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Dietary management in diabetes

Background

Type 1 diabetes is primarily an autoimmune disease and type 2 diabetes is primarily a metabolic condition. However, medical nutrition therapy is an integral part of management for both types of diabetes to improve glycaemic control and reduce the risk of complications.

Objective

To outline the principles of dietary management in type 1 and type 2 diabetes and provide strategies to assist in overcoming common difficulties related to diet.

Discussion

All people with diabetes should be provided with quality professional education on medical nutrition therapy upon diagnosis, and at regular intervals thereafter. For children and adolescent patients with type 1 diabetes, the challenge is to maintain good glycaemic control while providing adequate energy for growth and development. Modification in dietary advice is required, depending on developmental stage. In type 2 diabetes, the initial challenge is to achieve weight loss of 5–10% body weight, normalise blood glucose and reduce cardiovascular risk factors. Specific strategies include a kilojoule controlled diet with reduced saturated fat, trans fat and sodium; moderate protein; and high in dietary fibre and low glycaemic index carbohydrates. Carbohydrates should be spread evenly throughout the day and matched to medication.

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and also at 5–6 years.³ Type 1 diabetes is a disease of disordered immune function involving destruction of the beta cells in the pancreas that secrete insulin in genetically susceptible people. Consequently, people with type 1 diabetes do not produce any endogenous insulin and are dependent on exogenous insulin for life. To achieve optimal glycaemia and overall health, medical nutrition therapy (MNT) and regular physical activity are essential.

Type 2 diabetes is one of the most common chronic diseases in Australia, with rates increasing at approximately 13% per annum since 2000.¹ Rates of type 2 diabetes have increased in parallel with increased rates of overweight and obesity in Australia.⁵ Type 2 diabetes is most common in those aged 45 years or over, and reaches peak prevalence in the 60–64 years age group. However due to increased rates of childhood obesity, children and adolescents are now being diagnosed.¹ Type 2 diabetes is primarily a metabolic disease characterised by insulin resistance and relative insulin deficiency and is strongly associated with obesity in genetically susceptible individuals. Management includes MNT, regular physical activity and/or oral hypoglycaemic agents with the aim to increase insulin sensitivity and/or increase insulin secretion, although eventually many people also require exogenous insulin.

While diabetes is characterised by abnormal glucose metabolism, abnormalities in blood lipids and blood pressure are also common. Consequently, people with diabetes are at an increased risk of developing a range of micro- and macro-vascular complications including: nephropathy, neuropathy, retinopathy, cardiovascular disease and peripheral vascular disease.

There are approximately 1 million people in Australia with diabetes, approximately 13% of these have type 1 diabetes.^{1,2}

Type 1 diabetes is one of the most common childhood diseases in Australia, with rates increasing at 3% per annum since 2000.³ Possible reasons include an increased genetic susceptibility of the population, new or increased exposure to environmental triggers including viral and dietary factors, increased rates of overweight/obesity, as well as an earlier age of onset.⁴ There are two peaks in the age of onset: the major peak at 10–14 years

Dietary management in diabetes

The primary objectives of dietary intervention are essentially the same for both type 1 and type 2 diabetes.⁶

- Achieve and maintain blood glucose and blood pressure levels in the normal range, or as close to the normal range as safely possible, and achieve and maintain a lipid and lipoprotein profile to reduce cardiovascular disease risk
- Achieve and maintain a healthy body weight
- Prevent, or at least slow, the development of the complications of diabetes
- Consider personal and cultural food preferences and an individual's willingness to change
- Maintain the pleasure of eating by only limiting food choices when indicated by scientific evidence.

