to limit physical activity. Mechanisation and computerisation at work and home have amplified a sedentary lifestyle with passive leisure activities, e.g. watching television or playing computer games, now becoming increasingly prevalent.

2.3. The failure to breastfeed

It is now widely accepted that human milk is the uniquely superior food for infants. Exclusive breastfeeding promotes in the child appropriate immunological responsiveness and lowers the risk of infections and of atopic diseases such as asthma. It may also limit the development of childhood obesity and of non-insulin dependent diabetes in later life. Both the child and the mother also benefit from the greater psychosocial interactions associated with breastfeeding. In addition the mother has a more favourable post-pregnancy weight loss and a reduced risk of pre-menopausal breast cancer. It is surprising therefore that so little emphasis is given to breastfeeding in Europe.

European countries show great disparities in breast-feeding rates. In Norway, 96% of babies are currently being exclusively breastfed at four months of age. In Sweden in 1996 73% of mothers were still partially breastfeeding at 6 months compared with 21% of UK and only 8% of N. Irish mothers. Poorer educated, single and younger mothers breastfeed less, so clearly a major European public health initiative is needed on breastfeeding. Despite limited and unreliable statistics, an upward trend in European breastfeeding rates is usually reported.

There has been an intense debate about the desirable length of exclusive breastfeeding. The original policy of specifying a period of 4-6 months led to concern that this would in practice be interpreted as suggesting weaning from 3 months onwards. Further scientific reviews now suggest that the vast majority of mothers and their babies can thrive while exclusively breastfeeding for about 6 months. Exclusive breastfeeding should certainly continue for a minimum for four months and breast milk should provide the principal source of milk for the child for up to one year.

To facilitate the development of healthy breastfeeding practices will need a transformation in European strategies so that all sectors of society allow their children to have as beneficial a start to life as is now evident in Norway. National surveillance and support systems should now be established to help induce a major increase in breastfeeding. Many of the

recommendations included in the Innocenti Declaration for exclusive breastfeeding should be adopted and socio-economic policies on maternal benefits may need to be improved in many member states. The more effective involvement of the health care sector is needed as well as a shift in many societal attitudes and arrangements which at present impede breastfeeding.

3. Adult Health

3.1. Obesity and diabetes

The prevalence of obesity is increasing rapidly in all age groups in most EU-countries and is one of the fastest growing epidemics, obesity now affecting 10-20 % of the adult population and excess weight gain affecting the majority of middle-aged adults. The prevalence of overweight and obesity in childhood is also probably increasing in Europe: in overweight children aged 6 to 10 years, the excess weight tends to persist into adult life with particularly deleterious effects. Recent studies reveal that European children are becoming very inactive and eating energy dense diets rich in fats and sugars. This inactivity and dietary pattern is conducive to weight gain (see below).

Obesity leads to serious co-morbidities such as type 2 diabetes, cardiovascular disease, certain cancers and reduced life expectancy. The risk of diabetes is increased by obesity up to 100-fold if a child enters adulthood obese and continues to gain weight. At least 80% of the increasing number of diabetics can be attributed to excess weight gain, particularly if fat accumulates within the abdomen. Excess abdominal fat markedly enhances the risk of high blood pressure, diabetes mellitus, blood lipid disorders and cardiovascular disease. Genetic factors, smoking, excess alcohol and fetal with early childhood malnutrition followed by rapid growth predispose to abdominal fat accumulation in later life. So a waist-hip circumference ratio >1.0 in men and >0.85 in women denotes a major risk. Caucasians with a waist measurement ≥ 94 cm for men and >80 cm for women have an increased risk and the higher values of ≥ 102 cm in men and ≥88 cm in women indicate a severe risk of diabetes and cardiovascular disease. Asian immigrants are at greater risk of diabetes and cardiovascular disease at much lower body weights and waist circumferences than Caucasians [5,6].

There is robust evidence from cross-sectional and longitudinal studies that an energy dense, high fat diet and physical inactivity are independent risk factors for weight gain and obesity. Furthermore, interactions between dietary fat and physical fitness determine fat balance so the obesity promoting effect of a high fat diet is enhanced in sedentary individuals; those with a familial and genetic predisposition to obesity are especially vulnerable. A diet with a higher fat content seems to be better tolerated without weight gain by physically active individuals than by sedentary people. The original 1950s Seven Country Study [7] which included men in Finland, The Netherlands, Greece, Italy and former Yugoslavia showed that the total fat content of the diet did not relate to the risk of coronary heart disease, but it did predict the average weight of each group of men studied. The Greeks, however, seemed to avoid frank obesity despite their higher fat intakes (Figure 2) by virtue of their intense physical activity. More recent studies on volunteers show that fat intakes need to be as low as 20-25% to avoid the spontaneous and unrecognised over-consumption of energy which leads to weight gain if individuals are sedentary. At high fat intakes of over 35% individuals have to be very active, i.e. on their feet for sustained periods and walking for 60-80 minutes each day of the week to avoid excessive weight gain. Recent cross-cultural analyses (Figure 2) show that from 15% fat upwards there is a greater likelihood of a society having an increased proportion of adults with excessive body weights, i.e. over a BMI of 25. The activity needed to prevent substantial weight gain on high fat diets is equivalent to a physical activity level (PAL) of over 1.75. This PAL is the activity cost and the body's small energy cost in responding to food, these two costs amounting to 75% of the individual's basal energy needs. This value is similar to that which limits the likelihood of obesity occurring in different societies around the world [16], the activity level needed to reduce the risk of colon cancer [17]

and is the same value as that measured in formerly obese women who managed to maintain their reduced weight after substantial weight loss [18]. Detailed studies show that the energy value of moderate exercise, i.e. the 30 minutes brisk walking per day advocated by many international committees, e.g. the National Institutes of Health [19] for limiting the risk of high blood pressure, diabetes or cardiovascular disease, involves less energy expenditure than that needed to preserve energy balance. At these modest activity levels individuals who eat moderate amounts of fat-rich foods readily overcompensate for their increased work output so both physical activity and dietary changes are needed by almost all European children and adults to prevent the current epidemic of overweight and obesity from escalating further.

The precise interactions between activity level and dietary fat in determining energy balance is unknown and obscured by individual susceptibility to weight gain and by cultural features including the proportion of daily intake eaten outside the home where assessing and controlling portion sizes and fat intake is often extremely difficult. High density diets rich in sugars and maltidextrins instead of fat are nearly as conducive to the passive over-consumption of energy as with fatty foods in short-term feeding trials. Yet in Europe, as elsewhere, there is an inverse relationship between sugar and fat consumption. This so called fat-sugar see-saw occurs with thinner individuals tending to have higher sugar intakes. In practice these adults are also more physically activity. A societal drive to focus on low fat alternatives to the usual products on the market will generally lead to the consumption of foods with a higher sugar content. Only a small proportion of the European population currently eats a low fat, low sugar diet, despite this being a feature of the traditional Mediterranean diet (Figure 2) and the usual diet of Asia where, until recently, obesity was a rarity. The fat/sugar see-saw effect does not seem to be a physiological obligation but rather a culturally driven and opportunistic choice that might well be modified in favour of both a low fat and a low sugar diet.

There is some current scientific concern that advocating a low fat diet could lead to an increase in cardiovascular risk [20], but integrated analyses of the effect of diets with the nutrients values shown in Table 1, i.e. with less than 30% fat from diets rich in cereals, vegetables and fruit and with a low salt and sugar content, show that there is no enhanced risk [21]. These diets and more extreme reductions in total dietary fat have also been tested in a series of trials. These, and European national public health strategies, are found to reduce, not increase, morbidity and mortality rates from both coronary heart disease and stroke. Therefore, although total dietary fat is not directly linked to cardiovascular disease risk (see below) a policy to reduce the energy density and particularly the fat content of the diet of all Europeans in member states is needed to limit the development of obesity.

Ad libitum consumption of diets low in fat and high in protein and starchy carbohydrates with a high fibre content and a low glycaemic index contributes not only to the prevention of weight gain in normal weight subjects but also causes a spontaneous weight loss of 3-4 kg in overweight subjects, and has beneficial effects on the risk of diabetes.. The addition of daily physical activity to the diet can increase the weight loss in overweight subjects and particularly helps to prevent weight regain. Implementation of this dietary change with increased physical activity can be predicted to reduce the mean body weight of the EU's adult population and decrease the prevalence of obesity and diabetes substantially.

