DM

The implementation of nutritional advice for people with diabetes

Nutrition Subcommittee of the Diabetes Care Advisory Committee of Diabetes UK*

Accepted 10 July 2003

Abstract

These consensus-based recommendations emphasize the practical implementation of nutritional advice for people with diabetes, and describe the provision of services required to provide the information. Important changes from previous recommendations include greater flexibility in the proportions of energy derived from carbohydrate and monounsaturated fat, further liberalization in the consumption of sucrose, more active promotion of foods with a low glycaemic index, and greater emphasis on the provision of nutritional advice in the context of wider lifestyle changes, particularly physical activity. Monounsaturated fats are now promoted as the main source of dietary fat because of their lower susceptibility to lipid peroxidation and consequent lower atherogenic potential. Consumption of sucrose for patients who are not overweight can be increased up to 10% of daily energy ~~derived from carbohydrate~~ provided that this is eaten in the context of a healthy diet and distributed throughout the day. Evidence is presented for the effectiveness of advice provided by trained dieticians. The increasing evidence for the importance of good metabolic control and the growing requirement for measures to prevent Type 2 diabetes in an increasingly obese population will require major expansion of dietetic services if the standards in National Service Frameworks are to be successfully implemented.

Diabet. Med. 20, 786–807 (2003)

Keywords diabetes, diet, nutrition, exercise, cardiovascular disease, nephropathy

Introduction

It is 10 years since Diabetes UK (at that time The British Diabetic Association) last published recommendations for the dietary management of people with diabetes [1]. Since then the evidence base for current nutritional recommendations has been extensively reviewed on behalf of the European Association for the Study of Diabetes [2] (EASD) and more recently for the American Diabetes Association (ADA) [3]. The Nutrition Subcommittee of Diabetes UK is in general agreement with the conclusions reached in these technical reviews and with the recommendations based on those conclusions [4,5]. The purpose of this paper is to provide consensus-based recommendations, drawing on the technical reviews of the EASD [2], ADA [3] and other sources, for the practical implementation of nutritional advice in the UK, particularly in the context of the *National Service Frameworks for Diabetes* [6,7] and The Department of Health's paper on *The Expert Patient* [8].

Aims and goals of nutritional advice

Nutritional advice and information is essential for the prevention of diabetes in those at risk of Type 2 diabetes and for the effective management of the condition in those with Type 1 and Type 2 diabetes. The aim is to provide those who need advice with the information required to make appropriate choices on the type and quantity of the food which they eat. The advice must take account of the individual's personal and cultural preferences, beliefs and lifestyle, and must respect the individual's wishes and willingness to change. It must be adapted to the specific needs of the individual which may change with time and circumstance; for example, age, pregnancy, hospital admission, nephropathy, intercurrent illness and other illnesses. The beneficial effects of physical activity in the prevention and management of diabetes [2,9] and the

Correspondence to: Dr H. Connor, County Hospital, Hereford HR1 2ER, UK. E-mail: henry.connor@hhtr.nhs.uk

*Members of the Subcommittee: H. Connor (Chairman), F. Annan, E. Bunn, G. Frost, N. McGough, T. Sarwar, B. Thomas.

relationship between exercise, energy balance and body weight are an integral part of nutritional counselling.

The goals of dietary advice are:

- to maintain or improve health through the use of appropriate and healthy food choices
- to achieve and maintain optimal metabolic and physiological outcomes, including:
  - reduction of risk for microvascular disease by achieving near normal glycaemia without undue risk of hypoglycaemia
  - reduction of risk of macrovascular disease, including management of body weight, dyslipidaemia and hypertension
- to optimize outcomes in diabetic nephropathy and in any concomitant disorder such as coeliac disease or cystic fibrosis.

The implementation of these aims and goals requires that nutritional advice must be made available and accessible on both an individual and a population basis. The provision of a district-wide dietetic service must ensure that there is co-ordination between services provided in primary, community and specialist care, and that there is integration with the nutritional advice provided by other programmes such as the National Service Framework for Coronary Heart Disease [10].

Body weight and shape

Most people with Type 2 and many of those with Type 1 diabetes are overweight. The World Health Organization has defined obesity as 'a disease state in which excess fat has accumulated to an extent that health may be adversely affected', and has categorized normal weight, overweight, obesity and severe obesity using the body mass index (BMI, kg/m^2) [11]. However, BMI is a measure of total body weight and not of body fat, but obesity is an excess of body fat and not necessarily of total body weight. Moreover, the BMI takes no account of the distribution of body fat. Some people with diabetes have an increased amount of intra-abdominal body fat even though, as judged by BMI, they are not obese [2]. The same is true of some non-white populations if they are categorized using ranges of BMI which have been derived from Caucasian populations [12].

It is well recognized that it is obesity with an abdominal distribution (also termed central or visceral obesity) rather than gluteal fat accumulation (the apple shape as opposed to the pear shape) which is associated with insulin resistance, a very atherogenic lipid profile and the other features of the metabolic syndrome [2,13]. Because measurements of skin-fold thickness will underestimate body fat in people with central obesity, the measurement of waist–hip ratio (WHR) was introduced to differentiate between abdominal and gluteal obesity [2]. However, experience has shown that waist circumference (WC) alone, measured half way between the lowest point of the rib cage and the iliac crest, is a better criterion, particularly for long-term follow-up [13]. This is probably because the WHR will underestimate abdominal obesity in those people who also have a degree of gluteal obesity. Diabetes UK therefore recommends assessment using both BMI and WC (Table 1). In Caucasian populations a WC of ≥ 102 cm in men and ≥ 88 cm in women predicts risk of diseases associated with obesity [14], whereas in Asian populations the figures are ≥ 90 and ≥ 80 cm, respectively [12]. There is also evidence that prediction of an atherogenic profile is enhanced if WC is combined with measurement of fasting triglyceride concentration [13].

Physical activity and exercise

Regular physical exercise improves insulin resistance and lipid profile (reduction in triglyceride and increase in total HDL and HDL 2 concentrations) and lowers blood pressure (although blood pressure will rise during exercise) [2]. It reduces mortality in Type 1 diabetes [2] and can reduce HbA_{1c} by 0.7% in Type 2 diabetes [15]. The metabolic benefits in Type 2 diabetes are lost within 3–10 days of stopping regular exercise [2]. Physical activity protects against the development of Type 2 diabetes [2,9]. The protective effect takes up to 4 years to develop [9], is 'dose-related' and requires an intensity of exercise which is greater than normal walking [2]. Some

Table 1 Co-morbidity risks associated with different levels of body mass index (BMI) and waist circumference in adults

	Caucasian Waist circumference (cm)		Asian-Pacific Waist circumference (cm)	
Male	< 102	≥ 102	< 90	≥ 90
Female	< 88	≥ 88	< 80	≥ 80
Risk of co-morbidity	BMI (kg/m^2)		BMI (kg/m^2)	
Low (but ↑ risk of other clinical problems)	< 18.5		< 18.5	
Average	18.5–24.9	< 18.5	18.5–22.9	< 18.5
Increased	25.0–29.9	18.5–24.9	23.0–24.9	18.5–22.9
Moderate	30.0–34.9	25.0–29.9	25.0–29.9	23.0–24.9
Severe	35.0–39.9	30.0–34.9	30.0–34.9	25.0–29.9
Very severe	≥ 40.0	≥ 35.0	≥ 35.0	≥ 30.0

Adapted from International Diabetes Institute [12].

Table 2 The composition of the diet

Component	Comment
Protein	Not > 1 g per kg body weight—see also: sections on nephropathy and children
Total fat	< 35% of energy intake
Saturated + transunsaturated fat	< 10% of energy intake
n-6 polyunsaturated fat	< 10% of energy intake
n-3 polyunsaturated fat	Eat fish, especially oily fish, once or twice weekly Fish oil supplements: not recommended
cis-monounsaturated fat	10–20% } 60–70% of energy intake
Total carbohydrate	45–60% }
Sucrose	Up to 10% of daily energy, provided it is eaten in the context of a healthy diet. Those who are overweight or who have hypertriglyceridaemia should consider using non-nutritive sweeteners where appropriate
Fibre	No quantitative recommendation *Soluble fibre*—has beneficial effects on glycaemic and lipid metabolism *'Insoluble' fibre*—no direct effects on glycaemic and lipid metabolism but its high satiety content may benefit those trying to lose weight and it is advantageous to gastrointestinal health
Vitamins and anti-oxidants	Encourage foods naturally rich in vitamins and antioxidants. With the exception of some patients in 'Special groups' and 'Special situations' (qv) there is no evidence for the use of supplements and some evidence that some are harmful
Salt	≤ 6 g sodium chloride per day

populations take less exercise than others; for example, Asians living in Britain are generally more sedentary than British Caucasians who, in turn, take less exercise than most Asians living in India [16]. Most people with diabetes should be encouraged to take 20–30 min of physical activity on most days, the activity level being adjusted for age and fitness [4].

Energy balance and body weight

The energy content of the diet must be appropriate to sustain growth in children, to prevent or correct obesity in adults and to maintain body weight in those who are ill. The major determinant of energy requirement is basal metabolic rate which is itself principally determined by body mass, especially lean body mass, and to a lesser extent by age and gender; physical activity accounts for 10–50% of energy needs [17]. Walking at 3 miles/h (5 km/h) increases the energy requirement of a middle-aged adult from approximately 70 kcal/h to about 250 kcal/h [17]. An extra two slices of bread or an extra pint of beer is therefore equivalent to brisk walking for 1 h. For most middle-aged or elderly people exercise has only a modest direct effect on excessive body weight, but it is useful as an adjunct to other weight loss strategies and in the long-term maintenance of weight loss [3] and should be encouraged for its other benefits on glycaemic control and general health.

Composition of the diet

The current recommendations of the EASD and ADA on dietary composition [2–5] are summarized, with minor amendments, in Tables 2 and 3. Important differences from the previous UK recommendations [1] are:

- Greater flexibility in the proportions of energy derived from carbohydrate and from monounsaturated fat (Table 2). Monounsaturated fats (Table 4) are promoted as the main source of dietary fat because of their lower susceptibility to lipid peroxidation and consequent lower atherogenic potential [18]. Moreover, provided that energy intake is controlled, the use of monounsaturated fat instead of carbohydrate as a replacement for saturated fat causes an increase as opposed to a decrease in HDL-cholesterol [19], which is of particular benefit in Type 2 diabetes.
- Further liberalization in the consumption of sucrose, from the previous 25 g/day up to 10% of the daily energy ~~derived from carbohydrate,~~ provided that this is eaten in the context of a healthy diet and distributed throughout the day. However, those who are overweight should avoid sucrose where this is practicable.
- More active promotion of carbohydrate foods with a low glycaemic index.
- Greater emphasis on the benefits of regular exercise.

For many people, including the majority with Type 2 diabetes, the major nutritional consideration is the correction or limitation of obesity. All patients, relatives and carers should be advised about the principles of healthy eating [20] which apply to the general population.

Translating theory into practice

The role of the dietician

It takes considerable skill to apply the nutritional objectives of diabetes management in a way which is realistic and practical.

Table 3 Food choices

Choice	Comment
Nutritive sweeteners	
Fructose	No proven advantage over sucrose No reason to avoid naturally occurring fructose in fruits, etc.
Sugar alcohols	Lower cariogenic effect but no other advantages over sucrose May cause diarrhoea
Non-nutritive (intense) sweeteners	Useful in beverages Potentially useful in the overweight Safe if ADI not exceeded—heavy users should use a variety of different products
'Diabetic' foods	Unnecessary, expensive May cause diarrhoea Not recommended
Plant stanols and sterols	Approx. 2 g per day can reduce LDL-cholesterol by 10–15%—see section on dyslipidaemia
Fat replacers and substitutes	May facilitate weight loss Long-term studies needed
Herbal preparations	No convincing evidence of benefit

Table 4 Sources of fatty acids

cis-monounsaturated	*trans*-unsaturated	Polyunsaturated
Olive oil Some rapeseed oils Fat spreads derived from olive oil	Hydrogenated vegetable oils (hard margarine) Manufactured foods containing hydrogenated vegetable oils (e.g. pies, pastry, biscuits, cakes)	*n-6* Corn, sunflower, safflower, soyabean oils and seeds Fat spreads derived from these oils *n-3* Oily fish and marine oils

While the desired aims in terms of dietary composition should underpin dietary guidance, they should not be regarded as rigid targets to be imposed on every diabetic individual. For most patients, the actual target will be to make specific dietary changes in the right direction, i.e. towards the ideal. The nature of these changes will vary according to individual nutritional and clinical priorities, habitual diet and lifestyle and prevalence of risk factors. The focus should always be on modifying an individual's existing eating habits (food choice and the timing of its consumption) in an acceptable and hence achievable way. The role of the dietician is to facilitate appropriate diet and lifestyle change, not to dictate what should or should not be eaten.

Assessment

Assessment is a prerequisite for giving dietary advice. It is impossible to know what dietary changes need to be made, and what changes may be feasible, without some knowledge of the individual's background and habitual eating habits. Such assessments should include the following.

Nutritional information

- *Meal pattern* The usual distribution of meals and snacks throughout the day and the extent to which this varies from day to day, between weekdays and weekends, or is influenced by factors such as shift work, business, school meals, travel.
- *Food choices* The types of foods which comprise these meals and snacks and the typical amounts consumed.
- *Overall dietary balance* How closely the dietary pattern matches *Balance of Good Health* guidelines, e.g. the number of portions of fruit and vegetables consumed per day.
- *Nutritional adequacy* The likelihood of dietary surplus or deficiency.
- *Alcohol consumption* Typical intake and whether this ever exceeds safe limits.
- *Beliefs or misconceptions held about diet and diabetes* For example, that sugar is forbidden or that diabetic foods are essential.