Management in type 1 diabetes

Dietetic advice is required at the initial diagnosis of type 1 diabetes, with follow up 2–4 weeks later and regular (at least annual) review thereafter. The nutritional management

of children with type 1 diabetes focuses on providing adequate energy for growth and development, and may initially require additional energy intake to compensate for weight loss before diagnosis. Appetite and activity levels change as children and adolescents grow into adulthood, and dietetic advice needs to be modified accordingly.⁷

The recommended meal plan should consider usual appetite, food intake patterns, level of exercise and insulin regimen (*Table 1*). Recommendations are based on healthy eating principles of three balanced meals per day, healthy snacks, and regular physical activity.⁸ A key aspect of MNT is advice on carbohydrate amount, type and distribution over the day, taking into account the age of the individual (*Table 2*) and their insulin regimen (*Table 1*).⁶

When using intensive insulin therapy regimens, education about carbohydrate quantification is essential to allow adjustments in insulin dose. In clinical practice, a number of methods for carbohydrate quantification are commonly taught, including 1 g increments, 10 g portions and 15 g exchanges. Recent studies have demonstrated that carbohydrate

counting is difficult and repeated age appropriate education by experienced health professionals is necessary to maintain accuracy in estimations.^{9,10} Although intensive regimens increase flexibility in food intake, regularity in meal routines and monitoring blood glucose levels at least four times daily remain important for optimal glycaemic control.

Dietary advice for all people with type 1 diabetes should include education regarding the glycaemic index (GI).¹¹ Low GI foods are encouraged as these foods minimise the postprandial glycaemic excursion and improve long term glycaemic outcome.¹² Low GI foods (such as some wholegrain breads, most pasta, legumes, temperate climate fruits, milk and yoghurt) cause a gradual sustained rise in postprandial blood glucose levels and improved long term glycaemic control compared to high GI foods that produce dramatic fluctuations in postprandial blood glucose levels. Low GI foods should be incorporated at all meals and snacks and used instead of high GI foods where practical.

When dealing with children, it is important to involve the whole family in making dietary

Table 1. Recommended meal plans for different insulin regimens

Insulin regimen	Meal structure and dietary considerations
Twice daily mixed insulin doses	Three meals and three snacks per day at regular times to balance the insulin action profile Consistent carbohydrate quantities from day-to-day Treat hypoglycaemia with one short acting carbohydrate followed by a long acting carbohydrate
Multiple daily injections using rapid acting insulin pre-meals and long acting insulin as basal dose • Greater flexibility in meal timing and meal quantities as able to change meal time insulin dose and timing	Snacks between meals are optional and should not exceed 1–2 carbohydrate serves (eg. 15–30 g carbohydrate) unless an additional injection is given ²⁰ Requires knowledge of carbohydrate counting for insulin dose adjustment at meal times Treat hypoglycaemia with short acting carbohydrate only
Insulin pump therapy • Provides a continuous subcutaneous infusion of basal insulin, with bolus dose given to match carbohydrate quantity eaten • Offers greatest flexibility in meal timing and quantities (ideal for teenagers who sleep late/stay out late, or for toddlers with erratic eating habits) ²¹	Basal rates, insulin: carbohydrate ratios and correction factors are individually calculated Bolus type and dose can be adjusted to match meal composition, hence better mimics physiological need Carbohydrate counting knowledge is essential as it must match bolus insulin to all the carbohydrate eaten at both meals and snacks Pre-prandial insulin bolus ideally given for best glycaemic outcome Missed meal time insulin bolus is the biggest contributor to poor glycaemic outcome Treat hypoglycaemia with short acting carbohydrates only

changes. Advice should focus on decreasing the intake of sweetened drinks and saturated fat while increasing the intake of wholegrain breads and cereals (preferably with a low GI), fruit, vegetables and low fat dairy products (except

children less than 2 years of age who require regular fat dairy foods).¹³ 'Diabetic foods' are not recommended (other than diet soft drinks) because they are not necessary, expensive, often high in fat, and may contain sweeteners with

laxative effects.

Maintenance of an appropriate body weight is a key strategy of care for people with type 1 diabetes. Additional contributing factors to excessive weight gain may be:

- over-insulinisation
- snacking to match insulin peaks, and
- excess energy intake to avoid or treat hypoglycaemia.

