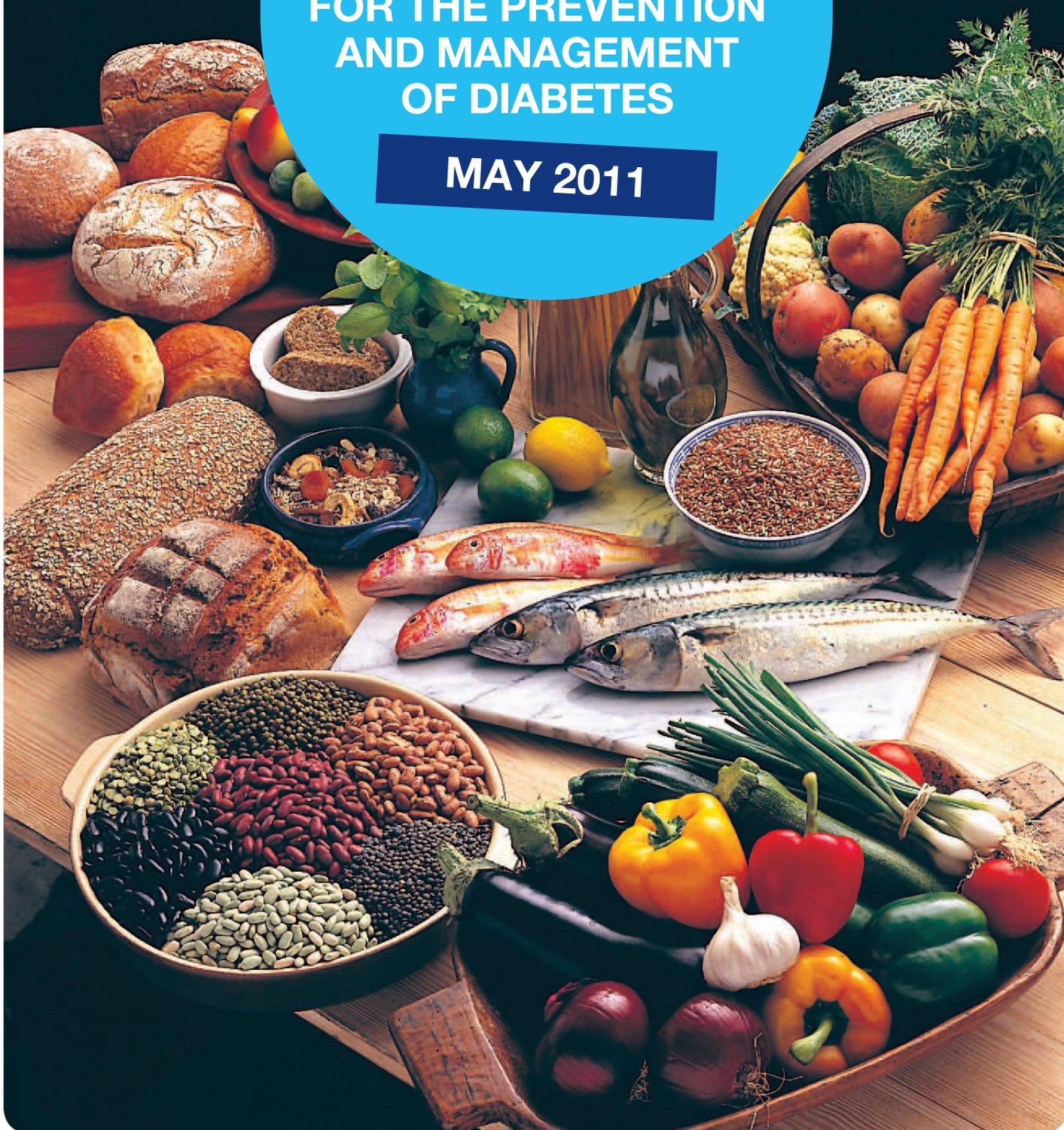


# EVIDENCE-BASED NUTRITION GUIDELINES

FOR THE PREVENTION  
AND MANAGEMENT  
OF DIABETES

MAY 2011



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# CONTENTS

<b>1</b>	Introduction	5
<b>2</b>	Aims and goals	6
<b>3</b>	Nutrition management and models of education	7
<b>4</b>	Prevention of Type 2 diabetes in high risk groups	9
<b>5</b>	Nutrition recommendations for people with diabetes	12
5.1	Glycaemic control for Type 1 diabetes	12
5.2	Glycaemic control of Type 2 diabetes	15
5.3	Weight management	17
5.4	Cardiovascular disease – blood lipids and blood pressure	19
<b>6</b>	Nutrition recommendations for managing diabetes-related complications	22
6.1	Short-term complications (hypoglycaemia)	22
6.2	Long-term complications	23
6.2.1	Macrovascular complications	23
6.2.1.1	Cardiovascular disease	23
6.2.2	Microvascular complications	23
6.2.2.1	Diabetic nephropathy	23
6.2.2.2	Lower limb ulcers (and amputations)	24
6.2.2.3	Gastroparesis	24
6.2.2.4	Retinopathy	24
7.	Additional considerations	25
7.1	Nutrition support	25
7.2	Disorders of the pancreas	26
7.3	Older person	26
7.4	Cystic fibrosis – related diabetes mellitus (CFRD)	26
7.5	Coeliac disease	27
7.6	Pregnancy and lactation	29

7.7	HIV and insulin resistance	30
7.8	Nutrition provided by external agencies	30
7.9	Fasting	30
7.10	Eating disorders	30
<hr/>		
<b>8.</b>	<b>Micronutrients, supplements and functional foods</b>	<b>32</b>
<hr/>		
<b>Appendix One:</b>	<b>Grading scheme for recommendations</b>	<b>33</b>
<hr/>		
<b>Appendix Two:</b>	<b>Overview of major nutrition recommendations included in the guidance</b>	<b>34</b>
<hr/>		

### **Note about these guidelines**

These guidelines represent the view of Diabetes UK, which were arrived at after careful consideration of the available evidence. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. The guidance does not, however, override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

# 1 INTRODUCTION

The purpose of this paper is to provide evidence-based recommendations for the practical implementation of nutrition advice in the UK.

It is almost 10 years since Diabetes UK published dietary recommendations for people with diabetes. Since then the evidence base for nutritional recommendations has been extensively reviewed by the American Diabetes Association (ADA) and the American Dietetic Association. The Diabetes UK nutrition working group of Diabetes UK is in agreement with the conclusions reached in these technical reviews and with the recommendations based on those conclusions.

The literature review for the ADA recommendations was completed in 2006/2007 and the nutrition working group proposed that the new guidelines should be drawn from the existing technical reviews together with a review of published evidenced from 2008 to August 2010.

The nutrition guidelines are relevant to people at high risk of developing Type 2 diabetes and people with Type 1 and Type 2.

Children are not included in the scope of these guidelines. The International Society of Paediatric and Adolescent Diabetes (ISPAD) clinical practice guidelines (2009) have been adopted by Diabetes UK.

The criteria for the grading of recommendations in this document are based upon a paper by Petrie et on behalf of the Scottish Intercollegiate Guidelines Network. (Appendix one)

Many studies rely on surrogate markers rather than hard end points eg studies reporting change in lipid levels rather than cardiac event rates and some of the recommendations made in this document are based upon this type of evidence.

A criticism often made about new guidelines is that they fail to acknowledge previous or competing guidelines [1]. These guidelines address this by adopting a system of signposting relevant, current guidelines for each section and these are highlighted by the following symbol: ⇨

## 2 AIMS AND GOALS

Nutrition management is fundamental for the prevention of Type 2 diabetes and the effective management of both Type 1 and Type 2 diabetes. The purpose of these guidelines is to provide information to healthcare professionals and people living with diabetes about nutritional interventions that will assist them in making appropriate food choices to reduce risk and improve glycaemic control and quality of life, in relation to their diabetes. Advice needs to be based on scientific evidence and then tailored specifically for the individual, taking into account their personal and cultural preferences, beliefs, lifestyle and the change that the individual is willing and able to make. An individual's circumstances may change over time and all advice should be tailored accordingly. Achieving nutrition related goals requires a co-ordinated team approach, with the person with diabetes at the centre of the decision making process. A registered dietitian with specialist knowledge should take the lead role in providing nutritional care. However, it is important that all members of the multi-disciplinary team are knowledgeable about diabetes-related nutrition management and support its implementation.

The beneficial effects of physical activity in the prevention and management of diabetes and the relationship between physical activity, energy balance and body weight are an integral part of lifestyle counseling and have been discussed in this document.

The aim of these Diabetes UK nutritional guidelines is to establish individualised evidence-based recommendations for people with diabetes and those at high risk of developing Type 2 diabetes, which:

- support self management to reduce the risk of Type 2 diabetes and its associated co-morbidities
- promote quality of life and healthy lifestyles
- provide flexibility and meet the needs of all individuals, including those with co-morbidities such as Coeliac disease and Cystic fibrosis.