Personal information

- Age, gender, socio-economic circumstances, ethnicity, occupation, literacy, numeracy.
- Ability and willingness to change.
- Emotional state if distressed by a new diagnosis of diabetes.

Clinical information

- The type of diabetes and whether it will be treated with insulin, oral hypoglycaemic drugs or diet alone.

- Physical activity.
- Body weight and shape, blood pressure, lipid profile, smoking and other cardiovascular risk factors.
- Other medical conditions, e.g. visual handicap, nephropathy, coeliac disease.

Only then is the dietician able to assess the patient's ability to accept information and readiness to accept any necessary changes, and to assess the nutritional priorities and discuss how current meal pattern and food choices can be modified in an acceptable way.

Education

Dietary education is an on-going interactive process between patient and professional, not a standard package which can be delivered to a patient in a single session. In the initial stages after diagnosis, people may be able to assimilate only a very limited amount of information. The process of dietary assessment provides an opportunity to explain the types of dietary changes needed and to explore how these may be met. Written information summarizing the key messages which the patient can take home and refer to later is usually essential. Regular follow-up is then essential to evaluate the effectiveness of change and to continue the learning process. Partners, carers and parents must be involved where appropriate.

A variety of educational strategies, targetted at individuals or groups, via verbal, written or audio-visual forms of information, can be used to expand and reinforce dietary messages. The most important aspect is to match the type and level of information to individual needs and abilities; some people like a lot of information; others can only cope with a little; those from ethnic minority groups may need oral or written information in their own language; educational material for children will obviously need to be different from that for elderly people.

Close liaison with other members of the diabetes care team, and training and updating of colleagues in respect of nutritional aspects of management, are essential to ensure that dietary messages are always consistent (see Provision of district dietetic services).

Monitoring progress

Follow-up and review of progress are essential. The frequency of follow-up depends on the type of treatment, on the patient's ability and confidence, and on diabetic control. All patients should have at least one follow-up review and the opportunity of an annual dietetic review, and those with special problems such as renal disease and pregnancy and prepregnancy or perceived poor practice or knowledge should be seen more frequently.

The dietary review should consider:

- meal pattern, compositional balance and food choices
- the extent to which specific dietary targets have been achieved
- reasons why targets have not been met and how barriers to change may be overcome
- patient's ability to interpret blood glucose measurements and make the necessary dietary adjustments
- acceptability of the dietary changes made and their impact on the patient's quality of life.

The clinical picture (e.g. glycaemic control, lipid profiles, weight change, blood pressure) must be reviewed as part of the dietary assessment so that the effectiveness of the dietary changes made can be assessed. Treatment goals can then be reinforced or adjusted if necessary.

Evidence for the effectiveness of dietetic advice

There is evidence for the effectiveness of dietetic advice in the prevention of Type 2 diabetes [21,22], in the management of both Type 1 [23] and Type 2 [21,24–28] and in a mixed group of patients with Type 1 and Type 2 diabetes [29]. Many of the studies in patients with Type 2 diabetes have combined dietary intervention with exercise and lifestyle management programmes. A meta-analysis of 89 studies showed that interventions which focused solely on dietary advice produced the greatest weight loss and the greatest improvements in metabolic control, but the majority of dietary interventions in this series were short-term and involved very low-calorie diets (400–800 kcal) [30–32].

Advice given by registered dieticians was an integral component of management in both the Diabetes Control and Complications Trial (DCCT) [23] and UK Prospective Diabetes Study (UKPDS) trials [24]. In the DCCT the average HbA_{1c} was significantly lower in patients who reported adhering to specific diet-related behaviour than in those who did not [23]. In the UKPDS study of newly diagnosed patients with Type 2 diabetes and in which the protocol required a 3-month run-in period on dietary therapy alone, there was evidence of significant improvement in glycaemic control during those 3 months, and this can only be attributed to the dietary advice [24]. In patients with established diabetes who were attending a hospital clinic which had no input from a registered dietician, the glycated haemoglobin decreased in 68% of patients when a registered dietician became available [29].

There is evidence that the amount of weight loss and improvement in glycaemic control in patients with Type 2 diabetes and glycaemic control in patients with Type 1 diabetes are related to the amount of dietetic time available and to how often patients are seen by a dietician [24,25,28,29], although one study in overweight patients with Type 2 diabetes found no difference in weight loss in patients who received 3 h of dietetic intervention in the first 12 months after diagnosis compared with those who received only three 15-min sessions at 6-monthly intervals [33]. Two American studies have shown that guideline-based medical nutrition therapy can be cost-effective in patients with Type 2 diabetes, judged by savings in drug therapy [34] or reduction in utilization of medical services [35], and American health insurance organizations are increasingly agreeing to pay for nutritional therapy provided by a registered dietician [36].

Whether dietary advice given by other health professionals is as effective as that given by registered dieticians does not appear to have been tested in diabetic patients but, in a randomized trial of the dietary management of hypercholesterolaemia, counselling by dieticians achieved greater reductions in LDL-cholesterol than did that given by physicians [37].

There is some evidence that the effectiveness of dieticians can be improved by training in change counselling and cognitive behavioural therapy [38]. The principles underlying change counselling and cognitive behavioural therapy have high face validity but, apart from some relatively short-term studies in obese patients and also in patients with eating disorders [38], are largely untested in the area of diabetes care [39]. Their implementation has considerable implications for staff training and time, and it has yet to be shown that staff can persist with these techniques in the long term [39]. They may, however, prove to be an essential skill for dieticians and other clinicians if the results obtained in clinical trials such as the DCCT [40] and the Dose Adjustment for Normal Eating (DAFNE) [41] project are to be translated to the majority of patients in routine clinical practice.

Weight management

Weight loss and stabilization is a major priority for those who are overweight. In the largest published study of weight loss in overweight people with diabetes, intentional weight loss of 11% of initial body weight (from a mean of 100 kg down to 89 kg) was associated with a 25% reduction in total mortality [RR 0.75; 95% confidence interval (CI) 0.67, 0.84] and a 28% reduction in cardiovascular and diabetes mortality (RR 0.72; CI 0.63, 0.82) [42]. The BMI decreased from 33.5 ± 5.0 to 27.7 ± 4.0 (mean $\pm$ SD) kg/m^2. The greatest reduction in mortality was associated with intentional weight loss of 9–13 kg, but lesser degrees of weight loss were also beneficial. A loss of 1–2 kg per month by means of a sustained energy deficit of approximately 500 kcal/day should be regarded as satisfactory and, as body weight tends to increase up to the sixth decade, avoidance of further weight gain may be considered a success in some patients [2].

Achieving long-term weight loss is notoriously difficult and there is no blueprint strategy for success. Standard weight reduction diets used in isolation are often unsuccessful, but structured lifestyle programmes which include education, energy reduction, regular physical activity and frequent participant contact can produce long-term weight loss of 5–7% [3]. Exercise and behaviour modification are most useful as adjuncts to other weight loss strategies, and exercise is helpful in maintaining weight loss [3].

The skill of the dietician is in determining the most appropriate strategy for the individual patient. Dietary assessment will reveal the changes in dietary habits and food choices which are most likely to achieve a calorie deficit. Reducing the dietary energy density (kcal per 100 g or 100 ml of food) is an important consideration. In one study successful long-term weight loss depended on the ability to maintain a low-energy, low-fat diet with an average of 25% energy being derived from fat [43]. Most people eat a remarkably constant volume of food from day to day, irrespective of its energy content [44]. Reducing the energy content of this bulk allows sufficient volume of food for satiety but with a lower energy yield. Replacing fat-rich foods and other dietary sources of fat with starchy carbohydrate foods (particularly those which contain cereal fibre) and with fruit and vegetables is the best way of achieving this aim, and is fully compatible with the nutritional objectives of diabetes management. Alcohol, which contains 7 kcal/g, should be restricted by those trying to lose weight.

The meal pattern is an important aspect of weight management. Provided that the daily energy intake is appropriate, the frequency of meals (e.g. whether one or two large meals or six smaller meals of equal total energy) makes little difference to the rate of weight loss, but it is probably better to avoid a 'feast or famine' pattern of eating, and most dieticians advise eating at regular intervals and avoiding long periods without food. Meals should be regarded as 'an occasion' when food is enjoyed and savoured, rather than consumed abstractedly while watching television, reading a newspaper or working.

Very low calorie diets (VLCDs)

VLCDs (< 800 kcal/day) produce more rapid initial weight loss than conventional diets, but long-term results are no better [3,42], probably because they do nothing to promote the behavioural changes and food choices which are required for long-term weight control. There is the possibility that they could predispose to binge eating, particularly if they are used in a cyclical on–off manner as is done in an unsupervised way by some members of the general public [2,42], and uncertainty remains about their long-term effects on body composition [2]. The ADA suggests that they should be considered only in conjunction with a structured weight management programme [3] and the EASD that their use should be restricted to patients with a BMI of ≥ 35 kg/m^2 who are supervised in experimental medical centres [4]. Careful monitoring of blood glucose concentration and of medication is essential.

Slimming clubs

Some people find it easier to lose weight with the support and motivation offered in a group setting. Slimming clubs may be available as part of local health promotion initiatives, sometimes with professional dietetic input, and sometimes with psychoeducational support [45]. Commercially run slimming organizations suit some people, but dieticians should check that the dietary advice is compatible with the requirements of diabetes.

Pharmacological treatments

Of the two agents currently available in the UK, orlistat is a pancreatic lipase inhibitor which blocks absorption of about 30% of ingested fat, and sibutramine is a serotonin and noradrenaline re-uptake inhibitor which acts mainly as a satiety-inducing agent but also increases basal thermogenesis. The circumstances in which these drugs may be prescribed in the UK, their contraindications and side-effects have been reviewed by the National Institute for Clinical Excellence [46,47]. In comparison with placebo, both drugs produce modest but clinically significant weight loss in overweight patients with Type 2 diabetes, including those treated with sulphonylureas, with improvements in carbohydrate metabolism which are generally in proportion to the amounts of weight loss [3,43]. A 12-month, randomized, prospective, placebo-controlled double-blind study of sibutramine in metformin-treated obese patients with Type 2 diabetes showed significant reductions in body weight in the sibutramine-treated group, with reductions in HbA_{1c} and triglyceride concentrations in those who lost > 10% of body weight [48]. The preliminary results of a 4-year study with orlistat in obese patients have shown a mean weight loss of 6.9 kg compared with 4.1 kg with placebo ($P < 0.001$) [49]. Most trials have included other interventions and these drugs should only be used in conjunction with dietary advice, exercise and behavioural counselling [46,47].

Gastric reduction surgery

Gastric reduction surgery, which can now be performed laparoscopically using an adjustable LAP-BAND, can produce substantial and sustained weight loss in patients with a BMI of > 35 kg/m^2 with improvement in some but not all of the major cardiovascular risk factors [43]. Long-term data comparing the benefits and risks with those of medical treatment are not available [3].

Carbohydrate management

Many factors affect the glycaemic response to foods. These include the amount of carbohydrate consumed, the composition of this carbohydrate (its proportional content of glucose, fructose, sucrose, lactose, amylose, amylopectin or resistant starch), the effects of cooking or processing on food structure, and other meal components (such as fats or proteins). The amount of carbohydrate in meals or snacks has much greater influence on glycaemia than the source or type [3], and, although carbohydrate restriction is no longer part of diabetes management, for most patients the total carbohydrate intake remains an important consideration in order to optimize glycaemic control.

Quantity of carbohydrate

Patients, especially those with insulin-treated diabetes, have historically been advised that they must eat approximately the same amount of carbohydrate at approximately the same time each day. Various systems (e.g. 'lines', 'portions', 'exchanges') were devised to allow them to calculate, and usually to restrict, their consumption of carbohydrate. In the 1980s there was an increasing realization that carbohydrate restriction was both unnecessary and also counterproductive, as it tended to result in an increased consumption of fat, and simpler methods of meal planning such as the Plate Model [50] were then introduced. Subsequently the introduction of new insulin regimens such as the basal-bolus system, using either conventional insulins or short-acting analogues, and insulin pumps has allowed greater flexibility in the timing of meals. The new insulin regimens, when combined with more frequent glucose monitoring, which has been simplified by the introduction of simpler and faster glucose meters, has also allowed more knowledgeable and motivated patients to vary their carbohydrate intake at any particular meal time by adjusting their insulin doses or physical activity or both, while avoiding hyper- or hypoglycaemia and enjoying a lower perceived burden of dietary restriction.

Different approaches are required for different patients and in different circumstances. An elderly person in a residential home will often have little or no control over the timing of meals, may have little choice in the type of food provided and, if dependent on others to give injections, may be limited to one or two insulin doses daily. There are also many people who live independently and who feel more comfortable about managing their diabetes by following a regular meal plan and who prefer to have no more than two injections per day. Those people on two fixed daily injections have better glycaemic control if they achieve day to day consistency in the amount and source of the carbohydrate content of their diets [51].

In contrast, knowledgeable and motivated patients can, in conjunction with frequent glucose monitoring, vary the amount of carbohydrate consumed or the time at which it is eaten by adjusting their insulin doses or physical activity or both. This more liberal approach has been advocated in Germany for some years [52] and more recently in the USA [53]. In the UK, preliminary results from the DAFNE trial have now been published [40]. Between these two extremes are patients whose glycaemic control and quality of life would benefit from a more flexible regimen, but who lack the ability, confidence or motivation to implement the necessary skills, sometimes because they have not received the education and support needed to acquire them.

It is therefore essential that dieticians should have a thorough knowledge of several different models for carbohydrate management. Most dieticians in the UK use a combination of methods when advising patients how to regulate their carbohydrate consumption. The most common methods are qualitative advice, which is used, according to circumstances, by 87%, and semiquantitative ('portions') by 59%; only 17% use 'exchanges' and all of them combine this method with other approaches [54].