The recommendations for the prevention and management of diabetes produced by the European Diabetic Association re-emphasise the need for substantial increases in physical activity, a lower dietary fat intake and a high consumption of whole grain cereals, vegetables and fruit in preventing weight gain and limiting the development and severity of diabetes.

3.2. Cardiovascular diseases in Europe

The rates of coronary heart disease and other cardiovascular diseases are two to five times higher in some EU areas than others, but new evidence highlights the very high rates of all cardiovascular diseases in Central and Eastern European countries. Heart disease shows a

clear North to South gradient within the EU, with the lowest rate in the Mediterranean populations. The distribution of stroke is different, being highest in Portugal and lowest in parts of Sweden, France and Germany. The burden of these diseases is immense, because although there has been some success in reducing premature deaths from coronary heart disease, more men and women are surviving with impaired cardiac function. In addition these are age-related disorders, so the increasing number of elderly means that the burden and demand on health care service is certain to escalate unless more effective preventive measures can be devised. The impact can be assessed in terms of the number of years spent in a disabled state (disability adjusted life years or DALYs). Cardiovascular diseases now contribute 18.5 % of all the DALYs in the established market economies of Europe, and demographic projections over the next 20 years alone suggest a 40% increase in the societal burden. This burden is much greater with stroke than heart disease, since a greater proportion of individuals survive a stroke and are usually prone to being more physically and mentally handicapped thereafter than those surviving with heart diseases. Currently, a substantial proportion of the health budget of the EU is taken with dealing with cardiovascular problems.

The major contributor to the development of heart disease is a diet which induces a rise in total blood cholesterol. This increase amplifies the risks of smoking and high blood pressure. The risk also increases because individuals who become sedentary and gain weight have low blood levels of high density lipoprotein: high levels are recognised to be protective.

There is now increasing evidence that the n-3 poly-unsaturated fatty acids found in fish, vegetables and in some vegetable oils have a distinct beneficial effect in limiting the likelihood of sudden cardiac death and of abnormal cardiac rhythms. Consuming diets rich in n-3 fats have also helped to halve the risk of recurrent heart attacks. So the earlier emphasis on the value of poly-unsaturated fats in terms of the n-6 fatty acids now needs to be modified to ensure an appropriate ratio of n-6 to n-3 fatty acids. Greater benefits seem also to accrue for the prevention of both coronary heart disease and stroke by ensuring that the diet contains a substantial amount of whole grain cereals, vegetables and fruits.

The likelihood of developing a stroke is dependent principally on the level of blood pressure, this being amplified by physical inactivity, excess weight gain and excess alcohol consumption. Blood pressure levels rise with age and excessive salt intake has been suggested to promote this age-related increase. Low intakes of potassium and perhaps of some other minerals exacerbate this effect but low fat (26%), low saturated fatty acid (7%) intake as well as these mineral changes, can have a major effect in lowering blood pressure without a change in sodium intake [22]. These minerals are usually present in whole grain cereals, vegetables and fruit. The recent 1998 consensus produced by the International and European Task Force for the Prevention of Coronary Heart Disease [23] specifies dietary goals for all adults. They also have more stringent recommendations for those who have evidence of high blood pressure, abnormal blood lipids or coronary heart disease. The recommendations for primary prevention are similar to earlier WHO proposals for population goals, and are included in Table 1.

Many studies show that even moderate physical activity is particularly important in reducing the likelihood of developing heart disease, high blood pressure and stroke. This activity need not involve intense physical training. In the Netherlands physical inactivity has been proposed as the single biggest contributor to the development of cardiovascular disease. Recently several professional groups have indicated that brisk walking for 30 minutes daily or 2 hours of active sports or other leisure activity weekly has a marked preventive effect. These levels are somewhat less than originally proposed, but can contribute to the prevention of obesity, diabetes and some cancers as well.

3.3. The salt controversy

The proposal that salt intakes should be reduced has been criticised, particularly in the last

five years, because of the inadequacy of direct evidence for a reduction in blood pressure when the salt intake of adults with a normal blood pressure is restricted [24]. Appreciable reductions in blood pressure are readily achieved in adults with high blood pressure but not in individuals with normal blood pressure if judged on the basis of interventions which have in general lasted for only a few days and been applied mostly to young adults who have a relatively low average blood pressure [25]. Given the scientific debate and the industrial interest in preserving salt intakes, it is then reasonable to question the value of a national or European plan to reduce the average salt content of all foods and particularly of the majority of processed foods which in Europe dominate the contribution to salt intake. It is now accepted that reducing weight, increasing exercise and limited alcohol intake are useful measures for treating those with high blood pressure and limit the likelihood of developing hypertension. In addition, a major American trial - The Dietary Approaches to Stop Hypertension (DASH I) trial - has emphasised the value of a low fat, high vegetable and fruit diet rich in fibre for reducing blood pressure even in adults with a normal blood pressure [22]. These improvements in blood pressure in normal and hypertensive individuals can be seen without any adjustment in salt intake. During the Crete conference, however, the preliminary results of the long-awaited DASH II trial of the impact of low salt diets on the normal blood pressure of different American groups was released by the National Institutes of Health [26]. This shows in the first large randomised, double-blind trial conducted with different groups fed controlled diets for 4 weeks, that reducing salt intake leads to a highly significant reduction in the blood pressure of normal adults as well as in adults with hypertension. The lower the sodium intake the better, so sodium intakes equivalent in salt terms to 3.8 g per day led to a greater fall in blood pressure than a modest reduction (6.05 g per day) which in turn induced significantly lower blood pressure than the standard diet containing 8.3 g salt equivalent per day. The National Institutes of Health have therefore highlighted the need to consider even lower intakes of salt than the <6g per day value suggested by recent expert committees and included in Table 1. The best DASH trial results were obtained with a combination of the DASH diet, i.e. low fat, high cereal, vegetable and fruit intakes and the lowest salt intake. The salt intake of 3.8 g should be related to the spectrum of salt intakes found in the INTERSALT study for different groups in Europe as displayed in Figure 3 which relates the salt intake to the likelihood of stroke in different parts of Europe. Clearly there is a need to rethink our approach to the salt content of European foods.

Three European findings highlight the importance of reducing salt intake. First, there is the result of a community intervention study in Portugal [28]. Reducing by even modest amount the very high salt intake of everybody living in a Portuguese village led to a progressive fall in the average blood pressure in this village's adults over a two-year period with significant differences from the results obtained in a village where no measures were taken. This community study should then be related to regional and then national interventions in Finland where both children and adults were targeted to reduce their salt intake as well as changing their diet. The average blood pressure of adults in North Karelia dropped by >10 mmHg which would be seen as a remarkable achievement if the impact of hypotensive drug therapy was being tested! In North Karelia and then in Finland as a whole, there has been a major decline in salt intake and other changes consistent with the two DASH trials and Table 1. There has been a substantial reduction in total fat intake from an average of 42% to <34% and a trebling of average vegetable consumption since the 1970s [29]. These changes are associated with >65% reductions in deaths from stroke and coronary heart disease in North Karelia [30]. These interventions highlight the value of implementing major dietary changes as proposed in Table 1.

The final piece of evidence is of a different nature. Whereas all the trials so far conducted have been aimed at testing whether there may be benefit from reducing the prevailing salt intake, a Dutch study assessed the value of reducing the salt content of infant formulae fed to babies [31]. Those babies randomly assigned to a formula containing less salt had clear evidence of a lower blood pressure at 6 months of age. More recently, however, the blood pressures of the same children were measured when they were 15 years old, with their having had no particular intervention between the age of 6 months and 15 years. Those who

from birth had been on a lower salt intake for the first six months of life had very substantial and statistically significantly lower blood pressure at 15 years of age. There is a long-recognised age-dependent increase in blood pressure in all societies except those on very low salt intakes so the Dutch evidence suggests that early exposure to salt is of crucial importance. There is therefore a need to take a radical approach to lowering the salt intake of babies as well as children and adults in Europe.