Guidance on appropriate food quantities for treatment of hypoglycaemia and food/insulin adjustment for exercise can be provided by an Accredited Practising Dietitian (APD).

Disordered eating and coeliac disease are more common in individuals with type 1 diabetes than in their nondiabetic peers.¹⁴ These conditions require extra education and dietary intervention with more frequent dietetic review, and should be referred accordingly. *Table 3* includes examples of common difficulties for patients relating to dietary management, and suggested solutions.

Management in type 2 diabetes

People with type 2 diabetes require dietetic advice at diagnosis (preferably within 1 month), a follow up visit 3 months after initial dietary intervention, and should receive ongoing MNT every 6–12 months.¹⁵ Due to the high prevalence of overweight and obesity in this group, and its primary role in the aetiology of the condition, weight loss of 5–10% of initial body weight at diagnosis is a primary objective, along with management of hyperglycaemia, hyperlipidaemia and/or hypertension. This can be achieved through a diet in which energy intake is balanced with regular physical activity, and one that is low in saturated fat and sodium and high in fibre and low GI carbohydrates. It is worth noting that reducing energy intake, regardless of dietary composition, and regular dietary counselling and support are the most likely predictors of successful weight loss.^{16,17}

It is important to limit the intake of saturated fat and avoid trans fats to assist with weight management, improve insulin sensitivity, and reduce blood lipids to decrease overall cardiovascular disease risk.

Carbohydrate intake should be spread out evenly over the day to assist with blood glucose management. For patients taking insulin and

Table 2. Common issues to consider at each life stage

Age group	Issues to consider
Toddler	<p>Encourage eating the usual family diet. Offer finger foods to encourage self feeding. Discourage offering a bottle for 'easy' carbohydrate intake</p> <p>Decreased appetite, food refusal and food fads are common. It is important continual 'grazing' and excessive milk consumption do not make these usual toddler behaviours more difficult</p> <p>Regular carbohydrate intake is required to prevent hypoglycaemia on twice daily insulin doses. Offer routine meals and snacks throughout the day</p> <p>Insulin pump therapy is beneficial in managing toddler eating behaviours.^{21,22} It is preferable that pre-prandial insulin doses are given, but dose can be split to pre-prandial and during the meal when eating is erratic or new foods are offered. It is important that carbohydrate quantities as small as 5 g are covered by insulin</p>
School aged children	<p>Blood testing during the school day is recommended for all children</p> <p>Meal and snack routine should ideally be incorporated into the usual school timetable</p> <p>Late/delayed morning tea is a common issue with the break between breakfast and snack too long, potentially causing hypoglycaemia. Recommend eating an extra carbohydrate snack on the way to school or before first bell so blood glucose remains stable until morning tea</p> <p>Children need to have understanding of the carbohydrate in foods to ensure appropriate distribution over the school day</p> <p>Avoid excessive eating at afternoon tea, which can contribute to evening hyperglycaemia. Either eat more during the day to spread carbohydrate more evenly or consider an extra dose of insulin in the afternoon to cope with extra carbohydrate load at snack time</p> <p>Extra carbohydrates for activity is required only for additional strenuous activity and is not needed for usual active play</p>
Teenagers	<p>Challenging behaviours in this age group include: smoking, drinking alcohol, staying out late, sleeping in, skipping insulin and missing meals</p> <p>Emphasis should be placed on the importance of routine meals and snacks, particularly during periods of rapid growth to prevent excessive afternoon or evening snacking</p> <p>Disordered eating habits can be an issue that clashes with diabetes management and may require specialist dietetic support</p> <p>Negotiations around, and consideration of, an insulin management regimen to suit lifestyle is important</p> <p>Alcohol can cause delayed hypoglycaemia and advice needs to be given about moderate alcohol consumption and regular carbohydrate intake when drinking</p> <p>Participation in competitive sport requires appropriate insulin adjustment, appropriate timing and quantity of carbohydrate intake, and adequate fluid to optimise performance</p>

some types of oral medications, carbohydrate intake should be matched with the action of their medication. Carbohydrate should come mainly from fibre rich fruits, vegetables, wholegrains and legumes, as well as low fat dairy products (milk and yoghurt), preferably with a low GI.¹¹