An example of a qualitative method is the 'plate model' which, although primarily a device for encouraging healthy

eating practices, is suitable for most non-insulin-treated patients and for some patients with Type 2 diabetes on fixed insulin doses. In this simple visual method the dinner plate serves as a pie chart to show the proportions of the plate that should be covered by the various food groups [50]. The smallest sector, about 1/5th of the total area, is for meat, fish, eggs or cheese. The remaining 4/5th is divided approximately equally with 2/5th for the staple food (rice, pasta, bread, potatoes, etc.) and 2/5th for fruit and vegetables. The advantages of this qualitative model are that it is simple, adaptable, embodies the principles of healthy eating, promotes memory and understanding through visual messages [55], and is easily implemented in residential and nursing homes.

Greater knowledge and understanding are required if insulin-treated patients are to have the flexibility to vary their carbohydrate intake and mealtimes. In the USA, carbohydrate counting received renewed impetus because of its success as one of the four meal-planning strategies used in the DCCT [56]. The current method is a structured system in which three levels of counting, of increasing complexity, are taught in a sequential manner [53]. *Level 1* or *Basic* introduces the concept of carbohydrate as a food component which raises blood glucose concentration. It encourages a consistent intake by using lists of food quantities [57]. Insulin adjustments are made by the healthcare professional. *Level 2* or *Intermediate* counting introduces the relationship between blood glucose concentrations and carbohydrate, insulin dose and physical activity. As patients learn to recognize the patterns of blood glucose response to these variables, they are taught how to adjust insulin doses, or carbohydrate intake, or timing of exercise, to maintain glycaemic stability. *Level 3* or *Advanced* counting is for those on basal-bolus regimens or pumps. Patients are now taught how to match bolus insulin doses to carbohydrate portions by calculating a personal insulin : carbohydrate ratio, e.g., 2 extra units of short-acting insulin for each 20 g of extra carbohydrate. This gives greater dietary flexibility while minimizing the frequency of hypoglycaemia and of peaks of blood glucose concentration, but does require intensive and time-consuming assessment and teaching by experienced and highly trained staff.

In the UK The DAFNE Project [41] has used adult education principles and skills-based training to teach flexible insulin adjustments to match the carbohydrate in a free diet on a meal by meal basis. Adult participants, all with Type 1 diabetes of > 2 years duration, without advanced complications, an average age of about 40 years and an HbA_{1c} of 7.5–12.0% (mean 9.4), attended a 5-day course in groups of six to eight. The educators (diabetes specialist nurses and dieticians) were trained by professional educators, and the courses were subject to external educational appraisal and peer review. Carbohydrate counting was taught using portions, one portion being approximately equivalent to 10–12 g of carbohydrate. The course did not attempt to teach healthy eating, although the benefits of this received a brief mention on the final day. Participants used a basal-bolus regimen with two injections of isophane insulin (at bedtime and before breakfast) with soluble insulin before each meal. Participants were shown how to calculate the dose of soluble insulin for each portion of carbohydrate which suited their individual needs, usually 1–3 units per portion, and were given a carbohydrate portion booklet. In contrast to the DCCT, participants received only routine care after the initial 5-day course. Statistically significant reductions in HbA_{1c} were found after 6 months (−1.0%) and 12 months (−0.5%), and there were statistically significant improvements in scores for quality of life, psychological well-being and satisfaction with treatment. There were no changes in body weight, serum lipid concentrations or frequency of severe hypoglycaemia. The DAFNE Project has shown that those who volunteered for the trial could, when given the freedom to eat as they chose, achieve improvements in glycaemic control and well-being and were more satisfied with this approach than with conventional management. It is, however, dependent on additional staff training and time and requires a commitment by the patient to a 5-day course (16% of the randomized volunteers withdraw at this stage), more intensive glucose monitoring and five injections daily. The proportion who continued with the DAFNE system after the trial ended is not stated.

Type of carbohydrate

It has now been well-established that dietary sucrose does not increase glycaemia more than isocaloric amounts of starch, and that people with diabetes need not restrict their intake of sucrose-containing foods because of concerns about hyperglycaemia (although there may be other health reasons for doing so). In recent years attempts have been made to devise a more meaningful way of quantifying the glycaemic effect of different foods by means of the glycaemic index (GI). Although attractive in theory, in practice this system has many limitations. Different methods of food processing or preparation can make large differences to the GI, as can the ripeness of certain foods such as bananas [58,59], and different strains of rice have different values [60]. Although there are published tables of the GIs of some 500 different individual foods [61], the GI of a specific food can be influenced by the other foods in a mixed meal. There is limited information on the GIs of different food combinations and some of this is based on theoretical calculations [62]. To complicate matters further, the GI of an individual food or a mixed meal may be influenced by what was eaten at the preceding meal [60,63] and foods with similar GIs may have different insulinaemic indices [63]. Despite these various problems, there is evidence that diets based on foods with a low GI can improve glycaemic control, insulin resistance, lipid profiles and fibrinolysis [58,62], though the evidence has been disputed [64] and the debate continues [65,66]. The ADA currently advises that there is insufficient evidence of long-term benefit to recommend the use of low GI diets as a primary strategy in meal planning [3].

Nevertheless, the GI can have value as a broad guide to good carbohydrate food choices, by stratifying foods into low,

medium and high GI categories. However, patients should be advised against placing too much reliance on tables of GI values in popular diet books because, besides the problems already described, the information can be misunderstood and misused. For example, it is easy to assume that a low GI food will have less glycaemic effect than a high GI one, whereas this is only the case if they are consumed in equi-carbohydrate loads. Thus, a typical helping of a low GI food such as pasta (which might be 35 g of carbohydrate) will have a greater glycaemic effect than a higher GI food such as a slice of bread (15 g of carbohydrate). Moreover, excessive emphasis on the GI content of a meal may divert attention away from other more important aspects such as fat or calorie content.

Other aspects of dietary advice

Insulin treatment

All members of the diabetes team must work with the person with diabetes to choose an insulin and dietary regimen which is best suited to the individual's lifestyle preferences. As regimens become more flexible it is essential that the dietician should be familiar with the time–action profiles of different insulins and insulin analogues. Insulin is anabolic and progressive weight gain can be a problem when glycaemic control is tightened or when insulin replaces oral hypoglycaemic agents in patients with Type 2 diabetes. This potential weight gain should be anticipated and explained to the patient so that dietary measures can be discussed and instituted. Combined treatment with insulin and metformin, which can reduce insulin dosage by improving insulin resistance and perhaps also by its anorectic effect, can be useful in those who are overweight [67,68]. The thiazolinediones, which also reduce insulin resistance but which are associated with 3–4 kg weight gain [69,70], are not currently licensed in the UK for use with insulin, but a preliminary report suggests that the combination can be useful [71], particularly if metformin is contraindicated or causes gastrointestinal side-effects.

Oral hypoglycaemic drugs

Metformin is probably the initial oral hypoglycaemic drug of choice in overweight people with Type 2 diabetes who need more than just dietary management, because weight gain is less common than with sulphonylureas, thiazolinediones or insulin, and because the incidence of hypoglycaemia is only slightly greater than in those treated by diet alone [72]. The meglitinides, of which repaglinide and nateglinide are currently available in the UK, are probably weight neutral [73,74], although in one study repaglinide was associated with an average weight gain of 2.4 kg when used alone and 3.0 kg in combination with metformin, whereas weight in those treated with metformin alone decreased by 0.9 kg [75]. All those treated with sulphonylureas or meglitinides must be given advice on the causes, recognition and management of hypoglycaemia. Acarbose does not cause hypoglycaemia when used as sole therapy, but if hypoglycaemia occurs when it is being used with another agent then treatment must be with glucose and not with sucrose, because its action as an alphaglucosidase inhibitor prevents hydrolysis of disaccharides [76].

Hypoglycaemia

Glucose (10–20 g) is the preferred sugar for the immediate treatment of acute hypoglycaemia because it does not require digestion or metabolism [3]. Some patients prefer to use snack bars, but the presence of fat may slow the absorption of carbohydrate, though gastric emptying during hypoglycaemia is as rapid for solids as it is for fluids [3]. After recovery from hypoglycaemia a further 10–20 g of slower-acting carbohydrate should be given, unless the next snack or meal is due, in which case it should be eaten straight away.

Exercise [3,77]

Regular exercise should be encouraged in all people with diabetes, and advice must be given on prevention of hypoglycaemia during and after exercise. Blood glucose concentration may increase during the early phase of intense exercise and metabolic decompensation can occur if the pre-exercise concentration is high. Diabetes UK advises that exercise should be postponed if the blood glucose concentration is > 15 mmol/l or if there is ketonuria [78]. If exercise is unplanned then additional carbohydrate must be taken before or during exercise to prevent hypoglycaemia. If exercise is planned then the dose of insulin or sulphonylurea prior to activity can be reduced. This is preferable to additional food in those who are overweight. Some people are best suited by a combination of a reduction in dosage together with a modest increase in food. Because there is considerable individual variation in the response to exercise, patients should be encouraged to monitor blood glucose concentrations before and after exercise to determine the magnitude of the adjustments in dosage and food which are needed for different types of exercise. While exercising, patients should have immediate access to rapidly absorbed carbohydrate in case hypoglycaemia should occur.

Muscles continue to replenish glycogen stores for many hours after exercise, and increased insulin sensitivity may persist until the next day, particularly after endurance exercise. Patients must therefore be aware of the potential for hypoglycaemia to occur many hours after exercise. Additional food and a reduction in insulin dosage may therefore be needed after a period of intensive exercise. At night the liver is the main source of glucose, and hyperinsulinaemia could block this source. The evening or bed-time dose of intermediate acting insulin may need to be reduced, and some patients find it helpful to have a larger than normal bed-time snack which should include carbohydrate from a slowly absorbed source. The potential for nocturnal hypoglycaemia is increased if exercise has been followed by significant amounts of alcohol.

Alcohol

The metabolic effects of alcohol are complex and are influenced by many variables, e.g. the type and quantity of alcohol and the rate of ingestion, age and gender, individual variation, timing of consumption in relation to meals, exercise, nutritional state, ill health and non-diabetic medications [79,80]. In clinical practice the major issues relate to the potential for alcohol to worsen hypoglycaemia and hypoglycaemic unawareness [79,81], the sustained effects of heavy drinking on glycaemic control [82,83], and possible aggravation of microvascular complications [79]. However, it is perfectly safe for most diabetic people to drink alcohol provided that certain precautions are followed.

Advice about sensible drinking given to the general population [84] (maximum of 14 units per week for women and 21 for men, observance of 1–2 alcohol-free days per week, avoidance during pregnancy and by those with gastritis, pancreatitis, severe liver disease, previous addiction) also applies to those with diabetes. Alcohol contains 7 kcal/g and can cause or aggravate hypertriglyceridaemia [80], so its use should be restricted by those who are trying to lose weight or who have significant hypertriglyceridaemia. Food slows the rate of absorption of alcohol and reduces its peak blood concentration [79]. Moderate amounts of alcohol, e.g. 2–3 units daily, taken before, during or soon after a meal, do not affect short-term glycaemic control, and provided that alcohol is taken in this context there is no convincing evidence in favour of low-carbohydrate beers, lagers and ciders, which may theoretically increase the risk of hypoglycaemia because of their greater alcohol content. In non-diabetic subjects alcohol enhances the early insulin response to sucrose, and those diabetic people who still have significant endogenous insulin reserves should consider using low-carbohydrate mixers and cordials and limiting their consumption of sweet drinks (including sweet wines and sherries) to minimize the risk of reactive hypoglycaemia [85].

Serious hypoglycaemia can occur with larger quantities of alcohol, particularly in insulin-treated patients and especially if food is omitted or if alcohol is substituted for some or all of the carbohydrate content of the meal. Delayed hypoglycaemia may occur up to 16 h after drinking [79], awareness of hypoglycaemia can be reduced at blood alcohol concentrations of 20–25 mmol/l (92–115 mg/dl) [81], recovery from hypoglycaemia may be delayed [79] and the effect of exogenous glucagon diminished [3]. Relatives and carers, as well as patients, should be aware of the risks of hypoglycaemia and should be prepared to rouse and feed a sleeping patient who has consumed alcohol the night before [79].

Heavy alcohol consumption can cause sustained but reversible hyperglycaemia in patients with Type 2 diabetes [85] and recurrent episodes of hypoglycaemia in Type 1 diabetes [79], and alcohol abuse should be considered in patients with otherwise unexplained poor glycaemic control.

Moderate alcohol consumption of 1–3 units daily probably has the same cardioprotective effect in diabetic as in non-diabetic populations [86,87] and may also have a protective effect in peripheral vascular disease [88,89].

Special groups

Children and adolescents

There is little research on the nutritional requirements of diabetic children [3] and the current guidelines of the International Society for Paediatric and Adolescent Diabetes are largely consensus based [90]. Recommendations represent a fusion of the general principles of dietetic management in diabetes care with the requirements for healthy children and adolescents. In the absence of a strong evidence base it is perhaps not surprising that a survey of dieticians providing a service to diabetic children in the UK in 1997 found major variations in the advice given and little evidence of evaluation of its effectiveness [91].

Ideally, children and their carers should be seen by a specialist paediatric dietician [90], though this is currently not always feasible in the UK, and there is in fact little difference in the working practices of paediatric and other dieticians when caring for diabetic children [91]. Diabetes is rare in infants and a specialist dietician should always be involved in these cases. Changes in eating habits are unlikely to be achieved unless the whole family becomes involved in decisions on healthy food choices [90]. School catering staff will need advice, and teachers and babysitters need to know about appropriate snacks and treatment of hypoglycaemia.