3.4. Cardiovascular disease and fetal programming

There is now a large body of evidence that the development of high blood pressure, coronary heart disease and stroke are strongly associated with the size of the individual at birth; premature delivery is less important than thinness at birth which is taken as an index of inadequate fetal nutrition. These babies are also much more susceptible to diabetes, particularly if excessive weight gain occurs in childhood and/or in adulthood. Rapidly accumulating evidence points to hormonal, metabolic and body compositional changes in the new-born induced by fetal responses to altered maternal/placental nutrition and hormonal supply with the height, pre-pregnancy weight, pregnancy weight gain and the mother's diet all being involved. As yet there are few clues as to how best to combat these problems although thin mothers with poor weight gain can benefit from energy/protein supplements and perhaps from extra folic acid intake. Additional zinc and n-3 fatty acids may also be involved [32] but there is no clear evidence that would allow as yet a coherent strategy of maternal intervention to be applied on a European basis. As yet there are no clear analyses of the relationship between birth weight and adult diseases in the EU as a whole, but low birth weights are particularly prevalent amongst the lower socio-economic groups.

3.5. Cancers

The emphasis on the importance of fruit and vegetables is reinforced when the dietary contributors to the huge burden of cancers in Europe is considered. Cancer rates vary substantially across Europe, both in terms of individual cancer rates and in relation to the overall burden of cancer morbidity and mortality [17]. Many cancers, particularly those involving the epithelial tissues, are more common in those who chew tobacco (mouth and pharyngeal cancers), in those who smoke (lung cancer) and in those who are physically inactive (colon cancer). Low vegetable and fruit intakes are linked to a marked increase in the risk of these cancers and also amplify the risks of stomach, pancreas and breast cancers. A doubling of vegetable and fruit intake in Holland has been estimated to have the potential for reducing overall cancer rates by a third. A number of different gene changes have been identified as being involved in a sequence of discrete steps during the development of some cancers, e.g. in the colon, where adenoma growth, its transformation to *in situ* cancers, the development of invasive properties and the wider spread of the cancer through the body - all have associated specific gene changes. However, these genetic changes do not inevitably determine the development of cancer but alter the individual susceptibility to a number of presumably different environmental factors. Thus, single, highly penetrant mutations in cancer genes explain only a very small proportion of cancers. Diet, smoking, excess alcohol and other unknown exposures involving particularly the duration rather than the level of exposure probably explain the substantial differences in cancer rates in different parts of Europe. The cumulative genetic changes and the likelihood of cancer development goes up rapidly with age. This emphasises the expected increases in cancer burden with the EU's ageing population and the importance of optimising diets, physical activity, and avoiding smoking not simply in later years, but throughout life. These concepts also re-emphasise the limited contribution of population genetic screening for cancer risk and the need to consider the prolonged impact of low levels of dietary factors, e.g. perhaps selenium and of other environmental exposures which maintain particular cancer-inducing pathways or promote greater genetic change with age. This is a very different nutritional concept from the usual toxicological concern with the effects of high but short term exposures to chemical carcinogens.

4. Special Groups

4.1. Women

Young European women should be an increasing priority in public health terms because, as their physical activity declines, they adapt by attempting to eat less food in order to limit their weight gain. On relatively low intakes, the nutritional quality of their diet needs to be high, particularly because of their susceptibility to anaemia. Iron deficiency and frank iron-deficiency anaemia are highly prevalent in Europe with considerable variations between countries. The prevalence of iron deficiency in Europeans peaks amongst adolescent girls due to their higher iron requirement. Short, thin women of Asian origin who are often on low iron intakes derived exclusively from vegetable sources have a particular problem. Genetic disorders in some Southern European populations, e.g. thalassaemia and in African immigrants with sickle cell disease also increase the prevalence of anaemia.

The impact on human performance of moderate iron store depletion is less severe than that of frank iron-deficient anaemia. Pregnant women who are anaemic give birth to babies with low iron stores, and the lower incorporation of iron in the developing brain of the new-born is not readily compensated for in infancy and early childhood. The effects of anaemia range from decreased physical fitness and work capacity, to a deterioration of immune functions and alterations in temperature regulation.

The low bio-availability of most forms of dietary iron contributes to the inadequate uptake of iron in women with high losses. This is a particular problem if women are vegetarian. The use of models which simulate the impact of various dietary patterns on iron balance suggest the value of good sources of biologically available haem iron, e.g. red meat, fish and poultry, since this form of iron is not inhibited in its absorption by other dietary factors.

Women's iron stores need to be substantial before pregnancy to allow the boost in circulating red cells during the early phase of pregnancy. Inadequate iron stores lead to a fall in haemoglobin levels and then to anaemia. A good maternal store of n-3 fatty acids also aids the growth of the fetal brain during late pregnancy and this continues well after birth if the child is breast fed. Women also need to have adequate intakes of folic acid to avoid the risk of the occurrence of neural tube defect and probably to improve the birth weight of their babies. The need for folic acid requires special consideration.

4.2. Neural tube defect (NTD) and folic acid.

Some birth defects, e.g. *spina bifida*, have clearly been linked to the diets of mothers before pregnancy and in the first few weeks after conception. The number of women producing these babies varies markedly across Europe, women in several Mediterranean countries having a lower risk. This seems to relate to the higher consumption of green vegetables and fruit rich in folic acid in Southern Europe. Carefully controlled trials have demonstrated the value of folic acid supplements given to women before and after conception. Several European countries therefore have a policy of proposing that all women of reproductive age should not only consume a diet rich in vegetables and fruits, but also take an additional 400 μg per day of folic acid.

Women who produce NTD babies have a higher frequency of a gene abnormality, Va/Va 5-10 methylene-tetrahydrofolate reductase, an enzyme involved in folic acid metabolism. This gene defect demands a higher dietary folic acid intake for the crucial use of folic acid in supporting cell replication and growth as well as in disposing of toxic products of normal amino acid metabolism such as homocysteine derived from methionine. Our ancestors appear not to have had this defect, because black Africans rarely have the gene change,

whereas 11% of Europeans and Japanese are affected. There is a South-North EU gradient with 16% of Italians displaying the gene change compared with 5.4% in the Netherlands. Thus, the observed national incidence of the gene defect does not correspond with the observed rates of NTD and suggests that the prevailing higher vegetable and fruit intakes in the Mediterranean countries protect women from having babies with NTD. In other countries, however, a low intake of dietary folates means that the women who do have the gene change are particularly at risk of having affected babies. These observations emphasise the importance of dietary differences within Europe and caution against assuming that national, ethnic or socio-economic subgroups will display more or less disease because of their genetic make-up; dietary factors may well prove to be the over riding influence.

New fortification systems in the US with modest amounts of folic acid added to breakfast cereals lead to an additional intake of about 80 μg/day folic acid and have resulted in a clear fall in the plasma homocysteine level of the population. A majority of the elderly in several EU countries have evidence of relative folate deficiency with high plasma homocysteine levels. Adults in European studies of cardiovascular disease show substantial elevations in plasma homocysteine level which have been shown to fall with adequate folate intakes. There is therefore increasing evidence of widespread folic acid deficiency in Europe affecting young and middle-aged adults as well as the elderly. Folic acid goals have therefore now been included as a major public health issue for the EU in Table 1. Some preliminary evidence also suggests that mental confusion and perhaps even Alzheimer's disease is linked to a poor folic acid status.

4.3. Other nutritional needs for appropriate brain development.

On a global basis, iodine deficiency disorders threaten 1 billion people, and in the last 5 years enormous efforts have been made to combat this major problem by ensuring the universal iodination of salt or other dietary items. Yet, in Europe, there is still evidence of appreciable and quite widespread iodine deficiency, particularly in the mountainous regions of Central and Southern Europe. Intakes depend upon the iodine content of the soil which is deficient particularly in parts of Germany, Italy and France. The danger of iodine deficiency is that of permanent brain damage induced during fetal development in women on marginal iodine intakes. Although frank goitre is rare today in Europe, sub-clinical enlargement of the thyroid is well documented and indicates the importance of ensuring appropriate universal iodine intakes. The European region has the worst record in the world in establishing a universal policy of salt iodization with 4 of the Member States having clear evidence of iodine deficiency without a rigorous policy on salt iodization.

