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The Peer Reviewed Journal of Clinical Practice

Nutrition and diabetes

Reprint Collection

Six steps to a healthy lifestyle

The glycaemic index explained

How to read food labels

Fat facts: dietary facts

Sugar and salt: a recipe for problems

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The articles in this reprint collection were originally published in *Medicine Today*, November 2006 to August 2008.

Nutrition and diabetes

The articles and patient handouts in this collection based on *Medicine Today's* Nutrition Titbits series provide health professionals with useful information about important nutritional topics and practical tips and resources for patient education. We have a bias towards diabetes-related issues and the topics featured reflect this, for the reasons listed below.

- Glycaemic index – because of the many myths and misunderstandings about this simple and useful concept.
- Food labels – because the information contained on packaged food labels often confuses people but can make healthy food choices simpler.
- Fats – because people often do not understand the differences between the various forms of fats (monounsaturated, polyunsaturated, saturated, cis, trans, omega-3 and omega-6 fats, and the sterols) and may miss the key points of 'trans and saturated fats are bad, monounsaturated fats are good, and less is best'.
- Sugar and salt – because sugar intake is the main concern of most people with diabetes and the importance of sodium intake is underestimated in these patients who are at increased risk of hypertension, heart failure and peripheral oedema.
- Fibre – because there are various types of fibre, making this a potentially confusing topic that often does not get the attention it deserves.
- Alcohol – because of the particular alcohol-related problems that can occur in people with diabetes and the 2009 NHMRC recommendations on daily alcohol intake.
- Healthy lifestyle in general – because it is easy to get lost in all the expert guidelines, recommendations and consensus statements. There are six simple steps that may help in patient counselling and may make healthy choices easy choices.

The articles and patient handouts were originally published between 2006 and 2008 and have been updated as necessary for this publication.

We hope you find the topics interesting and the tips and resources useful in your daily practice. MT

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Six steps to a healthy lifestyle - the keystone in managing type 2 diabetes

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Setting small, gradual goals can make it easier for patients with type 2 diabetes to attain a healthy lifestyle.

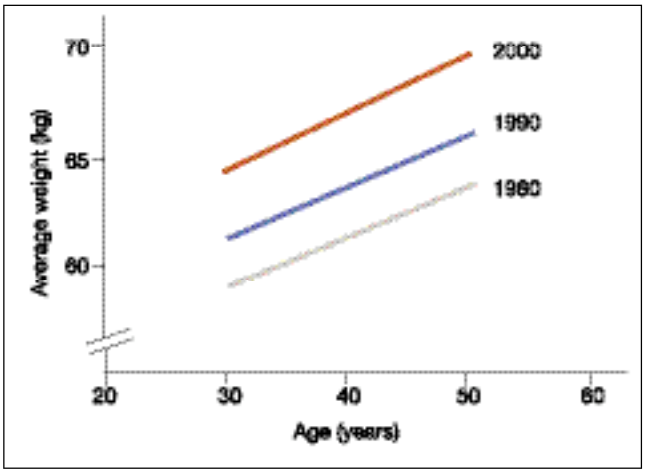

Figure 1. The increase in the average weight of Australian women aged 20 to 50 years from 1980 to 2000. As individuals we gain approximately 0.5 kg per year. As a nation the average Australian of any age gets fatter.

People with diabetes and their health professionals accept that having a healthy lifestyle is the keystone of diabetes management. But those people who have to adapt their lifestyle so it becomes healthy can find the necessary changes hard to accept. The 'healthy' choices are often hard choices and may require significant changes to the way people structure their day, do their shopping and cooking, and interact with friends and family.

This article outlines six steps to a healthy lifestyle and suggests a monitoring scheme to keep daily eating and activity on track.

Diet and exercise – too hard

'I know I should, but …'.

A diet is often perceived as a punishment, a deprivation and something imposed by an authority. People are told not to eat many of the foods they value and enjoy and to eat foods that they despise and dislike. As one patient put it, 'diet is die with a t'.