Nutritional and energy requirements change throughout childhood and adolescence; for example, those under 5 years need a diet which is relatively energy dense, energy intake doubles between the ages of 6 and 12 years, and protein intake per kg body weight decreases [17]. Regular dietetic review is therefore essential and should occur every 3–4 months during growth and puberty. Height and weight (actual and velocity measurements) should be recorded, together with a review of changes in lifestyle and physical activity. Older children need advice about the safe use of alcohol and all members of the team should be alert to the possibility of eating disorders (discussed below). In extreme cases of adolescent rebellion it may be more important to retain contact with the patient than to risk alienation by labouring the principles of healthy eating. Motivated adolescents may benefit from a more flexible approach to dietary and insulin management to permit the variability inherent in normal teenage lifestyles and eating habits.

The incidence of Type 2 diabetes is increasing in children of both ethnic minority and Caucasian origin [92] as the prevalence of childhood obesity continues to increase. Overt diabetes is probably just the tip of the metabolic iceberg in obese children, as an American study found impaired glucose tolerance (by ADA criteria) in 25% of 4–10-year-olds with a BMI > 29 kg/m^2 and in 21% of adolescents with a BMI > 35 kg/m^2, 4% of the obese adolescents having previously unrecognized

diabetes [93]. Dietary advice must take account of the requirement for calorie restriction while not compromising linear growth, and of any associated dyslipidaemia and hypertension, and physical activity must be encouraged [3].

Eating disorders

Although there is still debate about whether adolescent females with diabetes have an increased prevalence of overt eating disorders such as anorexia or bulimia, there is consensus that non-specific eating disorders are more common in this group of patients, and especially so if deliberate insulin omission as a means of weight control is categorized as an eating disorder [94–97]. Adolescent females with Type 1 diabetes are significantly heavier than their non-diabetic peers [98,99]. Concern about body weight and shape increases as body weight increases from adolescence to young adulthood, and the magnitude of the concern correlates with the degree of weight gain [95]. Rating scale measures show that dietary behaviour is particularly likely to become abnormal in the first year after diagnosis of diabetes, with a pathological focus on thinness and body dissatisfaction [100]. The emphasis on diet as an essential component of diabetic management, together with the weight gain following initiation of insulin treatment, the large insulin doses which may be required during adolescence and which can make weight control more difficult, all coincide with a time when the adolescent girl is particularly susceptible to psychosocial messages about body image and may explain the increased prevalence of non-specific eating disorders and insulin omission [94]. If so, the problem may be exacerbated by measures to achieve intensive glycaemic control because, despite increased dietetic advice and measures to increase the flexibility of the diet, adolescents in the intensive arm of DCCT were twice as likely to be overweight as those on conventional therapy [101]. There may be a case for less intensive glycaemic control in adolescent females [97], especially as there is some evidence that the increased incidence of microvascular complications in those with eating disorders is related as much to insulin omission to control weight as it is to the eating disorder itself [95]. Success rates for treatment of eating disorders are lower in diabetic than in non-diabetic people, and it is therefore important to recognize these conditions at any early stage. Those with an eating disorder are more likely to have high HbA_{1c} results, recurrent and unexplained episodes of diabetic ketoacidosis, recurrent severe hypoglycaemia, and an earlier onset of microvascular complications [96].

Although most research has focused on eating disorders in adolescents with Type 1 diabetes, this condition can persist well into adult life [95]. Moreover, the emotional distress associated with eating disorders in the adult with Type 2 diabetes is often greater than that in the Type 1 adolescent, as these overweight ladies become trapped in the vicious circle of low self esteem, increased restraint eating and binge eating [102].

Pregnancy

Pregnancy in pregestational diabetes

Meticulous control of diabetes from the time of conception to delivery is essential to lessen the risks to both mother and child, and measures to optimize diabetic control must start before conception to minimize the risk of congenital malformation [103]. These should include a dietary review so that dietary adjustments can be made if necessary, particularly if there are changes in the insulin regimen. As with non-diabetic women, a folate supplement of 0.4 mg/day (5 mg/day if there is a previous history of neural tube defects) should be taken. Some clinicians routinely advise a dose of 5 mg daily because of the increased risk of neural tube defects in the children of diabetic women; there is no published evidence to support this advice and Diabetes UK is currently seeking a consensus of expert opinion on this matter [104]. Other vitamin and mineral supplements should be given if there is uncertainty about the nutritional status. Women whose body weight exceeds 120% of the ideal should be encouraged to lose weight before conception wherever possible [103].

Once pregnancy is confirmed, regular dietary follow-up is essential to maintain near-normal glycaemia whilst ensuring that the nutritional demands of pregnancy are also met. A stable meal pattern, usually composed of smaller but more frequent meals, is important. Food choice should focus on the need for micronutrient-rich foods (fruit, vegetables, low-fat dairy products and lean meat, fish or alternatives) rather than energy-dense fat-rich foods. Greater consumption of low glycaemic index food choices can be encouraged. General dietary guidance for pregnancy, including contraindications such as avoidance of alcohol and liver and liver products, unpasteurized dairy products and precooked cold meats, should be given.

Tighter glycaemic control means that the risk of hypoglycaemia is higher and clinicians should ensure their patients know how to avert or correct this. Written guidelines for coping with problems such as nausea or vomiting may also be helpful.

As pregnancy progresses, weight gain should be closely monitored. There are recommendations for weight gain, related to prepregnancy BMI, associated with the best maternal and fetal outcomes in the general American population; for a prepregnant BMI of 20–26 kg/m^2 the recommended gain is 11.5–16 kg [105]. If weight gain becomes rapid, there should be further focus on food choice to replace high-energy density foods with nutrient-rich, lower energy alternatives. The aim should be to stabilize weight or reduce the rate of weight gain. Active weight reduction is not appropriate because of the risk of compromising nutritional intake and fetal development. Energy consumption should be sufficient to prevent ketonaemia which is associated with lower development scores in the offspring when aged 6–9 years [106].

Lactation

Breast feeding should be encouraged, although this may be more difficult to establish if the infant requires specialist care

in a neonatal unit. The high energy costs of lactation mean that the mother is likely to require an additional 40–50 g carbohydrate/day compared with her prepregnancy intake [103]. Extra carbohydrate may be required before going to bed while the infant is still having nocturnal feeds.

Gestational diabetes

The benefits of dietary intervention and the optimal dietary prescription for the management of gestational diabetes remain uncertain [107], and because there is no clear consensus [108] local policies and practices vary considerably. On the basis of present knowledge it would seem reasonable to advise healthy food choices and, as fetal macrosomia may be more closely related to post- than to preprandial glucose concentrations [3], the carbohydrate content of the diet should be evenly distributed through the day with an emphasis on foods with a low glycaemic index. Reducing maternal obesity can reduce fetal weight but requires a level of energy restriction which may compromise fetal nutrition. Diabetes UK has previously advised an energy intake of 24–30 kcal/kg (1500–1800 kcal/day) for obese women with gestational diabetes [103], but there is no convincing evidence that this reduces either birth weight or the need for caesarean delivery [109].

Women with a history of gestational diabetes have an increased risk of recurrence in subsequent pregnancies and of Type 2 diabetes in later life, especially if they remain overweight [110]. They should therefore be offered postpartum advice on healthy eating, weight management and exercise, although the benefits of such advice have not yet been tested in a prospective study.

The elderly person

Few data are available on which to base diet and exercise prescriptions for elderly patients and the optimal composition of the diet is unknown [111]. In the absence of such information it is usual to apply the general principles of dietary management of diabetes but, as appetite is often diminished in the elderly, the use of nutrient-dense foods may need to be encouraged. Those who are overweight may benefit from weight reduction [112], provided that micronutrient intake is not compromised. Case studies suggest that zinc deficiency may be more common in the elderly [110]. Calcium intake should be at least 1200 mg daily, and a multivitamin supplement may be appropriate for those with reduced appetites [3]. The risk of hypoglycaemia with consequent falls and fractures should be minimized and targets for preprandial blood glucose concentrations may need to be relaxed. Dietary guidance must find the right balance between meeting the clinical needs of diabetes without diminishing the older person's ability to enjoy meals. Community care services must ensure the needs of those who live alone and are physically frail. Issues relating to the dietary management of people in residential care are discussed below. Physical activity and exercise are beneficial and should be encouraged as far as it is practicable to do so [113].

Institutional care

There are probably at least 15 000 elderly people with diabetes who live in residential or nursing homes in the UK [114], and unknown numbers of children in residential schools and homes and of adults in prison. These people often have little or no control over the timing of their meals and medications or the type and amount of food provided. Those living in hostel or bed-sit accommodation may have restricted access to facilities for food preparation and storage. People with learning disabilities and diabetes need more careful supervision of their food purchases and choices than their non-diabetic peers.

Undernutrition is common in elderly people in residential care. In a survey in Liverpool, 52% of residents had a daily energy intake which was lower than the estimated average requirement for age and sex, 19% had a BMI of < 20 kg/m^2 (only 8% had a BMI > 30 kg/m^2), all had intakes of vitamin D which were less than the reference nutrient intake (RNI), but none was taking vitamin D supplements, and intakes of calcium, iron and vitamin C were below the RNI in 10–17% [114]. There is evidence that elderly residents in long-term care who are given regular meals with less restrictive diets have improved nutritional status and a better quality of life [115]. The ADA now recommends that fat restriction is not indicated for the majority of this population because of the risk of malnutrition [116].

Diabetes UK has produced guidelines for dietary requirements for residents in long-term care homes [117] and has also published guidance for lay carers (Appendix). Community dieticians should establish working relationships with care home managers and assist in the training of both care staff and catering staff.

Problems of diabetes care in prisons include inappropriate foods and meal times and limited opportunities for exercise, but glycaemic control can be improved by input from a multidisciplinary diabetes team who must be fully aware of the realities of prison life [118]. Dieticians must be available to all prisons, for both general advice and individual consultation.

People from ethnic minorities

The prevalence of Type 2 diabetes, obesity and hypertension is greater in people of South Asian, Caribbean and West African origin than in the white population of the UK, and their diabetes is less likely to be detected and, when diagnosed, less likely to be adequately treated [119].

The principles of dietary management in respect of diabetes, obesity and cardiovascular disease are no different for ethnic minorities than for any other population, but they do have to be applied in a way which is culturally appropriate. Dieticians need to be familiar with customs, food habits and cooking practices of different ethnic groups, but they also need to be aware that there can be enormous diversity within a particular ethnic group, and even sometimes within a single family. Some people consume a diet which is no different from that of their

indigenous peers; others, particularly older people or recent immigrants, retain their traditional eating practices. Assumptions must never be made about an individual's food habits simply on the basis of ethnic origin. Detailed information can be obtained from the Multicultural Nutrition Group of the British Dietetic Association. (Appendix).

Other problems can hamper effective healthcare. Language barriers may make both dietary assessment and dietary guidance more difficult. Social problems such as poor housing, unemployment and poverty may have significant nutritional implications. Dieticians may have to work closely with local community support or health promotion agencies in order to provide the most appropriate care for their patients. A survey in 1987 found that 40% of hospital diabetic clinics with over 50 Asian patients had no specifically adapted diet sheet [120]. Dietary literature is now available from Diabetes UK in a number of Asian languages (see Appendix).

During the month of Ramadan, practising Muslims abstain from food and liquids between dawn and sunset, commonly eating one large evening meal after sunset and a light meal before dawn. The latter is optional in some societies but patients should be advised to eat it to reduce the risk of day time hypoglycaemia [121]. The period between sunrise and sunset will be longer when Ramadan occurs during the summer months, which happens periodically as Ramadan starts about 10 days earlier each year. Although people with diabetes can be exempted from fasting during Ramadan, many wish to observe the fast and, with appropriate advice, the great majority can do so safely [122]. In insulin-treated patients, the use of a short-acting analogue rather than regular human insulin results in smaller postprandial glycaemic excursions and less hypoglycaemia [123,124]. For patients treated with oral hypoglycaemics, the easiest regimen is to take the normal morning dose, together with any midday dose, at sunset and any evening dose before dawn [125]. The use of a meglitinide offers theoretical advantages but has not been investigated in this context. The content of the meal, as well as the timing, may change during Ramadan. Muslim sweets taken in Ramadan, *Khir* (rice pudding) and vermicelli are sugary and may require alterations in drug or insulin dosage [121].

Some Hindu women observe a partial fast in which only certain foods such as fruit and yoghurt may be eaten on 1 or 2 days each week [126].

Special situations

Intercurrent illness

Home care

During acute intercurrent illness it may be appropriate to take larger quantities of some foods and drinks which would normally be advised only in moderation. Patients should be provided with written information about the carbohydrate content of easily assimilable foods and drinks such as soups, ice cream, yoghurts, jellies, fruit juices and soft drinks. Fluid intake should be increased if there is fever, vomiting or diarrhoea. Commercial oral rehydration salts can help prevent or treat dehydration but, if these are not available, then sodium-containing fluids such as sports drinks or tomato juice may be used. All clinicians should reinforce standard 'sick day rules' such as the importance of continuing insulin (though insulin may sometimes have to be temporarily discontinued in very young children), more frequent glucose monitoring and criteria for seeking medical advice.

Hospital care

Responsibility for the management of diabetes in hospital should be shared between the person with diabetes and the healthcare team. Wherever possible, patients should be allowed to make their own food choices, though guidance may be needed from the dietician to ensure that meal plans are appropriate to the circumstances of the illness. Hospital dieticians should ensure that hospital menus contain appropriate choices for meals and snacks and that suitable foods and drinks are available in hospital canteens and shops and on hospital trolleys. This can be more difficult when these services are contracted out to independent suppliers. All wards must carry food and drink for the oral treatment of hypoglycaemia.

Catabolic illness, enteral and parenteral nutrition

Most hospitalized adults need 25–35 kcal of energy per kg body weight daily and in catabolic illness at least 1.0 g/kg body weight daily of protein is required if renal and liver function permit [3]. However, over-feeding should be avoided because it can cause hyperglycaemia, hypertriglyceridaemia and hypertonic dehydration (all of which are problems to which the sick diabetic patient may be particularly liable), as well as increased oxygen requirements and increased production of carbon dioxide [127,128]. After correction of hyperglycaemia diabetic patients may be deficient in phosphate, potassium and magnesium, and these deficiencies must be corrected and monitored to prevent the re-feeding syndrome [127].