### 3 NUTRITION MANAGEMENT AND MODELS OF EDUCATION

#### RECOMMENDATIONS

- Nutrition management is effective in people with diabetes and those at high risk of developing Type 2 diabetes, when it is an integrated component of education and clinical care. (A)
- Everyone with diabetes should receive individual, ongoing nutritional advice from a registered dietitian. (A)
- All people with diabetes and/or their carer should be offered structured education at the time of diagnosis with an annual follow-up. (A)
- Education should involve a person-centred approach and a variety of learning styles. (A)

Nutrition and lifestyle education programmes have been shown to be effective in delaying the onset of Type 2 diabetes [2, 3] and in achieving treatment goals for intermediate risk factors such as glycaemia, lipids, and blood pressure [4,5,6].

Structured education programmes are beneficial and clinically effective for individuals with Type 1 and Type 2 diabetes [7, 8, 9, 10, 11,12, 13, 14] and should comply with criteria outlined in National Institute for Health and Clinical Effectiveness (NICE) guidance (see signposts).

Culturally appropriate health education is more effective than the 'usual' health education for people from ethnic minority groups [15]. Educational visual aids are effective tools to support diabetes self-management [8] and are useful when educating individuals whose first language is not English or for those with sub-optimal literacy skills [16]. Telemedicine is an acceptable and feasible form of communication and is another tool that can be used for patient education. However, there is little evidence related to its effect on health outcomes [17,18].

There is consensus that person-centred care and self-management support are essential evidence-based components of good diabetes care [19] resulting in better quality of life, improved outcomes and fewer diabetes-related complications [20].

Nutrition management has shifted from a prescriptive one-size fits all approach to a person-centred approach. A person-centred approach puts the person at the centre of their care and involves assessing the person's willingness and readiness to change, tailoring recommendations to their personal preferences and joint decision making [5]. Training in patient-centeredness and cultural competence may improve communication and patient satisfaction, however, more research is needed to ascertain whether this training makes a difference to healthcare use or outcomes [21,22].

A registered dietitian with expertise in diabetes care should be providing nutrition advice to all people with diabetes or at high risk of developing diabetes. When commissioning specialist diabetes services, it is recommended that there are four whole time equivalent (WTE) diabetes specialist dietitians per 250,000 of the total population [see signposts]. Nutrition and weight management an area of concern for people with diabetes, with many requesting better access to a registered dietitian [23].

Relevant dietetic and nursing competencies for the treatment and management of diabetes, including the facilitation of diabetes self management, have been developed [24,25].

Nutrition interventions and self management group education have been shown to be cost effective [26, 27, 28] in high risk groups [29] and people with Type 1 [30] and Type 2 [31] diabetes and are associated with fewer visits to physician and health services with reductions of 23.5 per cent and 9.5 per cent respectively [32].

- ⇒ NICE (2011) Diabetes in adults quality standards. National Institute of Health and Clinical excellence
- ⇒ NICE (2003) Diabetes (Types 1 and 2) – patient education models. Technology Appraisal TA60. National Institute of Clinical Excellence, London
- ⇒ For diabetes information in different languages, visit the Diabetes UK language centre: [www.diabetes.org.uk/languages](http://www.diabetes.org.uk/languages)
- ⇒ Diabetes UK Task and finish group group report (2010). Commissioning specialist services for adults with diabetes. [www.diabetes.org.uk/SpecialistServices](http://www.diabetes.org.uk/SpecialistServices)

## 4 PREVENTION OF TYPE 2 DIABETES IN HIGH RISK GROUPS

### RECOMMENDATIONS

- Weight loss is the most important predictor of risk reduction for Type 2 diabetes. Weight loss of at least 5 to 7 per cent is effective for Type 2 diabetes prevention. (A)
- Lifestyle interventions that incorporate energy restriction, low fat diets and increased physical activity can effectively reduce the risk of Type 2 diabetes in high risk groups. (A)
- There is no evidence for the most effective dietary approach over another to achieve weight loss and prevent Type 2 diabetes. (D)
- Interventions promoting diet alone, increased physical activity alone or a combination of the two is equally effective in reducing risk. (A)
- Dietary patterns characterised by low intakes of saturated fat and higher intakes of unsaturated fat are protective. (B)
- Diets of low glycaemic index/load and higher in dietary fibre and wholegrains are protective. (B)
- Some specific foods (low fat dairy foods, green leafy vegetables, coffee and moderate intakes of alcohol) are associated with reduced risk of Type 2 diabetes. (B)
- Other foods (red meats, processed meat products and fried potatoes) are associated with increased risk of Type 2 diabetes. (B)

There is now strong evidence from randomised, controlled trials that lifestyle interventions incorporating diet and physical activity can prevent Type 2 diabetes in high risk individuals from different ethnic backgrounds [33, 34, 35] and that intensive lifestyle interventions are rated as very cost-effective [36]. The risk of Type 2 diabetes is reduced by 28 to 59 per cent after implementation of lifestyle change [37], and there is some evidence of a legacy effect, with three trials reporting lower incidences of Type 2 diabetes at 7 to 20 years follow-up beyond the planned intervention period [33, 38, 39].

The main components of these lifestyle interventions included weight loss, reduction in fat intake and increased physical activity. The most dominant predictor for Type 2 diabetes prevention is weight loss; every kilogram lost is associated with a 16 per cent reduction in risk [40]. However, there is little evidence supporting the best approach for weight reduction in people at risk of Type 2 diabetes. The four major randomised trials used largely similar dietary approaches which were characterised by modest energy reduction and reductions in total and saturated fat intake.

This strategy for weight loss is promoted by all major diabetes organisations [41,42] but evidence is emerging that alternative dietary methods may be as effective, including the Mediterranean diet [43], low carbohydrate diets [44] and meal replacements [45]. Further research is needed in this area to identify the optimal diet for weight loss and Type 2

diabetes prevention, and there may be opportunities to increase flexibility in dietary approaches for people at risk of Type 2 diabetes [37].

Most trials of lifestyle interventions to prevent Type 2 diabetes use a combination of diet and physical activity and do not distinguish the individual contributions of each component. One trial has reported that there were no differences in progression to Type 2 diabetes in high risk individuals randomly allocated either diet alone, physical activity alone or a combination of the two [33]. A recent review also states that there is no significant difference between approaches incorporating diet, physical activity or both [46], although there is evidence that in the absence of weight loss, increased physical activity can reduce the incidence of Type 2 diabetes by 44 per cent [40].

Epidemiological evidence from large studies has shown that there are components of the diet that may protect against Type 2 diabetes and these are summarised in the table opposite.

There are also specific vitamins and minerals that have been associated with a lower incidence of Type 2 diabetes, although these are usually taken as supplements rather than obtained from food. Epidemiological evidence suggests that high intakes of Vitamin D and calcium [59] and magnesium [60] may reduce risk, but the effect of chromium remains uncertain [61].

One of the most challenging aspects of Type 2 diabetes prevention remains the general application of positive results from clinical trials. There are on-going studies investigating different strategies in the community [62, 63, 64 ] but at present there is little evidence in translation of the success of randomised controlled trials to public health.

Dietary component	Factors related to reduced risk	Factors related to increased risk
<b>Nutrients</b>		
<b>Carbohydrate:</b>		
Glycaemic index		High GI diets increase risk by 40%. Highest quintile (mean GI = 83.1) associated with 59% increased risk [47]
Wholegrains	Wholegrains have a protective effect. Highest quintile (mean 3.2 servings/day) associated with risk reduction of 31% [48]	
<b>Fat:</b>		
Total and saturated fat	Replacing saturated fat with unsaturated fat has a beneficial effect on insulin sensitivity [49]	
<b>Protein:</b>		
Red meat		Relative risk increased by 26% for each serving increase of red meat [50].
Processed meat		Processed meat increases risk. Highest quintile ( $\geq 5$ servings / week) associated with 46% increased risk [51]. Relative risk increased by 19% for each serving increase of processed meat [52].
<b>Specific foods:</b>		
Dairy products	Dairy products are protective. Each serving/ day increase is associated with a risk reduction of 9 % in men and 4% in women [53,54]	
Fruit and vegetables	Green leafy vegetables reduce risk, an increase of 1.15 servings/day associated with 14% decrease in incidence [55] highest quintile (median 1.42 servings/ day) associated with risk reduction of ~ 30% [56]	
Coffee	4 or more cups/ day decrease risk by 47% [51]	
Alcohol	58% risk reduction associated with 15 – 29.9g/ day (1.5 – 3 UK units) [57]	
Potatoes and fried potatoes		2 weekly servings of fried potatoes increases risk by 16% [58]

## 5 NUTRITION RECOMMENDATIONS FOR PEOPLE WITH DIABETES

### 5.1 Glycaemic control and Type 1 diabetes

#### RECOMMENDATIONS

- Carbohydrate is the main nutritional consideration for glycaemic control in individuals with Type 1 diabetes (A)
- People using multiple daily injections (MDI) and continuous subcutaneous insulin infusion (CSII) benefit from adjusting insulin to carbohydrate intake and should be offered education to support this (A)
- Consistent quantities of carbohydrates on a day-to-day basis are beneficial for those people on fixed insulin regimens (C)
- Increased physical activity offers general health benefits although there is no evidence of benefit in glycaemic control (A)

#### Carbohydrate – amount and type

Carbohydrate is the main nutritional consideration for people with Type 1 diabetes in terms of glycaemic control, and both the amount and type have an effect on post-prandial blood glucose levels.