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Exercise often conjures up thoughts of muscular men and trim women jogging, cycling, doing aerobics and lifting weights; generally huffing and puffing and sweating. After all, 'no pain, no gain'. Many people have not done more than walk from the car park to the supermarket for years, and now they are expected to 'exercise'.

No wonder people with diabetes think that stopping eating the foods they like and starting activities they will find painful and embarrassing is 'too hard'.

And they are usually right. Most people do find it 'too hard' and cannot do it. Long-term adherence to, and success in, diet, exercise and weight-loss programs are rare.[1] After 12 months, most people have slipped back into their old habits and regained any weight they lost, plus the 0.5 kg per year that the average Australian gains (Figure 1).

Healthy lifestyle – easier

The goal sounds too simple – 'eat less and walk more'. If that is all there is to it why do most Australians gain weight and get less fit each year? People really can change their lifestyle. For many, the best approach is to try a series of achievable steps that add up to a significant and sustainable change over a one- to two-year time period.

The six steps to a healthy lifestyle

1. Aim for weight loss (or waist loss) if overweight

Most people with type 2 diabetes are either overweight or obese – that is, they have a BMI value of 25 kg/m^2 and over or 30 kg/m^2 and over, respectively.

No one likes to be told that they need to lose weight, but this is often the first advice given to patients once they have been diagnosed with diabetes. The benefits of weight loss can be great for someone with diabetes, including decreased insulin resistance, improved glycaemic control, improved blood lipids and reduced blood pressure.

The good news for patients is that even modest weight loss of about 5% of starting weight can be beneficial.[2] Encourage patients to set weight-loss goals. Refer them to local support programs and dietetic services. Community health centres and councils often have information about lifestyle programs in the local community.

Focusing on 'waist loss' rather than 'weight loss' is another useful approach,

Waist circumference

For men

Healthy waist: under 94 cm
Over waist: 94 to 102 cm
Very over waist: over 102 cm

For women

Healthy waist: under 80 cm
Over waist: 80 to 88 cm
Very over waist: over 88 cm

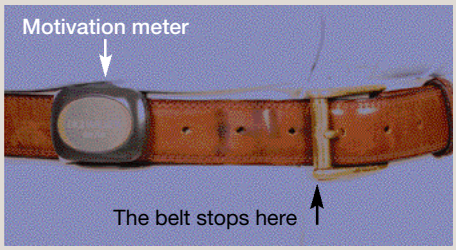

Figure 2. A 'belt lifestyle monitor'.

Tips for taking an accurate patient waist measurement

- Measure directly over the skin if possible (or over light clothing)
- Take the measurement after patient exhales normally
- The tape measure should be firm but not tight and kept parallel to the floor
- Keep the tape measure at the mid-way point from top of hip bone and bottom of lowest rib (roughly in line with the navel)

Tips for eating less

- Drink a glass of water before eating and with your meal
- Use a smaller plate
- Eat slowly
- Chew your food many times
- Put your fork down between mouthfuls
- Sit down while eating
- Eat with others and discuss the food you are eating
- Eat away from distractions (such as the television) and take time to savour your food
- Freeze left-overs straight away or only make enough food for one meal

especially for those people who are reluctant to step on the scales. Waist circumference is a valid measure of abdominal fat mass and disease risk.[3] Both men and women should lose some of their waist so that their belt fastens on a few notches smaller. Ideally, men should have a waist circumference of less than 94 cm and women, less than 80 cm (see the box above).

2. Eat less food

Most people eat not because they are hungry but because it is a mealtime or snacks are easily available. There is the tendency for people to keep eating until they are full and to think it is rude not to clear the plate or to refuse seconds or dessert. They may eat large amounts of food while they are watching TV and not even wait until they have finished one mouthful before taking the next. Often they do not even enjoy their food.

Some tips for eating less food are outlined in the box on this page.

3. Less energy-dense foods and drinks

The 'big three' energy foods are fat, alcohol and added sugar (sucrose), weighing in at approximately 36, 28 and 16 kJ/g (9, 7 and 4 kcal, respectively). Food and drink high in these three ingredients are the so-called 'empty foods' that provide energy but often not many other nutrients. Encourage people to find the fat, seek the sugar and assess the alcohol in their daily intake. All three can be easily identified and there are palatable ways to reduce fat and added sugar in foods, both during food preparation and at the table.