Most enteral formula feeds are high in carbohydrates, particularly low molecular weight carbohydrates, and low in fat. However, there is increasing evidence, from single meal and short-term studies, that diets with a reduced carbohydrate content and which contain up to 50% of total energy as fat with 30% of the energy from MUFA, result in better glycaemic control and improved lipid profiles with higher HDL-cholesterol and lower triglyceride concentrations [129–131]. Whether these products are helpful in sick patients has yet to be established. The greatest benefit might be expected in stable patients who require long-term enteral tube feeding or liquid food supplements. However there is only one long-term study of 3 months [132]. This was of 34 diabetic patients in two nursing homes who were randomly allocated to receive either a standard enteral feed or a reduced carbohydrate-high MUFA feed. There were no statistically significant differences in plasma glucose concentrations or HbA_{1c} results, although the high MUFA group had higher HDL-cholesterol and lower

triglyceride concentrations and 10% fewer infections. Some enteral feeds contain added fibre, typically 1.2–1.5 g of mostly insoluble fibre per 100 ml. The amount of fibre which can be added is limited by problems due to blocking of fine bore tubes, and there is no evidence that these products improve glycaemic control [131].

There is little published information about the use of different preparations for parenteral nutrition in diabetic patients, and no recommendations can be made for any particular product [131]. The initial choice of formula should be based on the clinical picture and biochemical results, with subsequent adjustments made on the basis of meticulous metabolic monitoring. As with enteral nutrition, mineral and vitamin deficiencies should be corrected before feeding is begun.

Palliative and terminal care

The aims of nutritional advice are different in patients receiving palliative or terminal care. Risk reduction for microvascular and macrovascular disease is no longer relevant and the main emphasis should be on avoidance of symptoms due to hyper- or hypoglycaemia. If palliative care is likely to be prolonged then efforts should be made to maintain energy intake and nutrient balance using dietary and management regimens which are as non-intrusive as possible. Changes in appetite and body weight or the use of glucocorticoids may require substantial alterations to insulin dose and regimen or to oral hypoglycaemic drugs, and these should be anticipated where possible. Patients with fickle appetites who are treated with sulphonylureas might find it better to take a meglitinide as and when they feel able to eat, but at present there are no comparative studies of these drugs in such situations.

Nephropathy

The role of dietary protein restriction in the management of diabetic nephropathy is still uncertain. There have been no studies in patients with Type 2 diabetes. In patients with Type 1 diabetes and a reduced glomerular filtration rate (GFR) the SIGN guidelines [9] recommend a reduction to 0.6–0.8 g/kg per day on the basis of evidence (categorized as level 1+) in two meta-analyses, one of which was based on only 108 patients [133]. In the second study the number of diabetic patients was also small, and the overall effect in both diabetic and non-diabetic patients was a reduction in the rate of decline of GFR by only 0.53 ml/min per year [134]. A recent Cochrane review concluded that protein reduction appeared to slow the rate of progression to renal failure in patients with Type 1 diabetes, but noted that the evidence was based on proxy indicators and that the optimum level of protein restriction was still unknown [135]; the authors suggested that a pragmatic approach might be to reduce protein intake to 0.8–1.0 g/kg per day, which is little different from that recommended by the EASD and ADA [4,5] for all people with diabetes. An ADA Technical Review noted that those studies which actually achieved reductions to 0.7 g/kg per day showed a significant reduction in the rate of decline in GFR in patients with Type 1 diabetes, although in one of these studies this may have been influenced by better control of hypertension [3]. The ADA Nutrition Recommendations graded the evidence as Grade C (approximately equivalent to level 2+) and concluded that restriction of protein to 0.8 g/kg per day 'may' slow progression [5]. By contrast, the ADA Nephropathy Recommendations grade the evidence as Grade B (approximately equivalent to level 2++), and say that there is general consensus that protein intake in patients with Type 1 diabetes and nephropathy should be restricted to 0.8 g/kg per day and that, as GFR begins to fall, 'further restriction to 0.6 g/kg/day may prove useful … in selected patients' [136].

Because the substitution of protein from plant sources for that from animals tends to result in a reduction in total protein intake, there is insufficient evidence to make definite recommendations about the source of protein [3]. There is some preliminary evidence to suggest that phytoestrogens, found particularly in soy protein and flaxseed, may retard the progression of various chronic renal diseases [137,138].

Because the evidence for protein restriction in diabetic nephropathy is still inconclusive it is not appropriate to make any general recommendation. If protein is reduced below 0.8 g/kg per day it should be done under the supervision of a specialist dietician, as there is the potential for nutritional deficiencies to occur [139]. This can be time consuming and in the Modification of Diet in Renal Disease Study each patient received 2–3 h of dietetic instruction per month [140]. It may be more effective to use available dietetic time to ensure that patients are not exceeding the recommended consumption of protein. The EASD and ADA recommendations for the general diabetic population suggest that protein should constitute 10–20% of daily energy [4,5]. However, in the EURODIAB IDDM Complications Study, the average protein intake was 1.5 ± 0.5 g/kg per day (mean ± SD), equivalent to 17.6 ± 3.5% of total energy intake, and accounted for more than 20% in 22% of patients [141]; and in the UKPD Study of patients with Type 2 diabetes protein accounted for 20.7 ± 4.2% (mean ± SD) of daily energy [142].

Hypertension [143]

In those who are overweight, there is a fall of approximately 1 mmHg in mean arterial pressure for each 1 kg body weight lost [143]. Salt restriction from a daily intake of 12 g to 6 g daily results in a drop in systolic/diastolic pressure of about 5/2–3 mmHg [143], and possibly more in hypertensive patients with Type 2 diabetes in whom it also potentiates the effect of some anti-hypertensive drugs [144,145]. There is epidemiological evidence to suggest an inverse relationship between blood pressure and consumption of potassium, magnesium and calcium [143], and some evidence that a diet rich in these minerals has an anti-hypertensive effect in hypertensive diabetic patients [146]. Reduction in salt consumption can be problematic if advice is also given to increase starchy carbohydrate, because most commercial cereal and bread products

contain 1% salt by weight. Options include the use of unsalted cereals such as porridge or muesli, the use of a home bread maker to obtain salt-free or low-salt bread, or replacing some cereal foods with fruit and vegetables which will also increase potassium consumption. Even replacing ordinary salt with a salt substitute which contains 50% sodium chloride, 40% potassium chloride and 10% magnesium chloride can have a useful effect in hypertensive patients with Type 2 diabetes [147]. Sustained and excessive consumption of alcohol has a deleterious effect on blood pressure, whereas regular physical exercise, e.g. 30–45 min of brisk walking on most days, is beneficial [143].

Dyslipidaemia [2,3]

Dyslipidaemia is often present in newly diagnosed patients or those with poor glycaemic control and should be reassessed after control of hyperglycaemia.

Many patients with Type 2 diabetes and some overweight patients with Type 1 diabetes have a dyslipidaemia associated with insulin resistance. This is characterized by an increase in triglyceride and small dense LDL particles and a reduction in HDL-cholesterol. It often persists after glycaemic control has been achieved. Lifestyle interventions include weight loss, particularly by reduction of saturated fat, which reduces concentrations of triglyceride and LDL-cholesterol and which may increase HDL-cholesterol. If weight loss is not required then energy from saturated fat can be replaced by carbohydrate or *cis*-monounsaturated fat. Regular physical exercise helps to reduce triglyceride concentrations and to improve insulin sensitivity.

Increased concentrations of total and LDL-cholesterol in adults should be treated energetically because of the high incidence of coronary heart disease in people with diabetes. Intervention is recommended if the total cholesterol is > 5.0 or LDL-cholesterol is > 3.0 mmol/l [9]. The principal dietary determinant of LDL-cholesterol is saturated fat and this, together with *trans*-unsaturated fat, should constitute < 10% of daily energy, and in some patients a reduction to < 8% may be helpful. Dietary cholesterol is less important than saturated fat, but dieticians should check that consumption of high-cholesterol foods such as eggs and shellfish is not excessive.

Sterols and stanols of plant origin have been shown to lower LDL-cholesterol concentrations, with an intake of 2 g/day producing an average reduction of 10–15% [148]. The effect is seen in both normolipidaemic and dyslipidaemic individuals, including those already treated with statins and other lipid-lowering agents [149]. Sterols and stanols are now being incorporated into spreads and other fat-derived products such as yoghurts, semiskimmed milk, cereal bars and soft cheeses, and are marketed as adjuncts to other dietary methods of reducing LDL-cholesterol. At present they are about two to four times more expensive than conventional margarines [148]. Although sterols and stanols have been shown to lower LDL-cholesterol, their long-term effects on morbidity and mortality due to coronary heart disease are unknown, and it is possible that any benefit due to cholesterol lowering may be offset by a reduction in the absorption of some fat-soluble vitamins and reduced plasma concentrations of the antioxidants β and α carotene and vitamin E, particularly since the reduced concentration of β carotene is disproportionately greater than the reduction in LDL-cholesterol. Any benefit may also be offset by other constituents in the food product; e.g. one spread also contains significant quantities of *trans*-unsaturated fatty acids [150]. There are as yet no long-term safety data on the use of these products in children or in pregnant women [149]. Phytosterolaemia, a very rare recessively inherited defect, is characterized by increased absorption of plant sterols and accelerated atherosclerosis, and it is not yet known whether the heterozygous carriers, whose prevalence is unknown, may accumulate plant sterols if the dietary intake is increased. Until further studies and large-scale monitoring have been undertaken the American Heart Association recommends that the use of these products be restricted to adults requiring treatment of hypercholesterolaemia or secondary prevention [149]. Whether they should be used in those with low HDL-cholesterol concentrations remains to be determined.

Hypertriglyceridaemia is sometimes associated with alcohol consumption and this possibility should always be considered. The use of pharmacological doses of fish oils, e.g. > 3 g daily, to treat hypertriglyceridaemia is not recommended because of potential deleterious effects on LDL-cholesterol and glycaemic control [3].

Coeliac disease

The increased prevalence of coeliac disease in Type 1 diabetes [151] places a double dietary burden on the patient, and expert dietetic advice is required. When untreated there is an increased risk of hypoglycaemia, and the introduction of a gluten-free diet results in an increase in insulin requirement [152]. The glycaemic indices of gluten-free bread, pasta and biscuits available in the UK, whether made from wheat or maize starch, are similar to those of gluten-containing products [153]. Beans and legumes can be used to increase the fibre content of the diet. Calcium supplements should be given to minimize the risk of osteoporosis if dietary intake is < 1500 mg/day [154].

Cystic fibrosis

The patient with cystic fibrosis and diabetes may be under weight, and a high-energy diet with extra calories from fat and no restriction on carbohydrate is required [155]. Insulin regimens need adjustment when supplementary overnight enteral tube feeding is used [155] and during periods of acute infection. Good metabolic control presents a challenge but is attainable with a basal-bolus regimen and is associated with weight gain [156].

Prevention of diabetes by diet and lifestyle change

This subject has recently been reviewed on behalf of the ADA [3]. In summary, there is good evidence that structured programmes of lifestyle change which emphasize weight loss (5–7% of body weight) by reduced energy and fat intake and increased physical activity can reduce the risk of overweight people with impaired glucose tolerance developing Type 2 diabetes. Exercise need not be especially vigorous and brisk walking will protect provided it is done regularly. There is some evidence that a higher intake of whole grain foods is associated with a lower incidence of Type 2 diabetes in women, but the evidence relating to foods of different glycaemic indices is conflicting. Moderate alcohol consumption, in comparison with abstinence or heavy drinking, may protect against Type 2 diabetes, but the evidence is not sufficiently strong to make a specific recommendation. Evidence that early introduction of cow's milk in infant feeding predisposes to Type 1 diabetes remains equivocal.

Two of the largest intervention studies have been the Diabetes Prevention Study in Finland [21] and the Diabetes Prevention Program in the USA [22]. Both of these used a combination of dietary advice and increased physical activity, setting similar targets and achieving identical results (Table 5). The subjects in the intervention groups received considerably more attention than would be feasible in routine clinical practice in the UK. For example, in the Finnish study they had seven sessions with a nutritionist in the first year and one session every 3 months thereafter and they completed 3-day food diaries three times yearly so that dietary advice could be individually tailored. Guidance on increasing physical activity was also given individually. In the American study a 16-lesson curriculum covering diet, exercise and behaviour modification was taught by case managers on a one-to-one basis during the first 24 weeks and there were subsequent monthly meetings between participants and their case managers. Participants were allowed up to $100 annually for 'rewards' such as T-shirts, and some were also provided with coupons for SlimFast or actual foods for short periods [157]. The American trial also included an arm given the same advice about diet as the control group and also metformin 850 mg b.d. In the metformin group the reduction in progression to diabetes was 31% [22], benefit from metformin was independent of the degree of weight loss, but metformin was not effective in those over 60 years of age [157]. The effect of intensive lifestyle intervention plus metformin was not studied. In another randomized study lasting 2 years the addition of orlistat to a conventional weight-reducing diet in subjects with impaired glucose tolerance resulted in greater weight loss than the diet alone, significantly greater improvement in glucose tolerance, and a lower rate of progression to diabetes (3.0 vs. 7.6%) [158]. A reduction of 25% in progression from impaired glucose tolerance to diabetes has also been reported using acarbose 100 mg tds without lifestyle interventions [159]. A preliminary report has indicated a reduction in progression from impaired glucose tolerance to diabetes of 28.8% with orlistat compared with 18.8% with placebo ($P < 0.005$) [49].