#### Amount of carbohydrate

There is no evidence for a recommended ideal amount of carbohydrate for maintaining long term glycaemic control in people with Type 1 diabetes. Intervention studies have failed to show any significant effect on glycaemic control of manipulating carbohydrate [65, 66,67,68].

On a meal-by-meal basis, matching insulin to the amount of carbohydrate consumed (carbohydrate counting and insulin dose adjustment) is an effective strategy in improving glycaemic control. Randomised controlled trials have shown carbohydrate counting can improve glycaemic control, quality of life and general well-being [69,70,71,72] without increases in severe hypoglycaemic events, body weight or blood lipids [73, 74]. Carbohydrate counting and insulin adjustment have proven to be efficacious and cost effective in the long term [75]. These strategies can only be utilised by individuals treated by MDI or CSII, where prandial insulin doses can be manipulated according to carbohydrate intake. For individuals on fixed or biphasic insulin regimens, consistency in the quantity of carbohydrate, glycaemic index (GI) and starch on a day-to-day basis are all beneficial and have been positively associated with improved HbA1c levels [76].

#### Type of carbohydrate

The amount of carbohydrate ingested is the primary determinant of post-prandial blood glucose response, but the type of carbohydrate also affects this response. Studies have investigated the effects of glycaemic index, dietary fibre and sugar on glycaemic control.

### **Glycaemic index (GI)**

A Cochrane review reported reductions of 0.5 per cent in HbA1c in people with diabetes adopting a low GI diet, but of the 11 studies included, only 1 related specifically to adults with Type 1 diabetes [77]. Observational studies have shown that dietary GI is independently associated with HbA1c, with intakes of high GI foods showing an association with higher HbA1c levels [78].

### **Dietary fibre**

The effect of dietary fibre on glycaemic control in Type 1 diabetes is unclear. Observational studies suggest that dietary fibre (of any type) is associated with lower HbA1c levels, with an additional benefit of reduced risk of severe ketoacidosis [79]. There is little evidence from randomised controlled trials; all studies in people with Type 1 diabetes are small, short-term and involve daily fibre intakes double that of the guidelines for daily amounts (GDA) of 24g per day. Longer-term (more than six months) studies investigating the benefits of a high fibre intake are scarce [80, 81].

High fibre intakes may be beneficial for the person with diabetes, but the first priority may be to encourage them to achieve GDAs for fibre [42].

### **Sugars and sweeteners**

Sucrose does not affect glycaemic control of diabetes differently from other types of carbohydrates, and individuals consuming a variety of sugars and starches show no difference in glycaemic control if the total amount of carbohydrate is similar [82, 83]. Fructose may reduce post-prandial glycaemia when it is used as a replacement for sucrose or starch [84]. Non-nutritive sweeteners are safe when consumed within the daily intake levels and may reduce HbA1c when used as part of a low-calorie diet [74] (see signpost).

⇒EU Directive. European Parliament and Council Directive 94/35/EC of June 1994 on sweeteners for use in foodstuffs, amended by Directives 96/83 EC and 2003/115/EC.

⇒Diabetes UK position statement on Sweeteners; [www.diabetes.org.uk/sweeteners2](http://www.diabetes.org.uk/sweeteners2)

### **Body weight**

There is no published evidence of a direct relationship between body weight and glycaemic control in people with Type 1 diabetes, although it should be noted that a high HbA1c may be associated with weight loss [85]. There is no published evidence from randomised controlled trials that weight management in itself appears to impact glycaemic control.

### **Physical activity**

Physical activity in people with Type 1 diabetes is not strongly associated with better glycaemic outcomes [70,86, 87] and although activity may reduce blood glucose levels it is also associated with increased hypo and hyperglycaemia [88] and the overall health benefits are not well documented [89,90].

On a day-to-day basis, activity can lead to hyperglycaemia or hypoglycaemia dependant on the timing, type and quantity of insulin, carbohydrate and physical activity [89].

Therapeutic regimens should be adjusted to allow safe participation in physical activity. Activity should not be seen as a treatment for controlling glucose levels, but instead as another variable which requires careful monitoring to guide the adjustment of insulin therapy and/or carbohydrate intake. For planned exercise, reduction in insulin is the preferred method to prevent hypoglycaemia while additional carbohydrate may be needed for unplanned activity [42].

### **Alcohol**

Alcohol in moderate amounts can be enjoyed safely by most people with Type 1 diabetes, and it is recommended that general advice about safe alcohol intake be applied to people with diabetes (see signposts). Studies have shown that moderate intakes of alcohol (1-2 units daily) confer similar benefits for people with diabetes to those without, in terms of cardiovascular risk reduction and all-cause mortality [90,91] and this effect has been noted in many populations, including those with Type 1 diabetes [92].

Recent studies have reported that a moderate intake of alcohol is associated with improved glycaemic control in people with diabetes [93], although alcohol is also associated with an increased risk of hypoglycaemia in those treated with insulin and insulin secretagogues [94]. Hypoglycaemia is a well-documented side-effect of alcohol in people with Type 1 diabetes [95], and can occur at relatively low levels of intake and up to 12 hours after ingestion [96, 97]. There is no evidence for the most effective treatment to prevent hypoglycaemia, but pragmatic advice includes recommending insulin dose adjustment, additional carbohydrate or a combination of the two according to individual need.

There are some medical conditions where alcohol is contraindicated and they include hypertension, hypertriglyceridaemia, some neuropathies, retinopathy and alcohol should be avoided during pregnancy.

⇒ [www.nhs.uk/Livewell/alcohol](http://www.nhs.uk/Livewell/alcohol)

⇒ [www.diabetes.org.uk/Guide-to-diabetes/Healthy\\_lifestyle/alcohol\\_and\\_diabetes](http://www.diabetes.org.uk/Guide-to-diabetes/Healthy_lifestyle/alcohol_and_diabetes)

## 5.2 Glycaemic control and Type 2 diabetes

### RECOMMENDATIONS

- Weight management should be the primary nutritional strategy in managing glucose control in Type 2 diabetes for people who are overweight or obese. (A)
- Regular, moderate physical activity can reduce HbA1c by 0.45 – 0.65 per cent independent of weight loss. (A)
- Focus should be on total energy intake rather than the source of energy in the diet (macronutrient composition) for optimal glycaemic control. (A)
- The total amount of carbohydrate consumed is a strong predictor of glycaemic response and monitoring total carbohydrate intake whether by use of exchanges, portions or experience-based estimation, remains a key strategy in achieving glycaemic control. (A)
- Low GI diets may reduce HbA1c up to 0.5 per cent. (A)

### Weight management

Between 80 and 90 per cent of people with Type 2 diabetes are overweight and approximately 60 -90 per cent of Type 2 diabetes is obesity related [98, 99]. Weight loss is important in people with Type 2 diabetes who are overweight or obese and should be the primary management strategy. Weight loss can also be an indicator of poor glycaemic control; the relationship between blood glucose and weight is not always straightforward. Weight gain is positively associated with insulin resistance and therefore weight loss improves insulin sensitivity [100], features of the metabolic syndrome and lowers triglycerides [101,102,103]. Intensification of therapy is often associated with weight gain. Sulphonylurea and glitazone therapy are associated with mean weight gain of 3kg [104] and initiation of insulin therapy is associated with 5kg weight gain [105].

⇒ See section 5.3 'Weight management', p 17.

### Physical activity

Physical activity has clear benefits on cardiovascular risk reduction and glycaemic control in people with Type 2 diabetes, with a meta-analysis reporting a mean weighted reduction of 0.45 per cent [106] to 0.65 per cent [107] in HbA1c. Different types of activity have different effects, aerobic exercise improves glycaemia and lowers LDL cholesterol by 5 per cent, but has little effect on other lipid levels [108] and resistance training has effects on both glycaemia and cardiovascular risk factors [109].