In certain countries of the EU there is strong resistance to universal salt iodination, on the spurious grounds that this approach is unsafe. Expert opinion is that iodine prophylaxis is without any adverse reaction, except for sporadic and transient cases of hyperthyroidism. These cases have been described in severely iodine deficient populations that have abruptly increased their iodine intake. This condition does not apply to the European region. The trivial cost and established procedures for iodization make it difficult to understand why this approach is not a routine throughout Europe.

4.4. Children: inappropriate diets and dental caries

Despite the introduction of several national policies within Europe to promote an appropriate weaning of breast fed babies, children are increasingly being introduced to inappropriate diets at an extremely young age. Anaemia rates in infants and young children vary widely across Europe and one of the promoting factors is the use of undiluted cows milk below the age of 1 year. The diet of many 1-4 year olds is also not conducive to iron absorption. Dietary habits are substantially affected by early experience within the family and it would appear that there is a major problem in the societal understanding of the appropriate diet for young children. Evidence shows that children weaned on an appreciable intake of a variety

of vegetables and fruit establish preferences and willingness to maintain these intakes in later life.

There are three problems relating to dental health in children and adults in Europe, *viz.* periodontal disease, dental erosion and dental caries but dental caries is the only well-documented major dental health problem of dietary origin in Europe. Recent FAO/WHO [33] analyses did not specify quantitative limits but did indicate the need to ensure adequate fluoride intakes and dental hygiene as well as reducing refined sugar intakes. Objections from industrial and some scientific sources to these conclusions led to this report being referred to a meeting of European Chief Dental Officers. They specified "frequent consumption of sugar-containing foods and drinks is the most important cause of tooth decay (caries)". Sucrose was identified as the most harmful of the "fermentable carbohydrates". "There is still a clear positive association with the intakes of fermentable carbohydrates and dental caries. When the intake or frequency of intake increases snacks containing fermentable carbohydrates become particularly harmful at a population level".

Dental caries is the single biggest cost (about 10%) of the EU health budget. The high cost of treatment relates to the progressive nature of dental caries which first affects pre-school and school-aged children, but now is increasingly recognised as also involving progressive dental demineralisation and tooth decay throughout adult life. Thus, with an ageing population the burden of dental disease is likely to increase in Europe.

The rates of dental caries have fallen over the last 30 years in response to national campaigns for tooth brushing and particularly for the use of fluoride in tooth paste. Despite these improvements, the burden of dental disease is still large because it affects all ages. The rate of affected teeth more than doubles from the age of 12 to 22 years, even when children are provided with special fluoride rinses, fluoride lozenges and varnishes. Thus, over 90 % of young adults in Europe have had dental caries and by the age 35 to 44, dental decay rates by WHO standards are either high or very high throughout Europe. Those aged 65 years or more, even when without dental plates and living in fluoridated areas, e.g. Ireland have an average of 26.5 filled or missing teeth. Thus, we need to rethink our focus on dental disease as simply a problem of the young.

Caries is induced by acids which are generated from those refined dietary sugars which are readily fermentable in the mouth by specific bacteria, e.g. *Streptococcus mutans.* This organism is induced to grow particularly by frequent intakes of drinks or foods containing these fermentable refined sugars. Thus the primary cause of caries is clear although an abundant salivary flow helps to dilute the acids and fluoride resists the acid's impact. The frequency of consumption of soft drinks, confectionery and sugary foods is the most important feature, but there is a very high correlation (0.75 to 0.97) between the frequency of these intakes and the total amount of ingested refined fermentable sugars. Population analyses suggest that less than 18 kg per person per year of sucrose intake is linked to lower rates of dental disease, and even clearer effects are seen with intakes below 10 kg per year. Studies in nurseries show that above 4 daily episodes of sugars intake from soft drinks, confectionery and snacks between meals increases the rate of caries markedly. An upper limit of free fermentable sugars amounting to about 60 g per day will induce the development of only a few new surface lesions per year per person. This corresponds approximately to the limits recommended by most EU member states with, for example, the Nordic countries specifying that not only should there be an infrequent daily consumption of sugars, but that a limit of 10% of energy should apply to children and adults on low energy intakes. This 10% value accords with the goal of $\leq$4 sugary intakes per day in Table 1 and is based on detailed studies of the frequencies of sugar intakes in relation to how much dental caries this intake induces. The 10-11% values usually advocated by EU member states accords with the need for infrequent sugar intakes whether in meals, snacks or drinks but also allows it to be clearly recognised that less than 20% of carbohydrates should be derived from this "fabricated" or "refined" source of sugars. Limiting sugar intake also helps to ensure adequate vitamin and mineral intakes.

Unfortunately further attempts to combat the effects of free fermentable sugars on dental caries by encouraging the additional use of fluoride needs to take account of the danger of inducing socially unacceptable levels of enamel fluorosis, with discoloration of front teeth. Thus a public health strategy which combines low intakes of the most cariogenic of the fermentable carbohydrates, i.e. refined sugars, and the appropriate intake of fluoride with good dental hygiene is important.

4.5. Elderly

The elderly represent a growing proportion of the European population, because of improvements in neonatal and infant survival as well as an extension in adult life span. In 1995, EU member states had a population of 373 millions, of whom 58 millions (16%) were aged 65 years or more and with 13 millions (3%) 80 years and above. Demographic projections predict that by 2050, the over-65 will be 32% and the over -80 will be 11% of the population. In 1998, Italy and Greece were the countries with the highest proportion of older people (23%). The population of Europe at present is the oldest in the world, and is projected to retain this position over the next 25 years. The greater proportion of the oldest old (above 80 years) will be women, as women outlive men by about 5 years in developed countries.

While an appreciable proportion of the elderly population remains healthy, old age is associated with an increased incidence of many different diseases, which greatly impact on the demand for health care. The greatest proportion of deaths in old age is accounted for by ischaemic heart disease, cerebro-vascular accidents, and the sequelae of osteoporotic fractures. In 1995, the number of hip fractures in the EU was 382,000 at a hospital cost of 3.6 billion ECUs and an estimated total care cost of about 9 billion ECUs.

Ageing is associated with a significant decrease in physical activity and in many physiological functions, and in substantial changes in body composition. Such changes lead to loss of autonomy. Thirty to 46% of people aged above 65 years are dependent on others. Loss of muscle mass and the associated decline in strength is a critical component of stability during walking, and thus of the ability to cope on one's own. Without this ability, falls and bone fractures may occur. To what extent the body compositional changes (loss of muscle mass and strength, loss of calcium from the bone, increase in fat mass) are an ageing phenomenon per se rather than a consequence of an age-related sedentary life-style remains to a large extent unclear. Nevertheless, physical activity and specific exercises prove valuable in improving the strength, mobility and stability as well as the mental well being of the elderly. This feature of elderly needs has not yet been fully recognised by policy makers or the public.

Whether the elderly have specific nutritional needs remains unclear. Some studies imply that additional vitamins and minerals are needed to improve immune function and reduce illness in the apparently healthy elderly. A diet rich in vegetables and fruits is also linked to better health. Many EU countries now recommend a supplement of 10 micrograms Vitamin D daily, to ensure that those over 60 years with little sunshine exposure maintain their vitamin D status and reduce the likelihood of bone disease. Vitamin B_{12} deficiency is also more common in the elderly because of a loss of the gastric intrinsic factor activity necessary for Vitamin B_{12} absorption. Fortification of food with excess folic acid might place these vulnerable individuals at risk of irreversible neural damage and mental deterioration. It is also recognised that older people on lower food intakes need a more nutrient dense diet, i.e. with a lower fat and refined sugar content than more active younger adults. Thus the elderly need to pay particular attention to both ensuring at least moderate physical activity and eating a high quality, nutrient dense diet (Figure 2). Some drugs interfere with nutrient absorption, metabolism and excretion. The number of individuals on medium or long term medication increases with age, and by the age of 70 most people are on several therapies for different conditions. The interaction of these drugs with each other, with nutritional needs

and with the organ functions of older people is poorly studied and uncertain. Therefore, particular care is needed to ensure an adequate nutrient intake in the elderly to minimise any additional drug-induced hazard. Those elderly with poor dentition will have particular problems in consuming the desirable intakes of whole grain cereals, vegetables and fruit which make an important contribution to micronutrient intakes.