Table 5 Diabetes Prevention Study [21] and Diabetes Prevention Program [22]

	Diabetes Prevention Study	Diabetes Prevention Programme
Target weight loss (% body weight)	5%+	7%+
Target physical activity (min/week)	210	150
Mean follow-up (years)	3.2	2.8
Percent reduction in progression to diabetes	58%	58%

Efforts to prevent Type 2 diabetes should be concentrated on those at greatest risk, e.g. those with a family history, members of ethnic groups with a high prevalence and women with a past history of gestational diabetes.

The provision of district dietetic services

Recent initiatives

Dietetic services should be organized on a district basis to ensure the complete integration of community and hospital services and co-ordination with other dietary initiatives, especially those in other National Service Frameworks (NSFs) such as those for Coronary Heart Disease [10] and Older People [160] and the forthcoming NSFs for Renal Services and Children. Service planning will also need to take account of the Department of Health's document on The Expert Patient [8].

Implementation of national diabetes strategies will require a major expansion of dietetic services to meet the required standards. Nutritional expertise and the provision of dietetic advice are essential components of 10 of the 12 standards in the NSF for England [6]. In particular, Standard 1 (prevention of Type 2 diabetes) calls for 'review of local strategies for improving diet and nutrition, increasing physical activity, reducing overweight and obesity and helping people to maintain weight loss …' and Standard 3 (empowering people with diabetes) states that 'The provision of information, education and psychological support that facilitates self-management is therefore the cornerstone of diabetes care. People with diabetes need the knowledge, skills and motivation to assess their risks, to understand what they will gain from changing their behaviour or lifestyle and to act on that understanding by engaging in appropriate behaviours'. The NSF recognizes that this will require structured education programmes and behavioural change programmes. The Clinical Standards for the Scottish Diabetes Framework [7] are more specific and require that all newly diagnosed people 'are offered at least one appropriately tailored formal education session, that educational programmes continues after diagnosis and include diet', that it is desirable for people with diabetes to have appropriate access to key

health professionals including state registered dietetic services (Standard 3), and that all people with diabetes must be offered an annual or more frequent review which includes dietary management (Standard 4).

The Department of Health's document on The Expert Patient [8] expands on some of the points made in the NSF, and envisages an Expert Patient's Programme which is something more than just education and provision of information but in which patients develop the confidence and motivation 'to use their own skills, information and professional services to take effective control over life with a chronic condition'. In this respect the concept of The Expert Patient is similar to the use of Nutrition Practice Guidelines for Type 1 diabetes in the USA [31,32] and even more so to the DAFNE Project in the UK [41]. Both these programmes require much more intensive input from both dieticians and patients than traditional methods of providing dietary advice, and The Expert Patient document recognizes the 'need for increased provision of, and equitable access to, services for people with chronic diseases'. Moreover, the time required to train staff in the skills needs for behavioural change programmes (which can be at least 40 h), and then to maintain those skills, is considerable [161].

Access to dietetic services—the current position

At present access to dietetic advice in the UK is far from being either readily available or equitable. In a hospital diabetic clinic in a Scottish teaching hospital in 1994 only 44% of patients had discussed their diet with a dietician in the last year and 5% could not recall ever having seen a dietician [162], and in Greenock in 1998 only 76% of general practitioners referred diabetic patients to a community-based dietetic service, even after an awareness initiative to raise the profile of the service [163]. In a recent district-wide survey of 8597 people with diabetes in the Sunderland Health District only 59% (77% of those attending a specialist diabetic clinic and 54% of those seen in primary care) had been seen by a dietician in the previous 8 years [164]. The smaller percentage in primary care reflects the lesser availability of dietetic expertise in primary care, but may also be influenced by where the dietetic clinics are held; uptake of dietetic advice is greater if the dietician works in the general practice diabetic clinic than if the service is provided separately on a central site [165]. In a survey of dieticians known to be engaged in the provision of diabetes care in the UK in 1997, only 69% reported that they were able to see more than half of newly diagnosed adult patients within 4 weeks and less than 50% were able to offer half or more of their patients an annual review [54]. Dietetic provision for diabetes was greater in secondary than in primary care (median 9.1 vs. 4.4 h per 100 000 general population per week), and was also greater in those districts in which a dietician was designated as co-ordinator for the dietetic service than in those where the co-ordinator was not a dietician or where there was no co-ordinator [54]. There was a three-fold difference between regions in England (median 6.0–20.2 h per 100 000 general population), with the median for England being lower than for Wales, Scotland and Northern Ireland (10.0 vs. 18.8, 16.7 and 15.8, respectively).

The lack of access to dietetic advice does not in any way reflect a lack of demand. In a questionnaire and focus group survey of the Needs of the Recently Diagnosed Person with Diabetes undertaken by Diabetes UK [166], patients ranked the need for information about diet and eating more highly than any other requirement, and those who reported meeting with a dietician at or near to the time of diagnosis rated this as the most useful aspect of a multidisciplinary service. There was an expressed need for earlier referral to a dietician and for more information about diet. This need is reflected in the calls to the Diabetes UK Careline which constitute the largest single category of enquiries (unpublished data). It is evident that there is a major deficiency in the provision of conventional dietetic care which must be remedied before it will be possible to offer the type of service required for The Expert Patient [8]. At present much dietetic advice, particularly in primary care, is provided by non-dietitians, mainly practice nurses. While there is evidence for the clinical effectiveness of dietetic advice given by professional dieticians (see above), there is, as yet, no such evidence base for dietetic advice given by non-dietitians. Diabetes UK therefore regards it as desirable that dietary advice should be provided by a state-registered dietician [166]. Until there are sufficient dieticians to achieve this objective, dieticians should provide structured education programmes for practice nurses on dietary advice for adults with uncomplicated Type 2 diabetes, with a proviso that most patients who do not achieve objectives for weight loss or metabolic control should be referred to a state-registered dietician, as should any patients who request such a referral or who have questions which cannot be answered by their nurse or doctor. The structured training which practice nurses will require to advise the patient with uncomplicated Type 2 diabetes will be similar to that which they require for prevention of diabetes [6].

Monitoring the provision and effectiveness of dietetic services

Educational goals must be outcome orientated and there must be audit protocols to assess the effectiveness of structured education, of behavioural change programmes and of clinical management [6]. Diabetes UK supports the Clinical Standards Advisory Group (CSAG) [167] recommendations that:

1. All newly diagnosed patients should be offered consultation with a registered dietician within 4 weeks of diagnosis, and the opportunity of at least one further review.
2. Non-crisis dietetic review should be available annually to every person with diabetes.
3. Provision should be made for more frequent review of patients with special problems, including those with dyslipidaemia, perceived poor practice or knowledge, pregnancy and prepregnancy and renal disease.
4. Appropriate practice requires appropriate educational literature and other teaching aids.

The audit of process of dietetic care, as envisaged in the CSAG, is relatively straightforward, albeit time consuming. However, the audit of effectiveness and outcome of dietetic care is more difficult because, except in the context of clinical trials, nutritional advice and counselling is usually just one of a number of interventions. It is therefore important that dieticians are involved in multidisciplinary audit with other health professionals. Dietetic services should also be subject to periodic surveys of patient satisfaction.

Staffing for a district diabetic dietetic service

In 1997 only 69% of dieticians were able to meet the first of the CSAG Standards and fewer than half could meet the second [54], and therefore Diabetes UK increased its recommended provision of dietetic staffing time for diabetes care to 22.5 h per 100 000 general population [54]. This was to be regarded as an overall target and one which would be inadequate in areas with a higher than average prevalence of diabetes as, for example, in those districts with a large Asian population. In 1997 only 15% of areas met this recommendation [54], which is for the clinical management of known cases of diabetes and does not take account of the requirement for prevention. Nor does it take account of the requirement to devote more time to education and counselling of people with diabetes, as envisaged in The Expert Patients Programme [8], the time needed to learn and maintain the skills of behavioural change counselling [161], and the increase in education for other health professionals required by the NSF [6]. The recommendation does, however, still represent a reasonable interim target for clinical management of known cases of diabetes, especially as the great majority of areas have yet to meet this standard. Additional time must be allowed for work on prevention and, in many districts, the case of need for this time could be strengthened by integration with the dietetic implications of the NSF for Coronary Heart Disease [10]. The district lead for dietetic services, who should ideally be a dietician [54], must be a full member of the Local Diabetes Services Advisory Group (LDSAG) because Primary Care Trusts, who are now becoming the major funders of healthcare provision in England and Wales, will usually expect the LDSAGs to prioritize and approve the bids and business cases for additional expenditure on diabetes care.

References

1 Nutrition Sub-Committee of the British Diabetic Association's Professional Advisory Committee. Dietary Recommendations for People with Diabetes. An Update for the 1990s. *Diabet Med* 1992; **9**: 189–202.

2 Ha TKK, Lean MEJ. Technical Review. Recommendations for the nutritional management of patients with diabetes. *Eur J Clin Nutrition* 1998; **52**: 467–481.

3 Franz MJ, Bantle JP, Beebe CA, Brunzell JD, Chiasson JL, Garg A *et al.* Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications. *Diabetes Care* 2002; **25**: 148–198.

4 Diabetes and Nutrition Study Group of the European Association for The Study of Diabetes. Recommendations for the nutritional management of patients with diabetes mellitus. *Eur J Clin Nutrition* 2000; **54**: 353–355.

5 American Diabetes Association Position Statement. Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications. *Diabetes Care* 2002; **25**: S50–S60.

6 Department of Health. *National Service Framework for Diabetes: Standards*. London: Department of Health, 2001.

7 NHS Scotland and Clinical Standards Board for Scotland. *Scottish Diabetes Framework*. Edinburgh: Scottish Executive, 2001.

8 Department of Health. *The Expert Patient: a New Approach to Chronic Disease Management for the 21st Century*. London: Department of Health, 2001.

9 Scottish Intercollegiate Guidelines Network (SIGN). *Management of Diabetes: A National Clinical Guideline*. Edinburgh: SIGN Executive, 2001.

10 Department of Health. *National Service Framework for Coronary Heart Disease*. London: Department of Health, 2000.

11 World Health Organisation. *Obesity, Preventing and Managing the Global Epidemic*. Geneva: WHO, 1998.

12 International Diabetes Institute. *The Asia-Pacific Perspective: Redefining Obesity and its Treatment*. Health Communications Australia Pty Limited, 2000, http://www.obesityasiapacific.com/default.htm

13 Despres J-P, Lemieur I, Prud'homme D. Treatment of obesity: need to focus on high risk abdominally obese patients. *Br Med J* 2001; **322**: 716–720.

14 Anonymous. Why and how should adults lose weight? *Drug Therapeutics Bull* 1998; **36**: 89–92.

15 Boule NG, Haddad E, Kenny GP, Wells GA, Sigal RJ. Effects of exercise on glycaemic control and body mass in Type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. *JAMA* 2001; **286**: 1218–1227.

16 Dhawan J, Bray CL. Asian Indians, coronary artery disease and physical exercise. *Heart* 1997; **78**: 550–554.

17 Department of Health. *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom*. Report of the Panel on Dietary Reference Values of the Committee on Medical Aspects of Food Policy. Report on Health and Social Subjects 41. London: HMSO, 1991.

18 Kratz M, Cullen P, Kannenberg F, Kassner A, Fobker M, Abuja PM *et al.* Effects of dietary fatty acids on the composition and oxidizability of low density lipoprotein. *Eur J Clin Nutr* 2002; **56**: 72–81.

19 Garg A. High-monosaturated fat diets for patients with diabetes mellitus: a meta-analysis. *Am J Clin Nutr* 1998; **67**: 577S–582S.

20 Health Education Authority. *The Balance of Good Health*. London: Department of Health, 1995.

21 Tuomilehto J, Lindstrom J, Eriksson JG, Valle TT, Hamalainen H, Ilanne-Parikka P *et al.* Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 2001; **344**: 1343–1350.

22 Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002; **346**: 393–403.

23 Delahanty L, Simkins S, Camelon K. Expanded role of the dietitian in the Diabetes Control and Complications Trial: implications for clinical practice. *J Am Dietetic Assoc* 1993; **93**: 758–764.

24 UKPDS Group. UK Prospective Diabetes Study 7: Response of fasting plasma glucose to diet therapy in newly presenting type II diabetic patients. *Metabolism* 1990; **39**: 905–912.

25 Franz MJ, Monk A, Barry B, McClain K, Weaver T, Cooper N *et al.* Effectiveness of medical nutrition therapy provided by dietitians in the management of non-insulin dependent diabetes mellitus: a randomised, controlled clinical trial. *J Am Dietetic Assoc* 1995; **95**: 1009–1017.

26 Agurs-Collins TD, Kumanyika SK, Ten Have TR, Adams-Campbell LL. A randomised controlled trial of weight reduction and exercise for diabetes management in older African-American subjects. *Diabetes Care* 1997; **20**: 1503–1511.

27 Paisey RB, Harvey P, Rice S, Belka I, Bower L, Dunn M *et al.* An intensive weight loss programme in established Type 2 diabetes and controls: effects on weight and atherosclerosis risk factors at 1 year. *Diabet Med* 1998; **15**: 73–79.

28 Jones K, Bone A, Gill G, Martin S, Padmore E, Dolan M *et al.* Factors affecting weight loss in obese Type 2 diabetes—the vital role of the dietitian. *Pract Diabetes* 1989; **6**: 18–19.

29 Matthews B, Hayes TM. The effect of dietary advice on diabetic control. *Pract Diabetes* 1987; **4**: 85–86.

30 Brown SA, Upchurch S, Anding R, Winter M, Ramirez G. Promoting weight loss in type II diabetes. *Diabetes Care* 1996; **19**: 613–624.

31 Delahanty LM. Clinical significance of medical nutrition therapy in achieving diabetes outcomes and the importance of the process. *J Am Dietetic Assoc* 1998; **98**: 28–30.