Studies show it is safe for individuals with Type 2 diabetes who are treated by diet alone or in conjunction with oral hypoglycaemic agents, to exercise in both the fasting and post-meal state [110] with the most beneficial effects on blood glucose levels observed post-prandially when blood glucose levels have more potential to reduce [111]. For individuals treated with sulphonylureas or insulin, care should be taken to minimise the impact of hypoglycaemia which can occur up to 24 hours after physical activity [107].

## **Diet**

There is little evidence for the ideal macronutrient composition of the diet in the management of hyperglycaemia in Type 2 diabetes. Small, short term intervention studies investigating the relationship between macronutrients and glycaemic control have reported contradictory results [112, 113, 114]. Epidemiological evidence has shown a relationship between high fat intake, high saturated fat intake and raised HbA1c levels [115], however intervention studies have failed to show any association between the type and amount of fat in meals and post-prandial glucose response [116, 117, 118, 119, 120, 121, 122].

It is unclear what ideal proportion of macronutrients to recommend for optimal glycaemic control for Type 2 diabetes, but total energy intake and weight loss are significant. Monounsaturated fat can be substituted for carbohydrate without detrimental effect to either lipids or glycaemic control, but saturated fat should be minimised [116, 117, 118, 120]. When protein is substituted for carbohydrate, short-term glycaemic control improves [113,114]. A modest reduction in carbohydrate intake is associated with improvements in glycaemic control and low carbohydrate diets can be particularly effective if associated with weight loss.

- **Carbohydrate**

Although the total amount of carbohydrate ingested is the primary determinant of post-prandial blood glucose response, there is little evidence to support specific strategies for recommendations about carbohydrate intake in Type 2 diabetes. The efficacy of carbohydrate counting in those individuals with Type 2 diabetes treated with insulin is largely unknown. Carbohydrate counting based on insulin to carbohydrate ratio has been shown to be as effective in reducing HbA1c as a simple algorithm based on self-monitored blood glucose (SMBG) [123].

- **Glycaemic index**

Low GI diets have shown improvements in HbA1c of up to 0.5 per cent [77, 124], and the majority of studies have been performed in people with Type 2 diabetes. Although two more recent randomised controlled trials have shown no evidence of benefit of low GI to other strategies [125, 126].

- **Dietary fibre**

Dietary fibre has many health benefits [127], but the impact on hyperglycaemia is limited. Post-prandial glucose levels have been shown to be reduced on high fibre diets (>20g /1,000 kcal) but changes in fasting plasma glucose and lower average plasma glucose levels are not significant [128]. Short term studies have demonstrated little or no effect on blood glucose, insulin or HbA1c [104, 128, 129,130,131].

- **Sugars and sweeteners**

Refer to the section 5.1 'Glycaemic control and Type 1 diabetes', page 13.

## 5.3 Weight management

### RECOMMENDATIONS

- Weight reduction for the overweight or obese person with Type 2 diabetes is effective in improving glycaemic control and cardiovascular risk factors. (A)
- The main requirement of a dietary approach to weight loss is that total energy intake should be less than energy expenditure. (D)
- Dietary, physical activity, surgical, pharmaceutical approaches that are currently recommended for people without diabetes are appropriate and can be adopted by people with diabetes. (D)

There is an absence of evidence for the role of weight loss in people with Type 1 diabetes, but weight management is the most effective treatment for overweight and obese people with Type 2 diabetes and weight loss is associated with a reduction in mortality of 25 per cent [132]. Uncertainties remain over the most effective dietary intervention to promote successful weight loss [133] and the gold standard, the randomised controlled trial, is rarely employed to compare different dietary interventions head-to-head. Studies investigating the effect of weight loss on glycaemic control in Type 2 diabetes have utilised low fat diets (also known as healthy eating), low carbohydrate diets, very low calorie liquid diets (VLCLD), meal replacements, commercial diets and increased physical activity.

#### Low-fat diets

This strategy is the most widely employed in research studies and has generated the greatest amount of evidence [88]. A recent large trial in the United States has shown that lifestyle interventions, including a low-fat diet, significantly reduced body weight, HbA1c and cardiovascular risk factors and these positive changes could be maintained over four years [134].

#### Low-carbohydrate diets

Low-carbohydrate diets have created some controversy, but both a recent review and meta-analysis suggest that they are associated with significant reductions in body weight and improvements in glycaemic control [121, 135]. It has been shown that the main mode of action of low carbohydrate diets is simply a reduction in energy intake due to carbohydrate restriction [136]. Systematic reviews have reported that although these diets may be more effective than comparison diets over the short-term, there is little published evidence from studies in people without diabetes showing benefit over the longer term [44, 137]. Concern has been expressed about the potential adverse effects of these diets, especially on cardiovascular risk, but there remains no evidence of harm over the short term [137].

#### VLCD

VLCLD consist of proprietary formula foods which are the sole source of nutrition and provide a full complement of vitamins, minerals, electrolytes and fatty acids. Both NICE and Dietitians in Obesity Management (DOM UK) (see signposts) recommend that these diets should be used for a maximum of 12 weeks continuously or intermittently with a

low calorie diet. However, the National Obesity Forum (NOF) (see signposts) panel report that there is no compelling requirement to restrict to a maximum duration of 12 weeks if there is adequate support and supervision. There is a suggestion that VLCD may be more effective than other strategies for weight loss in people with Type 2 diabetes [138].

### **Meal replacements**

Meal replacements consist of liquid shakes, soups or bars designed to be eaten in place of one or two meals daily. A meta-analysis reported that partial meal replacements produced greater weight loss than a reduced energy diet over the short term (six months) [139].

### **Commercial diet programmes**

There is an absence of published evidence for the effect of commercial weight loss programmes in people with diabetes. These programmes utilise a variety of interventions including group therapy, dietary advice and physical activity.

### **Physical activity**

Physical activity in isolation is not an effective strategy for weight loss in people with Type 2 diabetes [140] unless 60 minutes per day is undertaken [141]. However, evidence shows that a combination of diet and physical activity results in greater weight reduction than diet or physical activity alone [142]. Physical activity does have positive effects on cardiovascular risk and leads to significant reductions in diastolic blood pressure, triglycerides, fasting glucose [143] and glycated haemoglobin [140, 144].

In terms of dietary strategies for weight loss, encouraging the individual to adopt their diet of choice may well improve outcomes. It is the degree of adherence that will predict outcomes rather than type of dietary strategy [145]. It is intuitive that a diet an individual enjoys and finds acceptable is more likely to succeed [146].

⇒ NICE (2004) Obesity – the prevention, identification, assessment and treatment of overweight and obesity in adults and children. Clinical guidelines CG43. National Institute for Health and Clinical Excellence, London

⇒ [www.domuk.org](http://www.domuk.org)

⇒ [www.nationalobesityforum.org.uk/](http://www.nationalobesityforum.org.uk/)

## 5.4 Cardiovascular disease – blood lipids and blood pressure

### RECOMMENDATIONS

- Saturated fats (SFA) should be limited and replaced by unsaturated fats, predominantly monounsaturated fats (MUFA). (A)
- Daily consumption of foods fortified with plant sterols or stanols (2-3g /d) significantly improve total and LDL cholesterol for people with diabetes, irrespective of statin treatment. (A)
- Reduced sodium intake combined with the Dietary Approaches to Stop Hypertension (DASH) or Mediterranean-style diets can lower blood pressure. (A)
- A Mediterranean-style diet lowers blood pressure and improves HDL cholesterol and triglyceride levels. (B)
- In overweight individuals, a modest amount of maintained weight loss (4.5kg or more) results in improvements in blood pressure. (B)
- In individuals with Type 2 diabetes with elevated levels of blood triglycerides, supplementation with up to 3 gram per day of n-3 marine fish oils (DHA and EPA) can improve blood triglyceride levels without adverse effects. (B)
- Consumption of oily fish, rich in n-3 unsaturated fats, is recommended at least twice per week. (B)
- 30 to 60 minutes of aerobic exercise on a minimum of three occasions per week (minimum of 150 minutes each week) and resistance training at least twice per week lower blood pressure. (B)
- Intakes of trans-fatty acids should be limited. (C)

Individuals with diabetes have a three to four-fold increase in cardiovascular disease (CVD) risk compared to those without diabetes [141] and as a result it is recommended that dietary intervention should reflect those for people with existing CVD. Dietary approaches resulting in a reduction in total and LDL cholesterol and improvements in blood pressure have been shown to improve CVD outcomes in people with and without diabetes [147].

### Fat intake

There remains strong evidence that reductions in saturated fat and replacement with unsaturated fats, particularly monounsaturated fats, are effective in reducing the risk of CVD and form the basis of current recommendations across Europe and the USA [42, 148, 149]. The exact proportion of energy that should be derived from fat is less clear, and studies with percentages of energy from unsaturated fat of up to between 35 and 40 per cent, have resulted in beneficial effects on lipid profiles, blood pressure and weight that equal or are greater than low fat approaches [118, 134, 150].