4.6. Osteoporosis

Osteoporosis is produced by a high rate of bone loss, occurring after the menopause in women and in older ages in both sexes. It can be prevented by appropriate dietary means (high calcium intake, with vitamin D sufficiency) and physical activity. Early life physical activity and sound nutrition combined represent crucially important factors influencing peak bone mass. Peak bone mass is reached in late adolescence (in girls at 17-18 years and in boys about 2 years later). Thereafter, bone mass with its calcium content are lost throughout life, with the rate of loss peaking in the early postmenopausal stage.

In the elderly, low serum vitamin D levels are highly prevalent and affect 36 - 47% of the European elderly with the most affected being surprisingly in Southern Europe. The high prevalences of deficiency may reflect not only reduced exposure to sunlight, but also perhaps less efficient skin synthesis of Vitamin D from its precursor, when exposure does occur. This problem may compound the consequences of a lowering in calcium intake as total food intake declines with the decrease of physical activity. Nevertheless, adequate sunlight exposure would prevent and cure vitamin D deficiency in almost all older people.

Detailed studies have shown a 2.5-fold increase in pathological hip fractures when hip bone mineral density is in the lower normal range. Supplements of calcium of the order of 1.0 g/day appear to reduce the rate of bone loss in postmenopausal women by an average of 30% per year; hip fractures in elderly women are about 30% lower when they take this level of calcium as a supplement long term. Similar treatment with combined vitamin D and Ca supplements can reduce by a third the fracture rates in women in their 80s. As little as 1 hr. walking per day appears to be sufficient to slow down bone demineralisation.

4.7. Immigrants

An appreciable proportion of the population of various countries in Europe is represented by immigrants who number more than 20 millions. The immigrant proportion is 8% in France with almost half being of North African origin; in the UK 7% of the residents were born elsewhere, and nearly half of them came from Commonwealth countries, i.e. previous British colonies. There are 9% of individuals in the Netherlands both of whose parents were born abroad, but a broader definition would signify a much higher proportion of immigrant stock in Europe. Self-identified ethnicity is a shifting construct and it is unclear how long it takes for immigrants to merge with the host population in terms of their dietary and other behavioural features. Therefore it is difficult to ascertain whether immigrants are more or less liable to diseases because of their social conditions, dietary and other habits or because they are intrinsically different in their response to the same nutrient intakes as the host population.

Across Europe, immigrants generally belong to the lowest socio-economic classes. While data on their health and health-related behaviour are scarce, it is recognised that they often arrive with a greater burden of diseases derived from their previous circumstances. There is also little doubt that immigrants – with some notable exceptions – have higher risks and experience higher premature mortality than their "host" populations. Exceptions include the Maghreb immigrants to France who have lower colorectal and prostate cancer rates, and Moroccans who have lower CHD rates. In general, social inequalities and social exclusion appear to contribute substantially to the higher health risks of immigrants. The dietary habits of immigrants differ, often quite markedly, from those of the host population even after accounting for socio-economic level. Although differences in diet and lifestyle may be

progressively attenuated in younger generations, many dietary habits appear to persist. Interestingly, the composition of small meals and snacks tend to become more like those of the "host" population, while proper meals preserve their "ethnic" and traditional profile. In some ways, these traditional profiles may more closely adhere to the concept of a healthy diet, with preference for vegetables, fruit and pulses and with foods of a low fat content. Alcohol is also often avoided for religious reasons. On the other hand, the higher prevalence of iron deficiency recorded among immigrant children may be linked to faulty dietary habits, e.g. to excessive tea consumption as well as to low dietary haem iron intakes.

Other aspects of lifestyle, e.g. physical activity, tend to undergo a more rapid transition towards a sedentary state in immigrants. Thus both childhood and adult obesity rates are often higher among migrants than in the host population. A predisposition to diseases such as diabetes and coronary heart disease, together with marked abdominal adiposity, occurs in South Asians and is much more marked than in West-African and Afro-Caribbean immigrants, who are more prone to general obesity and hypertension, but with less coronary heart disease. The role of diet, physical inactivity, smoking and other environmental risks in explaining these differences remains unclear.

Some immigrant groups do represent separate communities within the population, and this sometime allows the development of more effective ways to help them to adjust their diets and other aspects of their lifestyles. Particular care has to be taken, however, in translating nutrient goals into ethnically appropriate food-based dietary guidelines for these communities.

5. Nutrient Population Goals

Attempts to reduce the level of disease risk of a population implies the need to identify the optimum range of dietary intakes for a population, and this is best done in quantitative terms, since specifying that individuals should eat more or less of a particular nutrient or food presupposes – unreasonably - that they are, or can be made, aware of their position in the population spectrum of intake and risk. Once the population average is specified, high risk groups with particular needs may also be identified. Table 1 summarises the latest figures developed on a consensus basis by different international and national professional groups considering the quantitative links between physical inactivity and the dietary patterns causing the major public health problems of Western societies. These values apply to households, and sub-groups, e.g. babies and children have special needs. Thus, these values cannot be directly specified for children, women or men selectively without adjustment.

As with most scientific and health issues there will be individual scientists or doctors with different views from these consensus reports and emerging research may suggest the need to adjust policies. Nevertheless over 100 expert reports produced throughout the world over the last 20 years are consistent with the conclusions set out here. These present major challenges for a few food manufacturing sectors.

The first specification in the Table relates to an aspect of lifestyle of great importance for the maintenance of good health, namely physical activity. The desirable level for physical activity is expressed in Table 1 as PAL. As noted earlier, the PAL is the ratio of the total energy expenditure to the estimated basal metabolic rate of an individual. In other words, the amount of energy spent in physical activity should be equal to at least three quarters that spent for basal purposes. A PAL of 1.75 involves the addition of about 90 minutes per day of moderate exercise in the daily routine of a sedentary person. The second line in Table 1 addresses the problem of obesity and the specified BMI 21-22 is the optimum population mean BMI which both limits the likelihood of underweight and of obesity [34,35]. Excess weight gain and obesity in children as well as in adults is now a major public health problem in Europe as elsewhere in the world. WHO has proposed for individuals a range of 18.5 to 25.0 as the normal limits and this range also applies to pre-pregnancy weights. New detailed studies suggest an optimum individual BMI of about 20.0, with Asians being especially

susceptible to weight related diseases at BMIs of 23 – 24 or over. Age adjustments might be needed when addressing population subgroups, in view of the age-related increase of weight recorded in old age in most affluent societies with their diverse health risks.

The dietary fat content, given in Table 1 as percent total energy, is for the primary prevention of obesity, and is not based on any suggested link with the development of cardiovascular disease. Higher fat intakes can be compatible with health, but only if high physical activity is sustained throughout life; a 35% fat value has been cited by FAO/WHO [36] as an option for individual adults with sustained physical activity. In sedentary societies, however, such as those in Europe, societal relationships [13] and physiological studies [37] seem to indicate that energy balance can only be achieved with less energy dense diets and with fat intakes of <30% fat and perhaps as low as 20 to 25% of total energy intake [5]. The integrated assessments of the impact of the changes proposed in Table 1 have been clearly defined with UN and other expert groups advocating the changes proposed. The value of 10% for saturated fatty acids has been proposed by the International Task Force for the Prevention of Coronary Heart Disease [6]. Note that in practice stearic acid (c 18:0) has little effect on blood cholesterol. The same Task Force also still specifies that dietary cholesterol should be maintained below 300 mg per day, on the basis of the recognised experimental amplification of the effect of saturated fatty acids on blood cholesterol and some individuals' unusual sensitivity to dietary cholesterol inducing increases in plasma cholesterol levels. However, in the European context, the specification for dietary cholesterol does not seem to be of practical significance as the intakes in Europe are on average well within this limit. Table 1 includes standard specifications on the appropriate goals for individual fatty acids. There is current concern about the need to increase the n-3 fatty acid content of European diets with the European consensus on coronary prevention [23] proposing the particular intake shown. The appropriate ratio of n-3 to n-6 fatty acids is of particular interest. The 15% value for monounsaturated fats in Table 1 is cited as suitable for those on a high (35%) fat diet while physically sustaining substantial activity [36].