32 Kulkarni KM, Gastle G, Gregory R, Holmes A, Leontos C, Powers M *et al.* Nutrition practice guidelines for type 1 diabetes mellitus positively affect dietitian practices and patient outcomes. *J Am Dietetic Assoc* 1998; **98**: 62–70.

33 Mengham LH, Morris BF, Palmer CR, White AJS. Is intensive dietetic intervention effective for overweight patients with IDDM? A randomised controlled trial in a general practice setting. *Pract Diabetes Int* 1999; **16**: 5–8.

34 Franz MJ, Splett PL, Monk A, Barry B, McClain K, Weaver T *et al.* Cost-effectiveness of medical nutrition therapy provided by dietitians for persons with non-insulin dependent diabetes mellitus. *J Am Dietetic Assoc* 1995; **95**: 1018–1024.

35 Sheils JF, Rubin R, Stapleton DC. The estimated costs and savings of medical nutrition therapy: the Medicare population. *J Am Dietetic Assoc* 1999; **99**: 428–435.

36 Pastors JG, Warshaw M, Daly A, Franz M, Kulkarni K. The evidence for the effectiveness of medical nutrition therapy in diabetes managements. *Diabetes Care* 2002; **25**: 608–613.

37 Henkin Y, Shai I, Zuk R, Brickner D, Zuilli I, Neumann L *et al.* Dietary treatment of hypercholesterolaemia: do dietitians do it better? A randomised controlled trial. *Am J Med* 2000; **109**: 549–555.

38 Rapoport L. Cognitive-behavioural therapy in obesity treatment. In Thomas B ed. *Manual of Dietetic Practice*, 3rd edn. Oxford: Blackwell Science, 2001; 478–482.

39 Doherty Y, James P, Roberts S. Stage of change counselling. In Snoek FJ, Skinner TC eds. *Psychology in Diabetes Care*. Chichester: John Wiley and Sons, 2000; 99–139.

40 Diabetes Control and Complications Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med* 1993; **329**: 977–986.

41 DAFNE Study Group. Training in flexible, intensive insulin management to enable dietary freedom in people with type 1 diabetes: dose adjustment for normal eating (DAFNE) randomised controlled trial. *Br Med J* 2002; **325**: 746–749.

42 Williamson DF, Thompson DJ, Thun M, Flanders D, Pamuk E, Byers T. Intentional weight loss and mortality among overweight individuals with diabetes. *Diabetes Care* 2000; **23**: 1499–1504.

43 Campbell L, Rössner S. Management of obesity in patients with Type 2 diabetes. *Diabet Med* 2001; **18**: 345–354.

44 Prentice AM, Poppitt SD. Importance of energy density and macronutrients in the regulation of energy intake. *Int J Obesity* 1996; **20**: S18–S23.

45 Gamsu DS, Sutton MS, Bennett L, Ward JD. The development of a psychoeducational group intervention for overweight women with type 2 diabetes mellitus: a service evaluation. *Pract Diabetes Int* 2002; **19**: 43–50.

46 National Institute for Clinical Excellence. *Guidance on the Use of Orlistat for the Treatment of Obesity in Adults.* NICE Technology Appraisal, No. 22. London: NICE, 2001; http://www.nice.org.uk

47 National Institute for Clinical Excellence. *Guidance on the Use of Sibutramine for the Treatment of Obesity in Adults.* NICE Technology Appraisal, No. 31. London: NICE, 2001; www.nice.org.uk

48 McNulty SJ, Ur E, Williams G. A randomised trial of sibutramine in the management of obese type 2 diabetic patients treated with Metformin. *Diabetes Care* 2003; **26**: 125–131.

49 Scheen AJ. Prevention of type 2 diabetes in obese patients: first results with orlistat in the XENDOS study. *Rev Med Liege* 2002; **57**: 617–621.

50 Karlstrom B, Vessby B, Eliasson M. Diet—a balanced approach. In Larkins R, Zimmet P, Chisholm D eds. *Diabetes 1988*. Amsterdam: Elsevier, 1989; 923–925.

51 Wolever TM, Hamad S, Chiasson JL, Josse RG, Leiter LA, Rodger NW *et al.* Day-to-day consistency in amount and source of carbohydrate associated with improved blood glucose control in type 1 diabetes. *J Am Coll Nutr* 1999; **18**: 242–247.

52 Mulhauser I, Bott U, Overmann H, Wagener W, Bender R, Jorgens V *et al.* Liberalised diet in patients with type 1 diabetes. *J Intern Med* 1995; **237**: 591–597.

53 Gillespie SJ, Kulkarni KD, Daly AE. Using carbohydrate counting in diabetes clinical practice. *J Am Diet Assoc* 1998; **98**: 897–905.

54 Nelson M, Lean MEJ, Connor H, Thomas BJ, Lord K, Hartland B *et al.* Survey of dietetic provision for patients with diabetes. *Diabet Med* 2000; **17**: 565–571.

55 Camelon RM, Hadell K, Jamsen PT, Ketonen KJ, Kohtamaki HM, Makimatilla S *et al.* The Plate Model: a visual method of teaching meal planning. Diabetes Atherosclerosis Intervention Study. *J Am Diet Assoc* 1998; **98**: 1155–1158.

56 Anderson EJ, Richardson M, Castle G, Cercone S, Dehanty L, Lyon R *et al.* Nutrition interventions for intensive therapy in the Diabetes Control and Complications Trial. *J Am Diet Assoc* 1993; **93**: 768–772.

57 Wheeler ML, Franz M, Barrier P, Holler H, Cronmiller N, Delhanty LM. Macronutrient and energy database for the 1995 Exchange Lists for Meal Planning: a rationale for clinical practice decisions. *J Am Diet Assoc* 1996; **96**: 1167–1171.

58 Wolever TMS. The glycemic index: flogging a dead horse? *Diabetes Care* 1997; **20**: 452–456.

59 Björck I, Liljeborg H, Ostman E. Low glycaemic index foods. *Br J Nutr* 2000; **83**: s49–55.

60 Hettiarachchi P, Jiffry MT, Jansz ER, Wickramasinghe AR, Fernando DJ. Glycaemic indices of different varieties of rice grown in Sri Lanka. *Ceylon Med J* 2001; **46**: 11–14.

61 Foster-Powell K, Miller JB. International tables of glycemic index. *Am J Clin Nutr* 1995; **62**: 871S–890S.

62 Frost G, Dornhorst A. The relevance of the glycaemic index to our understanding of dietary carbohydrates. *Diabet Med* 2000; **17**: 336–345.

63 Axelson M, Arvidsson LR, Lonnroth P, Smith U. Breakfast glycaemic response in patients with type 2 diabetes: effects of bed time dietary carbohydrates. *Eur J Clin Nutr* 1999; **53**: 706–710.

64 Coulston AM, Reaven GM. Much ado about (almost) nothing. *Diabetes Care* 1997; **20**: 241–243.

65 Miller JB, Colagiuri S, Foster-Powell K. The glycemic index is easy and works in practice. *Diabetes Care* 1997; **20**: 1628–1629.

66 Reaven GM, Coulston AM. Response to Brand, Miller *et al. Diabetes Care* 1997; **20**: 1629.

67 Relimpio F, Pumar A, Losada Mangas MA, Acosta D, Astorga R. Adding metformin versus insulin dose increase in insulin-treated but poorly controlled type 2 diabetes: an open-label randomized trial. *Diabet Med* 1998; **15**: 997–1002.

68 Robinson AC, Burke J, Robinson S, Johnston DG, Elkeles RS. The effects of metformin on glycaemic control and serum lipids in

insulin-treated NIDDM patients with suboptimal metabolic control. *Diabetes Care* 1998; **21**: 701–705.
69 Phillips LS, Grunberger G, Miller E, Patwardham R, Rappaport EB, Salzman A. Once-and-twice-daily dosing with rosiglitazone improves glycaemic control in patients with type 2 diabetes. *Diabetes Care* 2001; **24**: 308–315.
70 Chilcott J, Tappenden P, Jones ML, Wright JP. A systematic review of the clinical effectiveness of pioglitazone in the treatment of type 2 diabetes mellitus. *Clin Ther* 2001; **23**: 1792–1823.
71 Raskin P, Rendell M, Riddle MC, Dole JF, Freed MI, Rosenstock J. A randomized trial of rosiglitazone therapy in patients with inadequately controlled insulin-treated type 2 diabetes. *Diabetes Care* 2001; **24**: 1226–1232.
72 UK Prospective Diabetes Study Group. Effect of intensive blood glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). *Lancet* 1998; **352**: 854–865.
73 Horton ES, Clinkingbeard C, Gatlin M, Foley J, Mallows S, Shen S. Nateglinide alone and in combination with metformin improves glycaemic control by reducing meal time glucose levels in type 2 diabetes. *Diabetes Care* 2000; **23**: 1660–1665.
74 Moses RG, Gomis R, Frandsen KB, Schlienger JL, Dedov I. Flexible meal-related dosing with repaglinide facilitates glycaemic control in therapy-naïve type 2 diabetes. *Diabetes Care* 2001; **24**: 11–15.
75 Moses R, Slobodniuk R, Boyages S, Colagiuri S, Kidson W, Carter J *et al*. Effect of repaglinide addition to metformin monotherapy on glycaemic control in patients with type 2 diabetes. *Diabetes Care* 1999; **22**: 119–124.
76 Richard JL, Rodier M, Monnier L, Orsetti A, Mirouse J. Effect of acarbose on glucose and insulin response to sucrose load in reactive hypoglycaemia. *Diabetes Metab* 1988; **14**: 114–118.
77 Kemmer FW, Gudat U, Berger M. Exercise. In Alberti KGGM, Zimmet P, De Fronzo RA eds. *International Textbook of Diabetes Mellitus*, 2nd edn. Chichester: John Wiley and Sons, 1997; 799–815.
78 Diabetes UK. Frequently asked questions. www.diabetes.org.uk/faq/exercise.htm (accessed 2 June 2002).
79 Meeking DR, Cavan DA. Alcohol ingestion and glycaemic control in patients with insulin dependent diabetes mellitus. *Diabet Med* 1997; **14**: 279–283.
80 Bell DSH. Alcohol and the NIDDM patient. *Diabetes Care* 1996; **19**: 509–513.
81 Kerr D, Macdonald IA, Heller SR, Tattersall RB. Alcohol causes hypoglycaemic unawareness in healthy volunteers and patients with Type 1 (insulin-dependent) diabetes. *Diabetologia* 1990; **33**: 216–221.
82 Ben G, Gnudi L, Maran A, Gigante A, Duner E, Iori E *et al*. Effects of chronic alcohol intake on carbohydrate and lipid metabolism in subjects with type II (non-insulin-dependent) diabetes. *Am J Med* 1991; **90**: 70–76.
83 Peveler RC, Davies BA, Mayou RA, Fairburn CG, Mann JI. Self-care behaviour and blood glucose control in young adults with Type 1 diabetes mellitus. *Diabet Med* 1993; **10**: 74–80.
84 Royal Colleges of Physicians, Psychiatrists and General Practitioners. *Alcohol and the Heart in Perspective—Sensible Limits Reaffirmed*. Joint Working Party Report. London: Royal College of Physicians, 1995.
85 Avogaro A, Tiengo A. Alcohol, glucose metabolism and diabetes. *Diabet Metab Rev* 1993; **9**: 129–146.
86 Valmadrid CT, Klein R, Moss SE, Klein BEK, Cruickshanks KJ. Alcohol intake and the risk of coronary heart disease mortality in persons with older-onset diabetes mellitus. *JAMA* 1999; **282**: 239–246.
87 Criqui MH, Golomb BA. Should patients with diabetes drink to their health? *JAMA* 1999; **282**: 279–280.
88 Dormandy J, Heeck L, Vig S. Predictors of early disease in the lower limbs. *Semin Vasc Surg* 1999; **12**: 109–117.
89 Orchard TJ, Dorman JS, Maser RE, Becker DJ, Ellis D, LaPorte RE *et al*. Factors associated with avoidance of severe complications after 25 yr of IDDM. Pittsburgh Epidemiology of Diabetes Complications Study 1. *Diabetes Care* 1990; **13**: 741–747.
90 International Society for Paediatric and Adolescent Diabetes (ISPAD). *Consensus Guidelines on Nutritional Management*. Swift PGF ed. Zeist, the Netherlands: Medforum, 2000; www.d4pro.com/diabetesguidelines/ispad/ (accessed 22 April 2002).
91 Waldron S, Swift PGF, Raymond NT, Botha JL. A survey of the dietary management of children's diabetes. *Diabet Med* 1997; **14**: 698–702.
92 Drake AJ, Smith A, Betts PR, Crowne EC, Shield JPH. Type 2 diabetes in obese white children. *Arch Dis Child* 2002; **86**: 207–208.
93 Sinha R, Fisch G, Teague B, Tamborlane WV, Banyas B, Allen K *et al*. Prevalence of impaired glucose tolerance among children and adolescents with marked obesity. *N Engl J Med* 2002; **346**: 802–810.
94 Crow SJ, Keel PK, Kendall D. Eating disorders and insulin dependent diabetes mellitus. *Psychosomatics* 1998; **39**: 233–243.
95 Bryden KS, Neil A, Mayou RA, Peveler RC, Fairburn CG, Dunger DB. Eating habits, body weight and insulin misuse—a longitudinal study of teenagers and young adults with Type 1 diabetes. *Diabetes Care* 1999; **22**: 1956–1960.
96 Jones JM, Lawson ML, Daneman D, Olmsted MP, Rodin G. Eating disorders in adolescent females with and without Type 1 diabetes: cross sectional study. *Br Med J* 2000; **320**: 1563–1566.
97 Hoffman RP. Eating disorders in adolescents with Type 1 diabetes. *Postgraduate Med* 2001; **109**: 67–74.
98 Peveler RC, Fairburn CG, Boller I, Dunger D. Eating disorders in adolescents with IDDM. *Diabetes Care* 1992; **15**: 1356–1360.
99 Domargard A, Sarnblad S, Kroon M, Karlsson I, Skepper G, Aman J. Increased prevalence of overweight in adolescent girls with Type 1 diabetes mellitus. *Acta Paediatr* 1999; **88**: 1223–1228.
100 Steel JM, Lloyd GG, Young RJ, MacIntyre CC. Changes in eating attitudes during the first year of treatment for diabetes. *J Psychosom Res* 1990; **34**: 313–318.
101 Diabetes Control and Complications Trial Research Group. Effect of intensive diabetes treatment on the development and progression of long-term complications in adolescents with insulin-dependent diabetes mellitus: Diabetes Control and Complications Trial. *J Pediatr* 1994; **125**: 177–188.
102 Herpertz S, Albus C, Kielmann R, Hagemann-Patt H, Lichtblan K, Kohle K *et al*. Comorbidity of diabetes mellitus and eating disorders: a follow-up study. *J Psychosom Res* 2001; **51**: 673–678.
103 Jardine Brown C, Dawson A, Dodds R, Gamsu H, Gillmer M, Hall M *et al*. Report of the Pregnancy and Neonatal Care Group. British Diabetic Association. *Diabet Med* 1996; **13**: S43–S53.
104 Diabetes UK Care Recommendation. Folic acid supplementation in pregnancy. July 2001. http://www.diabetes.org.uk/infocentre/carerec/folic.htm (accessed 7 February 2002).
105 Abrams B, Altman SK, Pickett KE. Pregnancy weight gain: still controversial. *Am J Clin Nutr* 2000; **71**: 1233S–1241S.
106 Rizzo TA, Dooley SL, Metzger BE, Cho NH, Ogata ES, Silverman BL. Prenatal and perinatal influences on long-term psychomotor development in offspring of diabetic mothers. *Am J Obstet Gynecol* 1995; **173**: 1753–1758.
107 Jovanovic L. Time to reassess the optimal dietary prescription for women with gestational diabetes. *Am J Clin Nutr* 1999; **70**: 3–4.
108 Diabetes UK Care Recommendation. Recommendations for the management of pregnant women with diabetes (including gestational diabetes). October 2000. http://www.diabetes.org.uk/infocentre/carerec/preg.htm (accessed 18 April 2002).
109 Walkinshaw SA. Dietary regulation for gestational diabetes (Cochrane Review). In *The Cochrane Library*, Issue 4. Oxford: Update Software, 2001.