Recommendations for reduced intakes of Trans-fatty acids (TFAs) should be in line with those for the general population. A recent meta-analysis has shown between a 20 and 32 per cent higher risk of myocardial infarction (MI) or coronary heart disease (CHD) death for every two per cent of dietary energy from TFA isocalorically replacing carbohydrate, SFA, MUFA and PUFA [151].

A meta-analysis of randomised controlled trials (RCTs) which investigated increased poly-unsaturated fatty acid (PUFA) intakes found that advice to specifically increase n-6 PUFA, without also increasing n-3 PUFA, may increase the risk of CHD and death [152].

High intakes of oily fish, rich in n-3 unsaturated fats, are associated with reduced incidence of, and deaths from, CHD [153, 154] and interventions post-MI show reduced mortality in those consuming oily fish at least twice a week [155]. One study has shown an increased risk of CHD mortality in men with angina consuming fish and in particular fish oil capsules, although this increased risk remains unexplained [156].

Although there is some conflicting evidence and concerns of potential adverse effects of fish oils and fish oil supplementation on lipid profiles, there is evidence of the beneficial effects on reducing triglyceride levels for those with elevated blood triglycerides [157]. A Cochrane review confirmed that in this subgroup of patients, n-3 supplementation did not result in any adverse effects and may be a useful therapeutic strategy [158].

## **Salt**

Reductions in salt alone are effective in lowering blood pressure in both normotensive and hypertensive individuals [159], as per the UK guidelines to consume no more than 5–6 grams per day. Studies suggest further benefits from lower levels (3g per day); to achieve this goal would require significant effort from the food industry [160]. There are additional improvements seen when sodium reduction is combined with the DASH approach.

## **Dietary Approaches to Stop Hypertension (DASH)**

The DASH diet reduces cardiovascular risk factors and incorporates elements of a Mediterranean diet, the combined effect of which is greater than those achieved by the individual components. The improvements observed in Mediterranean-style diets are in addition to the effect of any weight loss and are seen in both people with and without diabetes [153, 161, 162].

A recent small UK study has found a high degree of compliance and acceptability with a DASH-style diet [163]. Studies using the DASH approach have shown the diets of participants to contain more calcium, magnesium, fibre, dairy and fruit and vegetables than control diets [164]. A small trial has shown DASH is more effective than potassium, magnesium and fibre supplements for lowering blood pressure in obese hypertensive subjects [165].

### **Dietary fibre**

There are no specific recommendations for individuals with diabetes, but higher intakes, particularly of soluble fibre, may have beneficial effects on blood lipid profiles and reduced risk of CVD and CHD [147]. Reductions of 2–3 per cent for total cholesterol, and up to 7 per cent for LDL cholesterol, may be obtained as a result of high fibre intakes. Intakes of total fibre in line with dietary reference values (DRV), including 10–25 grams per day of soluble fibre, are suggested for those at high risk of CVD [141, 166].

### **Alcohol**

Evidence suggests that more than two alcoholic drinks per day increases blood pressure and that drinking outside of meals may have more impact on hypertension [167, 168]. Low to moderate alcohol intake is associated with lower incidence of CVD, but a reduction in alcohol intake in hypertensive individuals has been shown to be effective in lowering blood pressure, especially if more than two drinks per day are consumed [168]. A systematic review carried out for people with diabetes found one to three drinks per day is associated with between 34 and 55 per cent lower incidence of diabetes-related CHD with no impairment of glucose control [90].

### **Plant sterol or stanol esters**

These are widely recognised to be effective in significantly reducing total and LDL cholesterol, in people with and without diabetes [169]. The reductions in LDL cholesterol are also seen in people already using cholesterol-lowering statin drugs [170]. Intakes of 2–3 grams per day of plant sterol or stanol esters are effective in lowering total and LDL cholesterol and may be recommended.

### **Weight loss**

Weight loss plays an important role in reducing CVD risk. A significant loss of 10 per cent of body weight over 18 months has shown long-lasting benefits for blood pressure in Type 2 diabetes; despite some weight regain [171]. Small reductions in weight and waist circumference (-1.3kg and -1.6cm respectively) have not shown any improvements in blood pressure [172], however 4.5kg or more of sustained weight loss, as part of a lifestyle approach including diet, has been shown to improve diastolic blood pressure [147].

### **Physical activity**

Increased physical activity is associated with reductions in cardiovascular risk in both Type 1 and Type 2 diabetes [88, 106, 173]. The most recent recommendation from the American Dietetic Association [174] suggests that maximum benefit is obtained from undertaking moderate aerobic activity at least three times weekly (a total of 150 minutes per week) together with resistance training at least twice weekly.

## 6 NUTRITION RECOMMENDATIONS FOR MANAGING DIABETES-RELATED COMPLICATIONS

### 6.1 Short-term complications (hypoglycaemia)

#### RECOMMENDATIONS

- 15–20g glucose should be used to treat hypoglycaemia. If glucose levels have not risen above 4mmol/l after 15 minutes, treatment should be repeated. (C)
- A follow up 15–20g carbohydrate snack may be necessary to reduce the risk of further hypoglycaemia. (C)

In people taking insulin or insulin secretagogues, changes in food intake, physical activity or medication can contribute to the development of hypoglycaemia [42]. The goal of treatment is to relieve hypoglycaemic symptoms and limit the risk of injury, while avoiding over-treating.

Glucose is the preferred treatment for hypoglycaemia with a 10g and 20g dose of oral glucose increasing blood glucose levels by approximately 2mmol/l and 5mmol/l respectively [42]. Sucrose may be as effective [175, 176, 177] and may be more palatable. The glycaemic response of a food used to treat hypoglycaemia is directly related to its glucose content, and as fruit juice and sucrose only contain half the amount of carbohydrate as glucose, a larger portion would be needed to produce the same effect [178].

Glucose levels often begin to fall approximately 60 minutes after glucose ingestion [42] hence the practice of introducing a follow-on carbohydrate snack despite the lack of robust supporting evidence. One small study has shown that a follow-on snack providing a more sustained glucose release may be useful to prevent the re-occurrence of the hypoglycaemic episode [179]. Treatment regimens and individual circumstances vary, and although glucose is recommended as a first-line treatment for any hypoglycaemic episode, taking extra starchy carbohydrate may be necessary for prolonged hypoglycaemia. It is recommended that hypoglycaemia treatment strategies are tailored to individual needs.

The prevention of hypoglycaemia is preferable to its treatment. Where lifestyle factors, such as exercise or alcohol consumption, may contribute to hypoglycaemia, proactive steps can often be taken to minimise any risks.

⇒ [www.diabetes.org.uk/hypo](http://www.diabetes.org.uk/hypo)

⇒ See section 5.1, 'Glycaemic control and Type 1 diabetes' page 12.

⇒ Sports advice for people with Type 1 diabetes – [www.runsweet.com](http://www.runsweet.com)

## 6.2 Long-term complications

### RECOMMENDATIONS

- Glycaemic control should be the main focus for preventing and slowing the rate of developing diabetes related complications. (A)
- Nutritional management should be an integral part of the care package. (D)

Glycaemic control is strongly associated with risk and progression of diabetes related complications. However, the role of specific nutrition management in the prevention and management of diabetes related complications is not supported by evidence from randomised controlled trials. As nutritional management is part of the package of care used to improve glycaemic control, good practice would be to offer dietetic advice and support to those with diabetes related complications.

### 6.2.1 Macro-vascular complications

(coronary artery disease, peripheral artery disease and stroke).

#### 6.2.1.1 Cardiovascular disease

There have been no randomised control studies in people with diabetes and cardiovascular disease lasting longer than six months. It is well documented that people with diabetes have the equivalent CVD risk as people with pre-existing CVD and no diabetes and therefore dietary interventions should address this risk.

⇒ Also see section 5.4 'Cardiovascular disease – blood lipids and blood pressure', page 19.

### 6.2.2 Micro-vascular complications

(diabetic nephropathy, neuropathy, retinopathy).

#### 6.2.2.1 Diabetic nephropathy

There are no randomised control trials investigating the effectiveness of the nutritional management of diabetes in kidney disease. One systematic review of the effect of dietary protein restriction in diabetic nephropathy concluded that the evidence was not strong enough to justify the use of protein restriction in the management of diabetic nephropathy [180]. However, this review does recommend that some people may respond to low protein diets and suggests that a six month trial may be initiated, and continued in those that respond.

⇒ British Renal Society – [www.britishrenal.org](http://www.britishrenal.org)

⇒ NICE (2008) Chronic Kidney Disease – early identification and management of chronic kidney disease in adults in primary and secondary care. Clinical guidelines CG73. National Institute of Clinical Excellence, London.