It is generally advisable for people with diabetes to avoid high protein diets due to

possible negative effects on kidney function and a lack of evidence for long term benefits.

Alcohol should be limited to no more than two standard drinks per day.¹⁸

Regular physical activity should also accompany dietary changes and ideally should include at least 150 minutes per week of moderate intensity aerobic exercise and

resistance training three times per week unless there are contraindications.¹⁹

Referral to other health professionals

General practitioners can refer patients with diabetes to an APD for a maximum of five allied health services using the Medicare Enhanced Primary Care plan. Alternatively, GPs can refer to an APD and either a credentialed diabetes educator or accredited exercise physiologist for group sessions.

Resource

To find an APD in your local area, visit the 'Find an APD' section of the Dietitians Association of Australia website at www.daa.asn.au or telephone 1800 812 942.

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Table 3. Clinical scenarios in paediatric type 1 diabetes

'My daughter refuses to eat breakfast before going to school and I'm worried that she will hypo on the way to school. What should I do?'

Skipping breakfast is not an option for any child with diabetes. Breakfast is an important meal to start the day. Make sure there is plenty of time to enjoy a good breakfast. Milkshakes, fruit smoothies and hot flavoured milk drinks are good starters. Alternatively, the child may prefer two small snacks (one at breakfast and one on the way to school). This will ensure sufficient carbohydrate intake to minimise the risk of a hypo.

'My child is very active during play time at school so I pack a lolly in his lunchbox every day to prevent a hypo. He eats more lollies now than he ever did before he was diagnosed with diabetes. Does this seem right?'

Your child should not need lollies every day to prevent hypos. Even if he is very active at play, his regular insulin dose and usual food intake should be adjusted to be appropriate for his usual level of activity. Additional carbohydrate foods are only required for extra strenuous activity. If you find that your child needs extra foods regularly, adjust the insulin dose appropriately.

'I eat too much after school, then have high blood glucose readings and am never hungry at the evening meal. I'm on an insulin pen, but still can't seem to get my levels right!'

Your levels are high because you are eating large quantities for afternoon tea at the time when you don't have an adequate amount of insulin on board, hence the high blood glucose reading.

Watch your food choices. High fat, high GI snack foods (eg. chips and biscuits) do not readily satisfy the appetite. Alternatively, choose healthy low GI foods that will satisfy your appetite and have less impact on your blood glucose (eg. reduced fat milk, grainy toast, cereal or fresh fruit). On an insulin pen regimen, snacks are optional. If your snack is limited to 1–2 serves (eg. 15–30 g) of carbohydrate, there is usually an adequate amount of background insulin to cope with that. Snacks larger than two serves either need to be reduced or consider taking an extra insulin dose to accommodate it. Try to work out why you are so hungry. Are you eating enough during the day, particularly at lunch or are you skimping on breakfast?

'I am very active and attend footy training three afternoons a week. I always eat extra foods before training but seem to hypo late evening after each session. Is there something more I should be doing?'

Delayed hypoglycemia after strenuous activity is usually an indication that either more carbohydrate or less insulin is required. Glucose stored in the liver may have been used during the activity and it is not until later in the evening, when the body tries to replenish its stores, that the hypo occurs. This can be prevented by eating more carbohydrates immediately after the event or at supper time. Alternatively, reduce your insulin dose. Ensure that the carbohydrate foods in your evening meal and supper are based on low GI food choices to sustain blood glucose levels overnight.

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