The recommendations on dietary carbohydrates propose that at least 55 % of dietary energy derives from this source and is in agreement with the value proposed by FAO/WHO [33], which also specified that the bulk of the carbohydrate containing foods should be rich in non starch polysaccharides i.e. fibre, and with a low glycemic index. The frequency of consumption of refined sugars, particularly sucrose, is the key to the development of dental caries so the limit set out in Table 1 relates to the maximum number of occasions when sugary foods, snacks or drinks should be consumed. The limit therefore applies to all episodes of refined sugar consumption per day. The total intake of refined sugars correlates very highly (r=0.75 - 0.97) with the frequency of consumption, so most member states specify limits for sugar intake in the same energy terms as other macronutrients**.** A 10% free refined sugars limit was proposed by WHO [38] and subsequently by the majority of EU countries. Some countries, e.g. Netherlands, specify the goal as 15-25% of all sugars including those in foods and milk sugars but this overall value is comparable to that specified for "refined" or "extracted" sugars as specified by other countries.

A large consensus exists on the health-protective effect of the consumption of an abundance of fresh fruit and vegetables, and there is a general agreement on the average value of 400 g/day as proposed by WHO [38], WCRF [17] and many other bodies. This quantity would also ensure that the specified population goal of at least 25 g/d of dietary fibre is met. This value is probably based on the Southgate method of analysis as cited by the International Task Force for the Prevention of Coronary Heart Disease [6]. The methodology for fibre analysis is disputed at present but the value is about 50% higher than the average fibre intakes in most European countries. The value is consistent with the FAO/WHO [33] report on carbohydrates. The goal for fruit and vegetables intake would also help in ensuring an adequate intake of folates. An intake of 400 μg folate is advocated by WHO, the US Academy of Science and other bodies. Dietary folates are about 50% bioavailable. This means that the prevention of NTD might require higher intakes of dietary folates and the use of folic acid.

The value of less than 6 g/d salt intake proposed in Table 1 is based on International Task Force for the Prevention of Coronary Heart Disease [6]. The WHO International Society of Hypertension Guidelines for the Management of Hypertension [39] noted that obese, elderly and black subjects are most susceptible to hypertension. Some experts and industrial groups, and one recent Canadian report [40], maintain that only hypertensives need to reduce their salt intake but this proposition neglects the concept of primary prevention, the older intervention studies on non-hypertensives [41] and now the new evidence from the DASH trials presented earlier. The national benefit from reducing average population blood pressure is much greater than that derived from managing the smaller number of hypertensive patients at high risk[42].

Table 1 includes the population goal of exclusive breast feeding for about 6 months. This specification derives from the most recent position taken from WHO [43] on the basis of a recent expert reanalysis of data. Exclusive breastfeeding should continue for at least four months and breastfeeding should be the principal source of milk for the infant until one year of age.

The iodine intake required for avoidance of iodine deficiency disorders is well established. With an average intake of 150 $\mu g.d^{-1}$ populations appear to be free of iodine deficiency disorders and at a minimum risk of the iodine supplementation side-effects, especially hyperthyroidism, the development of autoimmunity and thyroid cancer [44].

Besides the nutrients and other features specified in Table 1, other population nutrient goals have been developed addressing other conditions and diseases of public health relevance in Europe, such as iron deficiency anaemia and osteoporosis. Thus, an iron intake of 15 $mg.d^{-1}$ has been considered appropriate by the EU for European women. An average population intake >800 $mg.d^{-1}$ calcium is being proposed, as well as 10 $\mu g.d^{-1}$ vitamin D for elderly people. Intervention studies in post-menopausal women suggest benefits from high calcium intakes, although it is fully recognised that other factors contribute to maintain adequate bone mass in old age. An appropriate fluid intake is also required and an average intake of 2 l of water or 30 ml water per MJ food energy is suggested. This water intake includes intrinsic food water and that derived from prepared dishes. This intake is deemed necessary to maintain health at all ages.

A variety of US, UK and Australian official reports give figures for a moderate alcohol intake of <24-36 g/d for men and <12-24 g/d for women. However, despite the evidence of a potential benefit regarding the prevention of cardiovascular disease, risks of other effects are associated with even low intakes. Thus countries with particular concerns about high alcohol intakes, e.g. Finland and France, advocate a fall in current intakes and specify higher limits. Women are advised in all countries except Canada to drink less because of their greater metabolic and toxicological sensitivity. Cost-benefit analyses based on the social welfare as well as health benefits need still to be carried out.

The figures displayed in Table 1 need to be compared with the average intake of nutrients and foods eaten by Europeans enjoying the best health as judged by follow-up studies, the highest life expectancy and international comparisons (Fig.2). These data are taken mainly from the classic Seven Country Study [7] and all relate to Mediterranean diets from the 1930s-1960s. The follow up Seven Country Study has been used as it is the classic European study. These data validate Table 1 as a useful reference for the EU.

5.1. Translating Nutrient Goals into Dietary Guidelines

This process has been set out in an excellent WHO report [45]. Working Party 2's analyses show a marked difference between the current food intakes and those implied by Table 1 and set out, based on Mediterranean experience, in Figure 2.

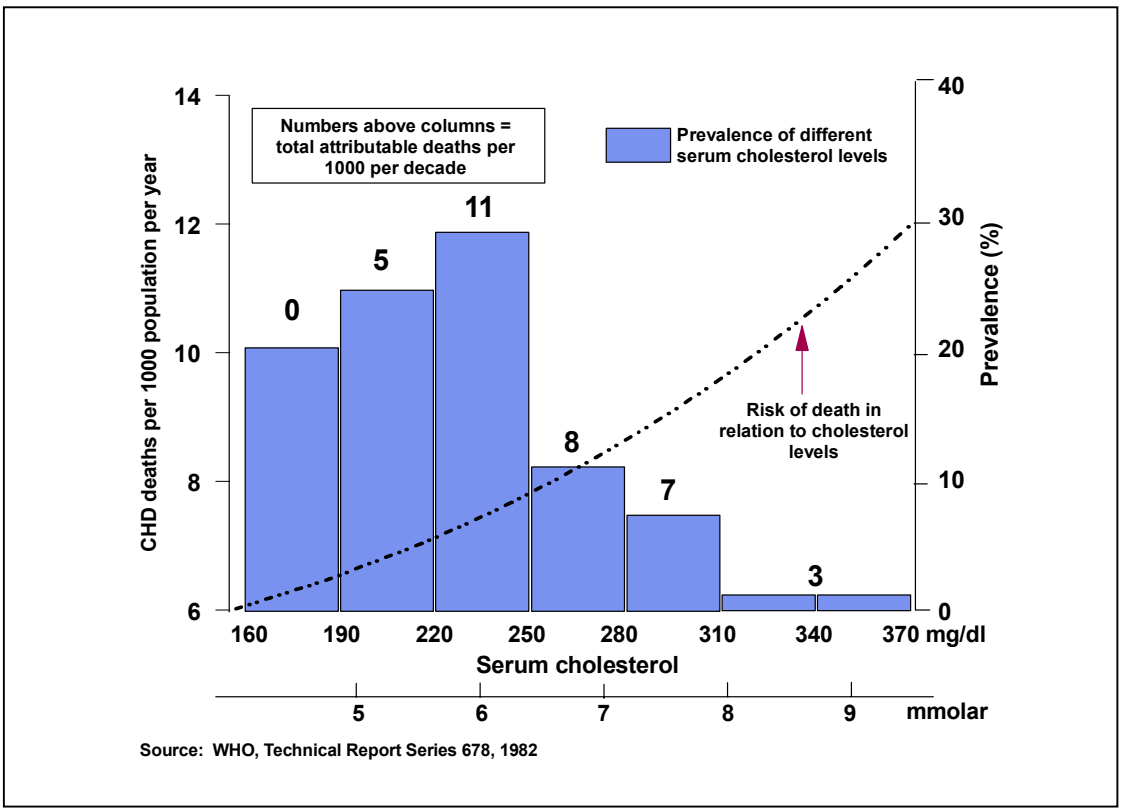
These differences reflect marked changes in European food patterns since the 1960s and very different dietary patterns across the EU. Thus in general there was a North-South gradient with higher total fat, saturated fat, sugar and salt with lower dietary fibre, vegetable and fruit intakes in the North in the 1960s as set out in a European WHO report in 1988 [46]. Since then fat, saturated fat and sugar intakes have in general been falling in the North and increasing in the South, thereby reducing the gradient. Now average national intakes remain considerably different from the ideal.