110 Dornhorst A, Frost G. The potential for dietary intervention postpartum in women with gestational diabetes. *Diabetes Care* 1997; **20**: 1635–1637.

111 Meneilly GS, Tessier D. Diabetes in the elderly. *Diabet Med* 1995; **12**: 949–960.

112 Elia M. Obesity in the elderly. *Obes Res* 2001; **9**: 244S–248S.

113 Mazzeo RS, Tanaka H. Exercise prescription for the elderly: current recommendations. *Sports Med* 2001; **31**: 809–818.

114 Benbow SJ, Hoyte R, Gill GV. Institutional dietary provision for diabetic patients. *Q J Med* 2001; **94**: 27–30.

115 Gilden JL. Nutrition and the older diabetic. *Clinics Geriatric Med* 1999; **15**: 371–390.

116 American Diabetes Association. Translation of the diabetes nutrition recommendations for health care institutions (position statement). *Diabetes Care* 2002; **25**: S61–S63.

117 British Diabetic Association. *Guidelines of Practice for Residents with Diabetes in Care Homes*. BDA Report. London: BDA, 1999; 48.

118 Gill GV, MacFarlane IA, Tucker N. Diabetes care in British prisons. Existing problems and potential solutions. *Diabet Med* 1992; **9**: 109–113.

119 Cappuccio FP, Cook DG, Atkinson RW, Strazzullo P. Prevalence, detection and management of cardiovascular risk factors in different ethnic groups in South London. *Heart* 1997; **78**: 555–563.

120 Goodwin AM, Keen H, Mather HM. Ethnic minorities in British Diabetic Clinics: a questionnaire survey. *Diabet Med* 1987; **4**: 266–269.

121 Qureshi B. Diabetes in Ramadan. *J R Soc Med* 2002; **95**: 489–490.

122 Burden M. Culturally sensitive care: managing diabetes during Ramadan. *Br J Community Nurs* 2001; **6**: 581–585.

123 Akram H, DeVerga V. Insulin lispro in the treatment of diabetes during the fasting month of Ramadan. Ramadan Study Group. *Diabet Med* 1999; **16**: 861–866.

124 Kadiri A, Al-Nakhi A, El-Ghazali S, Jabbar AAI, Arouj M, Akram J *et al*. Treatment of type 1 diabetes with insulin lispro during Ramadan. *Diabetes Metab* 2001; **27**: 482–486.

125 Belkhadir J, el Ghomari H, Klocker N, Mikou A, Nasciri M, Sabri M. Muslims with non-insulin dependent diabetes fasting during Ramadan: treatment with glibenclamide. *Br Med J* 1993; **308**: 292–295.

126 Govindji A. Dietary advice for the Asian diabetic. *Pract Diabetes* 1991; **8**: 202–203.

127 Klein CJ, Stanek GS, Wiles CE. Overfeeding macronutrients to critically ill adults: metabolic complications. *J Am Diet Assoc* 1998; **98**: 795–806.

128 Matz R. Parallels between treated uncontrolled diabetes and the refeeding syndrome with emphasis on fluid and electrolytes abnormalities. *Diabetes Care* 1994; **17**: 1209–1213.

129 Coulston AM. Clinical experience with modified enteral formulas for patients with diabetes. *Clin Nutr* 1998; **17**: 46–56.

130 Coulston AM. Enteral nutrition in the patient with diabetes mellitus. *Curr Opin Clin Nutr Metab Care* 2000; **3**: 11–15.

131 Wright J. Total parenteral nutrition and enteral nutrition in diabetes. *Curr Opin Clin Nutr Metab Care* 2000; **3**: 5–10.

132 Craig LD, Nicholson S, Silverstone FA, Kennedy RD. Use of a reduced-carbohydrate, modified-fat enteral formula for improving metabolic control and clinical outcomes in long-term care residents with type 2 diabetes: results of a pilot trial. *Nutrition* 1998; **14**: 529–534.

133 Pedrini MT, Levey AS, Lau J, Chalmers TC, Wang PH. The effect of dietary protein restriction on the progression of diabetic and non-diabetic renal disease: a meta-analysis. *Ann Intern Med* 1996; **124**: 627–632.

134 Kasiske BL, Lakatua JD, Ma JZ, Louis TA. A meta-analysis of the effects of dietary protein restriction on the rate of decline in renal function. *Am J Kidney Dis* 1998; **31**: 954–961.

135 Waugh NR, Robertson AM. Protein restriction for diabetic renal disease (Cochrane Review). In *The Cochrane Library*, Issue 4. Oxford: Update software, 2001.

136 American Diabetes Association. Diabetic nephropathy (position statement). *Diabetes Care* 2002; **25**: S85–89.

137 Velasquez MT, Bhathena SJ. Dietary phytoestrogens: a possible role in renal disease protection. *Am J Kidney Dis* 2001; **37**: 1056–1068.

138 Ranich T, Bhathena SJ, Velasquez MT. Protective effects of dietary phytoestrogens in chronic renal disease. *J Ren Nutr* 2001; **11**: 183–193.

139 Mehrotra R, Nolph KD. Low protein diets are not needed in chronic renal failure. *Miner Electrolyte Metab* 1999; **25**: 311–316.

140 Dolecek TA, Olsen MS, Caggiula AW, Dwyer JT, Milas NC, Gillis BP *et al*. Registered dietitian time requirements in the Modification of Diet in Renal Disease Study. *J Am Diet Assoc* 1995; **95**: 1307–1312.

141 Toeller M, Klischan A, Heitkamp G, Schumacher W, Milne R, Buyken A *et al*. and the EURODIAB IDDM Complications Study Group. Nutritional intake of 2868 patients from 30 centres in Europe. *Diabetologia* 1996; **39**: 929–939.

142 Eeley EA, Stratton IM, Hadden DR, Holman RR on behalf of The UK Prospective Diabetes Study Group. UKPDS 18: Estimated dietary intake in Type 2 diabetic patients randomly allocated to diet, sulphonylurea or insulin therapy. *Diabet Med* 1996; **13**: 656–662.

143 Arauz-Pacheco C, Parrott MA, Raskin P. The treatment of hypertension in adult patients with diabetes. American Diabetes Association Technical Review. *Diabetes Care* 2002; **25**: 134–147.

144 Houlihan CA, Allen TJ, Baxter AL, Panagiotopoulos S, Casley DJ, Cooper ME *et al*. A low-sodium diet potentiates the effects of losartan in type 2 diabetes. *Diabetes Care* 2002; **25**: 663–671.

145 Feldstein CA. Salt intake, hypertension and diabetes mellitus. *J Hum Hypertens* 2002; **16**: S48–51.

146 Hermansen K. Diet, blood pressure and hypertension. *Br J Nutr* 2000; **83**: S113–119.

147 Gilleran G, O'Leary M, Bartlett WA, Vinall H, Jones AF, Dodson PM. Effects of dietary sodium substitution with potassium and magnesium in hypertensive type II diabetics: a randomised blind controlled parallel study. *J Hum Hypertens* 1996; **10**: 517–521.

148 Law M. Plant sterol and stanol margarines and health. *Br Med J* 2000; **320**: 861–864.

149 Lichtenstein AH, Deckelbaum RJ, for the American Heart Association Nutrition Committee. Stanol/sterol ester-containing foods and blood cholesterol levels. *Circulation* 2001; **103**: 1177.

150 Vos E. Stanol/sterol margarines; trans fats and benecol. *Br Med J* 2001; bmj.com/egi/eletters/320/7238/861

151 Holmes GK. Coeliac disease and Type 1 diabetes mellitus—the case for screening. *Diabet Med* 2001; **18**: 169–177.

152 Iafusco D, Rea F, Prisco F. Hypoglycaemia and reduction of the insulin requirement as a sign of celiac disease in children with IDDM. *Diabetes Care* 1998; **21**: 1379–1380.

153 Packer SC, Dornhorst A, Frost GS. The glycaemic index of a range of gluten-free foods. *Diabet Med* 2000; **17**: 657–660.

154 Scott EM, Gaywood I, Scott BB, for the British Society of Gastroenterology. Guidelines for osteoporosis in coeliac and inflammatory bowel disease. *Gut* 2000; **46** Suppl. 1: 1–8.

155 Wilson DC, Kainins D, Stewart C, Hamilton N, Hanna AK, Durie PR *et al*. Challenges in the dietary treatment of cystic fibrosis related diabetes mellitus. *Clin Nutr* 2000; **19**: 87–93.

156 Hayes DR, Sheehan JP, Ulchaker MM, Rebar JM. Management dilemmas in the individual with cystic fibrosis and diabetes. *J Am Diet Assoc* 1994; **94**: 78–90.

157 Bloomgarden ZT. Diabetes and nutrition. *Diabetes Care* 2002; **25**: 1869–1875.

158 Heymsfield SB, Segal KR, Hauptman J, Lucas CP, Boldrin MN, Rissanen A *et al*. Effects of weight loss with orlistat on glucose tolerance and progression to type 2 diabetes in obese adults. *Arch Intern Med* 2000; **160**: 1321–1326.

159 Chiasson J-L, Josse RG, Gomis R, Hanefeld M, Avraham K, Laasko M. Acarbose for the prevention of type 2 diabetes mellitus: the STOP-NIDDM randomised trial. *Lancet* 2002; **359**: 2072–2077.

160 Department of Health. National Service Framework for Older People. London: Department of Health, 2001.
161 Doherty Y, Hall D, James PT, Roberts SH, Simpson J. Change counselling in diabetes. The development of a training programme for the diabetes team. *Patient Educ Counselling* 2000; **40**: 263–278.
162 Manning RM, Jung RT, Newton RW. Assessment of the dietary input into a hospital diabetes clinic. *Pract Diabetes* 1994; **11**: 104–105.
163 Pediani L, Bowie P. The benefits of dietitian-led community clinics for people with diabetes: using audit to raise GP awareness. *Pract Diabetes Int* 1999; **16**: 9–11.
164 Robson T, Blackwell D, Waine C, Kennedy RL. Factors affecting the use of dietetic services by patients with diabetes mellitus. *Diabet Med* 2001; **18**: 295–300.
165 Bradshaw C. Does the employment of an on-site dietitian improve the uptake of dietetic care in general practice diabetes clinics? *Pract Diabetes* 1994; **11**: 213–214.
166 Care Interventions Team. *Needs of the Recently Diagnosed*. Report and Recommendations of the Listening Project. London: Diabetes UK, 2001.
167 Clinical Standards Advisory Group. Standards of clinical care for people with diabetes. In *Report of a CSAG Committee and the Government Response*. London: HMSO, 1994.

Appendix—Resource literature and information

Diabetes UK 10, Parkway, London, NW1 7AA, UK.

Available on website (www.diabetes.org.uk)

Information on all currently available resources.
Eating Well with Diabetes

Leaflets and Books for purchase (Diabetes UK, PO Box 400, Swindon SN2 6EJ, UK)

Food Choices and Diabetes, Sweetener Guide
Diabetes: a Guide for South Asian People (available in five Asian languages)
Diabetes Cookbook, Managing your Weight—a Balanced Approach
Quick Diabetic Cooking

Presentation material (E-mail: info@diabetes.org.uk)

A presentation on diet available for loan on slides, Powerpoint or colour acetates.

British Dietetic Association, 148–149 Great Charles Street, Birmingham B3 3HT, UK.

Nutrition Advisory Group for the Elderly. Food and health policies for elderly people.

Multicultural Nutrition Group.