### **6.2.2.2 Lower limb ulcers and amputations**

There is no evidence for the role of diabetes-targeted nutrition in the healing of ulcers or reducing the risk of amputations and this is a field that needs further research. However, the NICE guidance for pressure ulcers [181] and Type 2 diabetes foot care [182] makes reference to the importance of nutrition, the multidisciplinary team (including a dietitian) and structured education.

If an individual needs an amputation, their nutritional status should be assessed and reviewed appropriately, as with all surgical procedures, nutritional support should be offered to those in a poor nutritional state.

⇒ See section 7.1 'Nutrition support', page 25.

### **6.2.2.3 Gastroparesis**

There is very little good quality evidence for effective nutritional management of gastroparesis. Although the evidence is weak, a recent review highlighted that dietary recommendations should rely on measures that promote gastric emptying or at a minimum do not retard emptying. Poor tolerance of a liquid diet is a predictive of a poor outcome [183]. Artificial (post-pyloric) feeding should be offered when nutritional status continues to decline because of gastroparesis [184].

### **6.2.2.4 Retinopathy**

There are no randomised trials specifically investigating the role of diet in the management of diabetic eye disease. However, as the management of glycaemic control is important, dietary review and counselling should again be offered as part of the package of care.

## 7 ADDITIONAL CONSIDERATIONS

### 7.1 Nutrition support

People with diabetes are known to have more frequent admissions to hospital and many will require nutrition support [184]. There is very little published evidence for nutrition support in people with diabetes either in hospital or in the community and the same applies to end of life care. In the absence of evidence, consensus recommendations have been adopted by these guidelines.

#### NUTRITION SUPPORT CONSENSUS RECOMMENDATIONS

- Standard protocols for nutritional support should be followed and adjustment of diabetes medication should be prioritised over dietary restriction.

Nutrition management should be in partnership with the patient and the multi-disciplinary diabetes team with the aim of improving care and optimising glucose control.

Hyperglycaemia is common in hospitalised patients and an important marker of poor clinical outcome and mortality in patients [38]. Optimising glucose control is paramount and is associated with better outcomes in conditions including accidental injury, stroke and critical illness, where hyperglycaemia predicts worse outcomes.

When feeding enterally, either standard or diabetes specific formula may be used but care should be taken not to over-feed as it may exacerbate hyperglycaemia [184]. Adequate diabetes medication should be given to achieve and maintain normoglycaemia.

There is no evidence for the most effective mode of long-term nutritional support for people with diabetes [184], but a systematic review of 23 short-term studies have shown that diabetes specific formulae (containing high proportions of monounsaturated fatty acids, fructose and fibre) significantly reduce postprandial blood glucose levels and reduced insulin requirements with no deleterious effect on lipid levels [184]. However, it should be noted that diabetes-specific formulae are not available in the UK.

Patients requiring parenteral nutrition should be treated with standard protocols and covered with adequate insulin to maintain normoglycaemia.

#### END-OF-LIFE CARE CONSENSUS RECOMMENDATIONS

- Where palliative care is likely to be prolonged, meeting fluid and nutritional requirements should utilise non-intrusive dietary and management regimens.
- Avoid hypoglycaemia or symptoms of overt hyperglycaemia.
- Alterations to insulin doses or diabetes medications may be required due to changes in appetite and body weight or the use of glucocorticoids.

End of life care is an important consideration. The aims of nutrition advice for these individuals are different as the risk of macro- and microvascular complications are no longer relevant. The main emphasis should be on the avoidance of symptoms due to hyper and hypoglycaemia, providing short-term symptomatic relief, while respecting the wishes of the individual.

⇒ <http://www.liv.ac.uk/mcpcil/liverpool-care-pathway/>

⇒ NICE (2006) Nutrition support in adults: oral nutrition support, enteral feeding and parenteral nutrition. Clinical guideline CG32. National Institute for Health and Clinical Excellence, London.

## **7.2 Disorders of the pancreas (including acute pancreatitis, chronic pancreatitis and cancer of the pancreas)**

Nutrition support is essential and the European Society for Clinical Nutrition and Metabolism (ESPEN) have produced nutrition guidelines related to the disorders of the pancreas which have been adopted by these nutrition guidelines. (see signpost)

⇒ [www.espen.org](http://www.espen.org)

⇒ See section 7.1 'Nutrition support', page 25.

## **7.3 Older person**

Nutrition may be compromised as people age, with physical, social and psychological factors all playing a part. There is some evidence that the older person with diabetes may have poorer nutritional status than those without diabetes, both in the community [186] and in hospital [187].

Assessment of nutritional status and support for those who may be malnourished should be available to all elderly people with diabetes.

⇒ NAGE (BDA specialist interest group).

⇒ Diabetes UK Good clinical practice guidelines for care home residents with diabetes (Jan 2010).

## **7.4 Cystic fibrosis related diabetes mellitus (CFRD)**

The prevalence of Cystic fibrosis related diabetes mellitus rises as the age of survival of CF patients increases and has features of both Type 1 and Type 2 diabetes. The onset is insidious and glycaemic status varies as it is influenced by the clinical state of the person.

### **RECOMMENDATIONS**

- Standard nutrition management for cystic fibrosis should be applied to individuals with diabetes. (D)
- Dose adjustment of insulin should be prioritised over dietary restriction. (D)

The UK Cystic Fibrosis Trust Diabetes Working group produced guidelines for the Management of Cystic Fibrosis Related Diabetes Mellitus (currently under review) and these have been adopted by these nutrition guidelines (see signpost)

⇒ [www.cftrust.org.uk/aboutcf/publications/consensusdoc/diabetes.pdf](http://www.cftrust.org.uk/aboutcf/publications/consensusdoc/diabetes.pdf)

## 7.5 Coeliac disease

Coeliac disease is more common in people who have an additional autoimmune condition, such as Type 1 diabetes. Up to 10 per cent of people with coeliac disease will have Type 1 diabetes. There is no increased risk of coeliac disease in people with Type 2 diabetes.

### RECOMMENDATIONS

- An experienced dietitian should provide advice about a gluten free diet and an individualised dietary plan for the person with diabetes. (D)

Coeliac UK has produced guidelines, Dietary management of people with Coeliac disease and Type 1 diabetes, which have been adopted by these nutritional guidelines (see signpost)

⇒ [www.coeliac.org.uk](http://www.coeliac.org.uk)

⇒ NICE (2004) – Type 1 diabetes: diagnosis and management of Type 1 diabetes in children and young people. Clinical guidelines CG15. National Institute for Health and Clinical Excellence, London.

## 7.6 Pregnancy and lactation

### RECOMMENDATIONS FOR PRE-CONCEPTION CARE

- Women with pre-existing diabetes considering pregnancy, are recommended to take 5mg folic acid a day and continue until the end of the twelfth week of pregnancy. (D)
- Women should be supported in positive health choices, including weight management where appropriate, and should seek pre-conception care as part of holistic care prior to subsequent pregnancies. (B)
- Women with pre-existing and gestational diabetes should be offered individualised nutritional education and have access to a multidisciplinary team, including structured education. (C)

Women who are contemplating pregnancy should be referred to specialist services and aim to optimise their glycaemic control at least three months prior to becoming pregnant. Recommended glycaemic targets are outlined by NICE 2008 [188]. The recommendation for a higher than normal folic acid supplement is based upon the higher incidence of neural tube defects in infants born to women with diabetes.

⇒ NICE (2008) Diabetes in Pregnancy. Management of diabetes and its complications from pre-conception to the postnatal period. Clinical guideline 63. National Institute for Health and Clinical Excellence, London.

⇒ Preconception information (video) [www.diabetes.org.uk/RebelRebel](http://www.diabetes.org.uk/RebelRebel)

### **RECOMMENDATIONS FOR ANTENATAL CARE**

- Women should be encouraged to aim for normal glycaemia. (A)
- Encourage appropriate weight gain in relation to the pre-pregnancy BMI. (B)

In addition to the standard healthy eating and food safety advice, women with diabetes should have access to a multidisciplinary team (linking diabetes and obstetric professionals, including an experienced dietitian) so that individualised nutritional care plans can be negotiated.

Although monitoring of weight is not encouraged by NICE, the evidence presented by IOM [189] together with the ADA recommendations [190, 191] and the findings of the Centre for Maternal and Child Enquiries (CMACE) enquiry in the UK [192], suggest that monitoring of weight is justified and weight gains close to that suggested by their pre-pregnancy weight should be encouraged [189].

In gestational diabetes there is evidence to suggest that dietary strategies focusing on low glycaemic index carbohydrates may offer improved glycaemic control [193].

Diabetes in pregnancy is associated with increased risk of hypertension and pre-eclampsia. Although it has been suggested that nutritional supplements might reduce this risk, there is no evidence to support this viewpoint [194, 195].