Clearly, in developing food-based dietary guidelines, there is a need to recognise the difficulty of achieving these goals in the short term. Traditionally, therefore, countries have often identified intermediate targets as a pragmatic step to improve health. Given, however, the variation in national health patterns within the EU and the remarkable improvements in public health achieved by coherent and sustained national strategies introduced for example in Finland and Norway, it is clear that it is possible to promote major changes in dietary practices over the next 10 to 20 years.

First, however, there is a need to consider what is achievable. Many member states' expert committees have opted for modest but achievable targets, e.g. taking a total fat goal of 35% rather than 30% or less. Thus Finland and Norway aimed for 35% when their fat intakes were about 42%. On reaching an average fat intake of 35% the target was then revised down to 30%. This revision did not signify an altered strategy, but a pragmatic adjustment with policies to reduce fat and saturated fat unchanged. Therefore member states need to consider how far dietary patterns of the population differ from the currently perceived ideal and whether or not to accept these goals or choose intermediate targets.

Figure 1

The dominance of deaths (coronary heart disease) in those with average levels of a risk factor (serum cholesterol levels)



Note: the number of deaths on the top of each column attributable to elevated cholesterol levels is calculated by assuming that all subjects reduce their cholesterol values to those in the lowest column. The deaths are then calculated by multiplying the increased cholesterol risk by the prevalence of individuals in the column. In practice public health policies advocate shifting the whole spectrum down so that all except those at the lowest risk benefit. This approach applies to many other problems, e.g. reducing blood pressure, body weight, alcohol intakes etc.

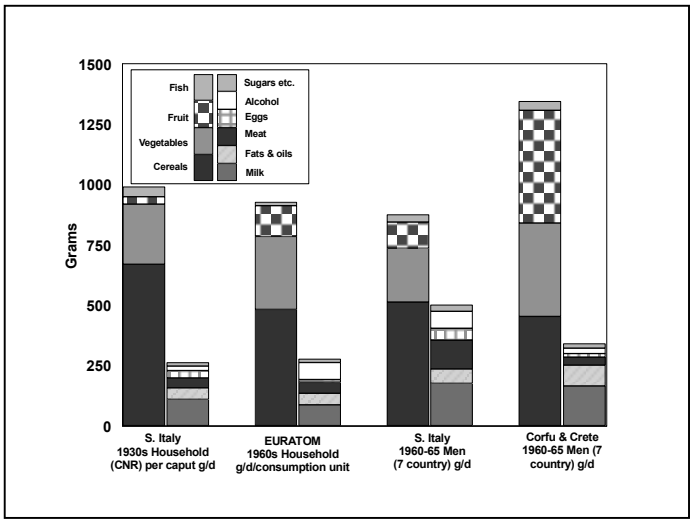
Source: WHO, 1982 [1].

http://eurodiet.med.uoc.gr/

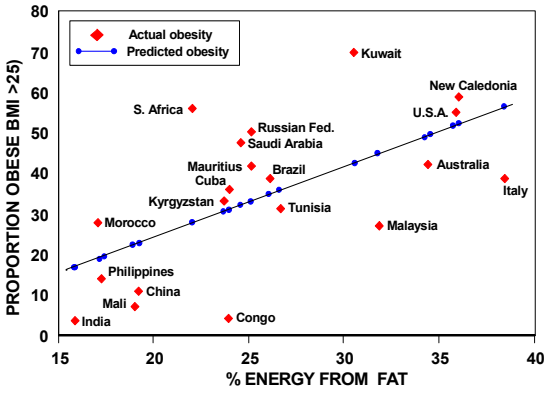
Figure 2

Validating the nutrient goals: the traditional Mediterranean diet and its health impact

The weights of different food groups eaten in the traditional Mediterranean diet



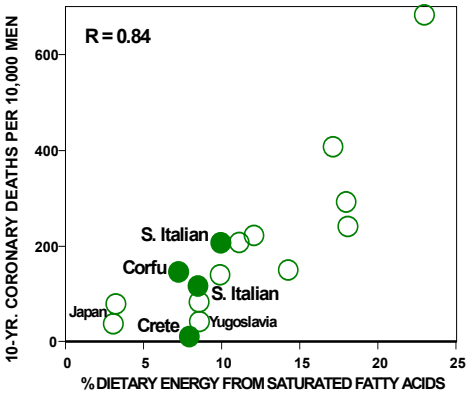
The population's prevalence of obesity relates to the fat content of the diet



The nutrient content of the above Italian and Greek diets.

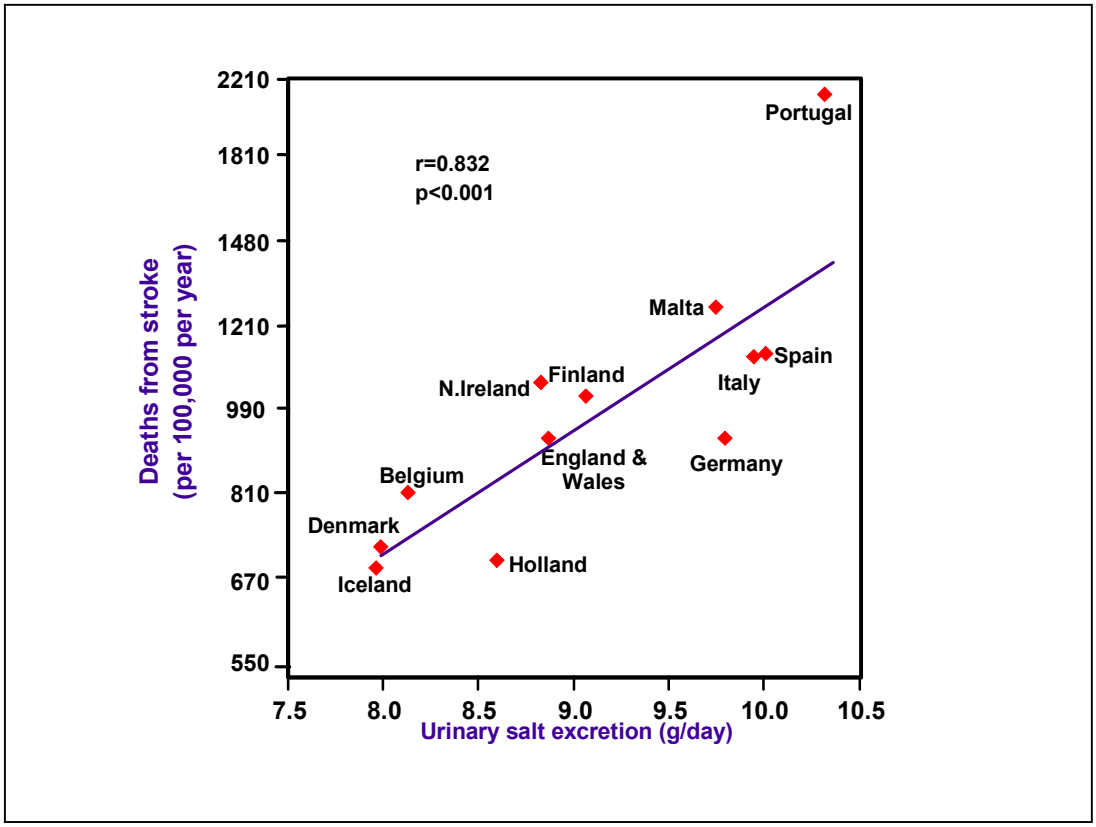
% Energy	S. Italy 1930s	Euratom 1960s	S. Italy 1960-65	Corfu & Crete 1960-65
Fats	*20	27	26	*32.5
Sat. FAs	5	8	9	7
Mono. FAs	10	16	13	22
Polyun-sat FAs	5	3	4	3
Simple refined sugars	2	2	<5	Approx. 0

10-year coronary mortality in men



* Chemical Analyses in the 7-Country Study with Crete 36%, Corfu 27%. Recent re-evaluation of some original diet records suggest 42% for Crete [8]. Some fatty acid values estimated by difference. Dietary intakes have been recalculated from a varietv of sources [9-12].