### **Recommendations for postnatal care**

- Women who are breastfeeding and managing their diabetes with insulin should decrease their insulin dose, consume additional carbohydrate, test more frequently and have hypoglycaemia treatment close to hand. (D)
- Women should be encouraged to set realistic goals regarding dietary behaviour and glycaemic control, which are safe and compatible with having a new baby. (D)
- Women with a history of gestational diabetes should be encouraged to follow a healthy lifestyle and consider weight management if appropriate, after giving birth. (D)

Diabetes is not a contraindication to breastfeeding and where possible breastfeeding should be encouraged in line with World Health Organisation (WHO) recommendations [196]. Breastfeeding may precipitate hypoglycaemia and requires increased frequency of glucose testing, an increased carbohydrate intake and a reduced insulin dose. Evidence of breastfeeding upon glucose levels is limited. However, the protective effects of breastfeeding on the infant and mother, both initially and in terms of chronic disease risk reduction, suggest that where possible it should be encouraged.

Gestational diabetes is a strong predictor of future gestational diabetes and Type 2 diabetes, and women should be encouraged to follow a healthy lifestyle and consider weight management if appropriate after giving birth [193].

## 7.7 HIV and insulin resistance

### RECOMMENDATIONS

- Diabetes pharmaceutical interventions are of limited value in HIV due to interactions with antiretroviral medication. (A)
- Lifestyle treatment guidelines for diabetes prevention and treatment for the general population should be applied in HIV. (D)

Obesity rates in people living with HIV are higher than expected and the metabolic syndrome is present in up to 18 per cent of HIV patients [197]. New diagnoses of HIV remain high [198] and the risk of developing Type 2 diabetes is up to four times higher than the general population.

Insulin resistance should be routinely assessed with HIV, particularly in those at higher risk, eg those with central obesity, lipodystrophy, or with a longer exposure to antiretroviral medication [199].

A meta-analysis indicated that pharmaceutical interventions for diabetes are of limited value in HIV, due to the interactions with antiretroviral medication [200] and evidence suggests that metformin can actually lead to a worsening of lipoatrophy [201]. Therefore, expert opinion suggests lifestyle intervention, as advised for the general diabetes population, should be the primary treatment [202].

## 7.8 Nutrition provided by external agencies (care homes, prisons and hospitals)

Some people with diabetes are not in charge of their own nutrition and have their food provided to them with varying degrees of choice. Although little sound research could be sourced in the UK, common themes were drawn from existing guidelines [203, 204,205,206,207, 208] to formulate **consensus guidelines**, which are listed below:

### CONSENSUS RECOMMENDATIONS

- All staff and carers should have sufficient training and understanding about diabetes and its dietary management.
- Education about food should be provided so that the individual can manage their own food choices where possible.
- All people with diabetes should be offered access to a registered dietitian and have a personalised assessment and nutritional plan as part of their regularly updated care plan.
- Menus, food trolleys, shops and vending machines should include snacks and meals that allow food choices that are in line with the dietary recommendations for people with diabetes.

- Meals and snacks should be made available around appropriate timing of medications.
- People with diabetes who are carbohydrate counting should have access to the carbohydrate values of meals and snacks.

## 7.9 Fasting

Fasting is a significant part of many religions; varying in timings, duration and restriction. Practitioners should be aware that many people with diabetes may choose to fast for their own personal, spiritual or religious reasons despite being exempt. Little evidence is available on which to make recommendations about fasting and most of it usually focuses on Ramadan [209], so consensus guidelines have been formulated:

- Fasting can be safe if a specific individual care plan is put in place that considers adjustments to timing and dosing of medication, frequent blood glucose monitoring and food and drink choices that are made when breaking the fast.
- Considerations should also be made to the carbohydrate and energy density of the food and drink choices.
- Education of the person with diabetes prior to, and possibly during fasting is essential for successful self-management of fasting with diabetes.

## 7.10 Eating disorders

### CONSENSUS RECOMMENDATIONS

- Members of the multi-disciplinary team (MDT) should be alert to the possibility of Bulimia nervosa, Anorexia nervosa and insulin dose manipulation (C)
- The risk of morbidity from poor metabolic control suggests that consideration should be given early to adults with Type 1 diabetes and where appropriate an urgent referral to local eating disorder units may be needed (D)

Eating disorders such as anorexia and bulimia are 2.4 times more likely in teenage girls with Type 1 diabetes [210], the reasons being multi-factorial [211,212, 213]. The deliberate omission of insulin to aid weight loss has serious consequences [214] and is referred to as diabulimia in the media. These eating disorders, in people with Type 1 diabetes, affect physical and emotional health, and can be associated with impaired metabolic control, DKA and increased risk of diabetic complications [212].

Eating disorders also co-exist with Type 2 diabetes, where binge eating seems to be most prevalent among younger women [215].

Although screening tools and treatment guidelines for eating disorders exist (see signposts) and are probably applicable to people with diabetes, they have not been validated for use in diabetes [216]. Most eating disorder guidelines support a multidisciplinary approach and if healthcare professionals involved with diabetes care feel ill-equipped to deal with patients who have eating disorders [217] they should refer the patient to eating disorder units (see signpost).

⇒ NICE (2004) – Eating disorders: core interventions in the treatment and management of anorexia nervosa, bulimia nervosa and related eating disorders. Clinical guideline CG9, National Institute for Health and Clinical Excellence.

⇒ NICE (2004) – Type 1 diabetes: diagnosis and management of children, young people and adults. Clinical guideline CG15. National Institute for Health and Clinical Excellence, London.

⇒ National Centre for Eating Disorders – [www.eating-disorders.org.uk](http://www.eating-disorders.org.uk)

⇒ National Charity for People with Eating Disorders and their Families: B-EAT – [www.b-eat.co.uk](http://www.b-eat.co.uk)

## **8 MICRONUTRIENTS, SUPPLEMENTS AND FUNCTIONAL FOODS**

There has and continues to be research into a range of micronutrients, supplements and functional foods (eg vitamin B3, chromium, magnesium, anti-oxidants, vitamin D, zinc, caffeine, cinnamon, chilli, karela and methi) and their effect on diabetes management or their association in causing the onset of diabetes. However, there is no clear evidence of benefit from vitamin or mineral supplementation in people with diabetes (compared with the general population), who do not have underlying deficiencies [42]. There are varying degrees of evidence from a range of studies looking into other supplements and functional foods. More robust research is required into micronutrients, supplements and functional foods before further recommendations about safety and effectiveness can be made. Individuals choosing to or considering using supplements or functional foods should be encouraged to discuss their individual needs with a registered dietitian or medical practitioner taking into account safety and risks.

### **Note:**

The use of n-3 supplements and plant stanols/sterols is discussed in section five. The use of folic acid supplementation in pre-conception and pregnancy is discussed in section seven.

### **Consensus Recommendations for Diabetic Foods**

- People with diabetes are not advised to purchase 'diabetic' foods.
- If 'diabetic' foods are consumed they should be eaten with caution – considering the laxative effect, fat and calorie content.
- People who are taking insulin and carbohydrate counting should be aware that they may need less insulin as not all the carbohydrate from polyols is absorbed.

Some confectionery, biscuits and bakery products are labelled as 'diabetic' and usually contain polyols as a substitute for sucrose. They are available in a variety of high street outlets including supermarkets, pharmacies, health food shops and from the internet.

The need for special 'diabetic' foods has been obsolete for over 30 years. Diabetes UK and the Department of Health (previously Food Standards Agency) have jointly called for an end to the use of health claims such as 'diabetic' or 'suitable for diabetics' on food labels. In 2008 a report from the Commission on 'diabetic' foods [218] concluded

- people with diabetes should be able to meet their dietary needs by appropriate selection from everyday foods.
- there are no grounds for especially formulated foods for people with diabetes to manage their condition
- that recommendations for special foods for people with diabetes be removed from European regulations.

Labelling a food as 'diabetic' misleads the consumer and implies a health benefit. 'Diabetic' foods are as high in fat and calories as standard products and large amounts could compromise health. They tend to cost more than standard products and this is an issue for those people who are affected by deprivation whom are at a greater risk of developing Type 2 diabetes. Excessive consumption of polyols can cause diarrhoea, flatulence and have a laxative effect. Individuals vary in their tolerance of polyols.

Polyols have fewer calories and less effect on blood glucose levels than sucrose. There is no evidence that the small amount used in these products benefits blood glucose control or weight. It is not exactly clear how polyols should be 'counted' by people who are adjusting their insulin dose according to the amount of carbohydrate they consume, as not all the carbohydrate from polyols is absorbed. Further research is needed.

## APPENDIX ONE

### Grading scheme for recommendations in the “Evidence-based nutrition guidelines for the prevention and management of diabetes”

The criteria for the grading of recommendations in this document are based upon a paper by Petrie et al published on behalf of the Scottish Intercollegiate Guidelines Network. The evidence was reviewed and the recommendations were linked to the evidence supporting them and graded according to the level of evidence upon which they were based, using the grading system below.

It should be noted that the level of evidence determines the grade assigned to each recommendation. The grade does not reflect the clinical importance attached to each recommendation.

Classification of evidence		Factors related to reduced risk	
Ia	Evidence from meta analysis of randomised controlled trials	A	Based on category I evidence
Ib	Evidence from at least one randomised controlled trial		
IIa	Evidence from at least one controlled study without randomisation	B	Based on category II evidence or extrapolated from category I
IIb	Evidence from at least one other of quasi experimental study		
III	Evidence from non- experimental descriptive studies such as comparative studies, correlation studies and case control studies	C	Based on category III or extrapolated from category I or II
IV	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities	D	Based on category IV evidence or extrapolated from category I, II or III

## APPENDIX TWO

### Overview of the major nutrition recommendations in the guidelines

#### Aims of the “Evidence-based nutrition guidelines for the prevention and management of diabetes”

To establish individualised evidence-based recommendations for people with diabetes and those at high risk of developing Type 2 diabetes which:

- support self management to reduce the risk of diabetes and its associated co-morbidities
- promote quality of life and healthy lifestyles
- provide flexibility and meet the needs of all individuals, including those with co-morbidities such as coeliac disease and cystic fibrosis.

#### 3. Recommendations for nutrition management and models of education

- Nutrition therapy is effective in people with diabetes and those at high risk of diabetes when it is an integrated component of education and clinical care. (A)
- Everyone with diabetes should receive individual, ongoing nutritional advice from a registered dietitian. (A)
- All people with diabetes and/or their carer should receive structured education at the time of diagnosis with an annual follow-up. (A)
- Education should involve a patient-centred approach and a variety of learning styles. (A)

#### 4. Recommendations for prevention of Type 2 diabetes in high risk groups

- Weight loss is the most important predictor of risk reduction for Type 2 diabetes. Weight loss of at least 5–7 per cent is effective for Type 2 diabetes prevention. (A)
- Lifestyle interventions that incorporate energy restriction, low fat diets and increased physical activity can effectively reduce the risk of Type 2 diabetes in high risk groups. (A)
- There is no evidence for the most effective dietary approach over another to achieve weight loss and prevent Type 2 diabetes. (D)
- Interventions promoting diet alone, increased physical activity alone or a combination of the two is equally effective in reducing risk. (A)
- Dietary patterns characterised by low intakes of saturated fat and higher intakes of unsaturated fat are protective. (B)

- Diets of low glycaemic index/load and higher in dietary fibre and wholegrains are protective. (B)
- Some specific foods (low fat dairy foods, green leafy vegetables, coffee and moderate intakes of alcohol) are associated with reduced risk of Type 2 diabetes. (B)
- Other foods (red meats, processed meat products and fried potatoes) are associated with increased risk of Type 2 diabetes. (B)

## 5. Recommendations for people with diabetes

### Glycaemic control and Type 1 diabetes

- Carbohydrate is the main nutritional consideration for glycaemic control in individuals with Type 1 diabetes. (A)
- People using MDI and CSII benefit from adjusting insulin to carbohydrate intake and should be offered education to support this. (A)
- Consistent quantities of carbohydrates on a day-to-day basis are beneficial for those individuals on fixed insulin regimens. (C)
- Increased physical activity offers general health benefits although there is no evidence of benefit in glycaemic control. (A)

### Glycaemic control and Type 2 diabetes

- Weight management should be the primary nutritional strategy in managing glucose control in Type 2 diabetes for people who are overweight or obese. (A)
- Regular, moderate physical activity can reduce HbA1c by 0.45–0.65 per cent independent of weight loss. (A)
- Focus should be on total energy intake rather than the source of energy in the diet (macronutrient composition) for optimal glycaemic control. (A)
- The total amount of carbohydrate consumed is a strong predictor of glycaemic response and monitoring total carbohydrate intake whether by use of exchanges, portions or experience-based estimation, remains a key strategy in achieving glycaemic control. (A)
- Low GI diets have been shown to reduce HbA1c up to 0.5 per cent. (A)

### Weight management

- Weight reduction for the overweight or obese person with Type 2 diabetes is effective in improving glycaemic control and cardiovascular risk factors. (A)
- The main requirement of a dietary approach to weight loss is that total energy intake should be less than energy expenditure. (D)
- Dietary, physical activity, surgical and pharmaceutical approaches that are currently recommended for people without diabetes are appropriate and can be adopted by people with diabetes. (D)

**Cardiovascular disease- blood lipids and blood pressure**

- Saturated fats (SFA) should be limited and replaced by unsaturated fats, predominantly monounsaturated fats (MUFA). (A)
- Daily consumption of foods fortified with plant sterols or stanols (2–3g/day) significantly improve total and LDL cholesterol for people with diabetes, irrespective of statin treatment. (A)
- Reduced sodium intake combined with the Dietary Approaches to Stop Hypertension (DASH) or Mediterranean-style diets can lower blood pressure. (A)
- A Mediterranean-style diet lowers blood pressure and improves HDL cholesterol and triglyceride levels. (B)
- In overweight individuals, a modest amount of maintained weight loss (4.5kg or more) results in improvements in blood pressure. (B)
- In individuals with Type 2 diabetes with elevated levels of blood triglycerides, supplementation with up to 3g per day of n-3 marine fish oils (DHA and EPA) can improve blood triglyceride levels without adverse effects. (B)
- Consumption of oily fish, rich in n-3 unsaturated fats, is recommended at least twice per week. (B)
- 30 to 60 minutes of aerobic exercise on a minimum of three occasions per week (minimum of 150 minutes each week) and resistance training at least twice per week lower blood pressure. (B)
- Intakes of trans-fatty acids should be limited. (C)

**6. Recommendations for managing diabetes related complications****Short-term complications: mild to moderate hypoglycaemia**

- 15–20g glucose should be used to treat hypoglycaemia. If glucose levels have not risen above 4mmol/l after 15 minutes, treatment should be repeated. (B)
- A follow up carbohydrate snack (15–20g) may be necessary in order to reduce the risk of further hypoglycaemia. (C)

**Longterm complications**

- Glycaemic control should be the main focus for preventing and slowing the rate of developing diabetes-related complications. (A)
- Nutritional management should be an integral part of the care package. (D)

## **7. Special considerations**

### **Nutrition support consensus guidelines**

- Standard protocols for nutritional support should be followed and adjustment of medication should be prioritised over dietary restriction.

### **End-of-Life Care consensus guidelines**

- Where palliative care is likely to be prolonged, meeting fluid and nutritional requirements should utilise non-intrusive dietary and management regimens.
- Avoid hypoglycaemia or symptoms of overt hyperglycaemia.
- Alterations to insulin doses or diabetes medications may be required due to changes in appetite and body weight or the use of glucocorticoids.

### **Cystic fibrosis**

- Standard nutrition management for cystic fibrosis should be applied to individuals with diabetes. (D)
- Dose adjustment of insulin should be prioritised over dietary restriction. (D)

### **Coeliac disease**

- An experienced dietitian should provide advice about a gluten free diet and an individualised dietary plan for the person with diabetes. (D)

### **Pregnancy and Lactation**

#### **Pre-conception care:**

- Women with pre-existing diabetes considering pregnancy, are recommended to take 5mg folic acid a day and continue until the end of the twelfth week of pregnancy. (D)
- Women should be supported in positive health choices, including weight management where appropriate, and should seek pre-conception care as part of holistic care prior to subsequent pregnancies. (B)
- Women with pre-existing and gestational diabetes should be offered individualised nutritional education and have access to a multidisciplinary team, including structured education (C)

#### **Antenatal care**

- Women should be encouraged to aim for normal glycaemia. (A)
- Encourage appropriate weight gain in relation to the pre-pregnancy BMI. (B)

**Postnatal care**

- Women who are breastfeeding and managing their diabetes with insulin should decrease their insulin dose, consume additional carbohydrate, test more frequently and have hypoglycaemia treatment close to hand. (D)
- Women should be encouraged to set realistic goals regarding dietary behaviour and glycaemic control that are safe and compatible with having a new baby. (D)
- Women with a history of gestational diabetes should be encouraged to follow a healthy lifestyle and consider weight management if appropriate, after giving birth. (D)

**HIV and insulin resistance**

- Diabetes pharmaceutical interventions are of limited value in HIV due to interactions with antiretroviral medication. (A)
- Lifestyle treatment guidelines for diabetes prevention and treatment for the general population should be applied in HIV. (D)

**Eating disorders**

- Members of the MDT should be alert to the possibility of Bulimia nervosa, Anorexia nervosa and insulin dose manipulation (C)
- The risk of morbidity from poor metabolic control suggests that consideration should be given early to adults with Type 1 diabetes and where appropriate an urgent referral to local eating disorder units may be needed (D)

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