NOTE : The weights of food are related to a different base in the three surveys with alcohol expressed or estimated as pure alcohol. Simple refined sugars are derived from dietary records. The obesity relationship is from Bray and Popkin [13] and coronary mortality rates from the cohorts in the Seven Country Study [7] since the 1960s. Further analyses have also reinforced the dietary impact on CHD mortality [14]. Cretan fat intakes have fallen to 36% but obesity in children and adults is escalating as is heart disease; the population has become sedentary whereas the men studied in 1960 were extremely active. The average BMI of Greek men has risen markedly and was already high in 1960 [15].



Taken from McGregor [27]

Figure 3

Deaths from stroke in different European countries, plotted against urinary salt excretion, derived from the INTERSALT data

TABLE 1

Population goals for nutrients and features of lifestyle consistent with the prevention of major public health problems in Europe.

Component	Population average	Levels of evidence[19]
Physical Activity Levels	PAL > 1.75[2]	++
Adult Body Weight as BMI	BMI 21-22 (18.5-25)[3]	++
Dietary Energy	Equal to energy value of PAL	++++
Dietary Fat % E	20-35[4,5]	++
Fatty Acids % total E[6]		
Saturated	7 - 10	++++
Trans	<2	++
Monounsaturated	10 - 15[7]	++
Polyunsaturated (PUFA)	Total PUFA: 7 - 8	
n-6	<7-8	+++
n-3[7]	2 g linolenic + 200 mg very long chain	++
Dietary Cholesterol[8]	<300 mg	++
Alcohol, if consumed, (g/day)	24-36 (12 - 24)[9]	++
Carbohydrates		
Total % E	>55-75[10]	+++
Free refined sugars % E	<10-12[11]	+++
Sugary snacks, confectionery and sugary drinks, per day	<4	++
Fruit and Vegetables (g/d)	>400[12]	++
Reference nutrient intakes and goals for the adult population		
Breast Feeding duration (exclusive)	about 6 months	+++
Dietary Fibre (g.d^{-1})	>25[13]	++
Folate from food (µg/d)	>400[14]	+++
Calcium mg/day	800 (1500[15])	+++
Sodium (as salt) (g/d)	<6 (< 4)[16]	++++(++++)
Potassium g/d (mmol/d)	> 3.0 (>75)[17]	++
Iron (mg/d)	>15[18]	++
Iodine (µg/d)	150 50 (infants) – 200 (pregnancy)	+++
Fluoride (mg/l)	1	++
Vitamin D (µg/d) for elderly	10	

NOTES TO TABLE 1

1. This is the value that could be applied to households but cannot necessarily be directly specified for children, women or men selectively without adjustment.
2. This value is expressed as the ratio of the total energy expenditure to the estimated basal metabolic rate of an individual. The limit is derived from an analysis of activity levels needed cross-culturally to limit the risk of obesity [16] and the risk of colon cancer [17]. It is also in keeping with estimates based on reported levels for the prevention of cardiovascular disease [47].
3. The BMI 21-22 is the optimum population mean BMI which both limits the likelihood of underweight and of obesity [34;48]. The 18.5-25.0 values are the normal limits proposed by WHO [5] for individuals and include pre-pregnancy weights. Detailed studies suggest an optimum individual BMI of about 20.0 with Asians being especially susceptible to weight related diseases at BMIs of 23 - 24.
4. This value for dietary fat is not based on any suggested link with the development of cardiovascular disease but for the primary prevention of obesity. The lowest value is considered appropriate for sedentary populations by WHO [5] and is based on societal relationships [38] and physiological studies [37]. Concern about blood lipid effects on transfer to low fat diets [20] need to distinguish short-term and long-term changes. If slowly absorbed starches rich in fibre rather than sugars with high fructose content are chosen [49] then lipid changes are short-term. Physical activity also improves triglyceride and HDL cholesterol levels; post-prandial lipaemia also improves.
5. The 35% fat value was cited by FAO/WHO [36] as an option for individual adults with sustained physical activity which needs them to be maintained throughout life. Higher intakes can be compatible with health providing high physical activity is sustained throughout life.
6. Proposed by the International Task Force for the Prevention of Coronary Heart Disease [36]. Note that in practice stearic acid (c 18:0) has little effect on blood cholesterol.
7. The 15% value for monounsaturated fats is cited as suitable for those on a high (35%) fat diet while physically sustaining substantial activity [50]. The n-3 values are taken from the European Consensus on Coronary Prevention [23].
8. Dietary cholesterol limits are still specified by The International Task Force [36] on the basis of the recognised experimental amplification of the effect of saturated fatty acids on blood cholesterol and some individuals' unusual sensitivity to dietary cholesterol inducing increases in plasma cholesterol levels.
9. Alcohol values are taken from a variety of US, UK and Australian official reports. The upper range for men is given first with women advised in all countries but Canada to drink less because of their greater metabolic and toxicological sensitivity. Countries with particular concerns about high alcohol intakes, e.g. Finland and France, advocate a fall in current intakes but specify higher limits. Most Nordic countries, however, advocate the lowest limit shown as an upper value: cost-benefit analyses based on the social welfare as well as health benefits suggest that the lower values are optimum.
10. Proposed by FAO/WHO [33] with explicit recommendations for the bulk of carbohydrate-containing foods to be rich in non-starch polysaccharides and with a low glycaemic index.
11. Free refined sugars limits were proposed by WHO[38] and subsequently by the majority of EU countries. Some countries, e.g. Netherlands, specify the goal as 15-25% of all sugars including those in foods and milk sugars. This means that the refined sugar intake is comparable to that specified by other countries. Industries with major sugar interests and some scientists contest these values highlighting the widely agreed conclusion that sugar frequency is the key to dental caries; total intake and frequency correlate very highly (r=0.75 - 0.97) so most countries specify limits in the same energy terms as other macronutrients.
12. This is an average value proposed by WHO, WCRF and many other bodies.
13. Dietary fibre: this value is probably based on the Southgate method of analysis as cited by the International Task Force for the Prevention of Coronary Heart Disease [6]. The methodology for fibre analysis is disputed at present but the value is about 50% higher than the average fibre intakes in most European countries. The value is consistent with the FAO/WHO report on carbohydrates [33].

14. An intake of 400 μg refers to folate needs as advocated by WHO, the US Acad. of Sci. and other bodies. Dietary folate intakes need to be greater than folic acid intakes since the bioavailability of food folate is about 50% lower than that of folic acid.
15. Other factors contribute to bone mass but intervention studies in post-menopausal women suggest benefit from high calcium intakes.
16. WHO International Society of Hypertension Guidelines for the Management of Hypertension [39] noted that obese, elderly and black subjects are most susceptible. The values are based on International Task Force [6]. Some experts and industrial groups, and one recent Canadian report, maintain that only hypertensives need to reduce their salt intake but this proposition neglects the concept of primary prevention and the observed intervention studies on non-hypertensives [41]. The national benefit from reducing average population blood pressure is much greater than that derived from managing the smaller number of hypertensive patients at high risk [42].
17. These iron values are taken from the EU Reference Nutrient Intakes for Women.
18. Levels of evidence are based on those used in several guideline systems, e.g. the Cochrane System and the US Academy of Science scheme.

++++ Multiple double blind placebo controlled trials.
+++ Single study of double blind analyses or, for breastfeeding, a series of non-double blind analyses.
++ Ecological analyses compatible with non-double blind intervention and physiological studies.
+ Integration of multiple levels of evidence by expert groups.

These trials and other analyses do not prove that only the particular values in Table 1 are correct, but the evidence from dietary change or differences support these values.

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