People with diabetes are advised to seek lean low-fat red meats as sources of iron and low-fat dairy products as sources of calcium. Soy milk products are low in calcium unless fortified.

Some fats are better than others. Saturated and trans fats are associated with increased LDL cholesterol and cardiovascular risk, while mono and polyunsaturated fats (omega-3 and omega-6 fats) improve the lipid profile and decrease cardiovascular risk.

Many animal foods and processed foods are high in saturated and trans fats, as are some vegetable oils (such as coconut and palm). Food sources of saturated and other fats are listed in Table 1.

Food labels list the ingredients of foods, and people can learn to identify foods likely to be high in saturated or trans fat and/or high in added sugar, and then their healthier alternatives. Table 2 is a guide of what to look for on the nutrition panels of food labels.[4]

The 2009 NHMRC Alcohol Guidelines advises no more than two standard drinks per day (20 g) for all Australians, a reduction for men but not for women from the previous recommendations.[5]

4. Eat low-GI carbohydrates

It is recommended that 45 to 65% of food energy be provided by carbohydrate.[6] Carbohydrate foods with a low glycaemic index (GI) release glucose more gradually and may cause lower postprandial blood glucose values.[7] The slow release of glucose may also reduce the risk of hypoglycaemia between meals for those on insulin or sulfonylurea therapy. Because low-GI foods are generally more filling than high-GI alternatives, people may find it easier to limit their total intake. Examples of low-GI foods include wholegrain breads, legumes and fruits such as apples and pears. Some low-, moderate- and high-GI foods are listed in Table 3.[8]

continued

Table 1. Types of fats found in foods

Unhealthy fats

Saturated and/or trans fats

Fats

Butter, lard, copha, cooking margarine, hydrogenated margarines, ghee, dripping, dairy blends, vegetable shortening

Cream, sour cream

Fatty meats

Chops, poultry skin, chicken wings, fatty mince, fatty pork

Smallgoods (sausages, saveloys, fritz/devon, salami, bacon, mettwurst)

Paté

Full-fat dairy products

Milk, cheese, cream cheese, yoghurt, ice cream

Plant sources

Coconut oil, cream and milk

Palm oil (used in many fast foods, takeaway foods, cakes and biscuits)

Toasted breakfast cereal, e.g. muesli

Takeaway foods

Commercial cakes, pastries, biscuits and chocolates

Deep fried or battered foods

Pies, pasties, sausage rolls

Pastries – shortcrust and puff pastry

Potato crisps, hot chips

Healthy fats

Monounsaturated fats

Oils and margarines

Canola*

Olive

Macadamia

Sunola (a sunflower oil high in oleic acid)*

Peanut

Vegetables

Avocados

Olives

Nuts

Almonds

Peanuts, peanut paste

Cashews

Hazelnuts

Macadamias

Pecans

Polyunsaturated fats

Oils and margarines

Sunflower

Safflower

Corn

Soybean*

Sesame

Cottonseed

Grapeseed

Linseed (also known as flaxseed oil)*

Nuts and seeds

Walnuts*

Pine nuts

Brazil nuts

Sesame seeds

Sunflower seeds

Linseeds*

Fish and other seafood

Canned: Sardines*, salmon*, mackerel*

Fresh: Atlantic salmon*, tuna*, mullet*, gem fish*, trevally*, snook*, flathead, calamari*

* Good sources of omega-3 fats.

Low-GI foods are often higher in fibre, particularly soluble fibre. Soluble fibre forms a gel that slows gastric emptying and intestinal nutrient absorption. It can increase satiety, slow the rate of starch digestion and lower LDL cholesterol. Insoluble fibre passes through the colon unchanged, increasing stool weight by its own mass and by its ability to hold water. Fibre increases bulk, softens the stool and can increase the regularity and comfort of passing stool.

Most Australians only eat one-third of the recommended fibre intake. Fibre intake can be increased by replacing nutrient-poor energy-dense foods and drinks with vegetables, fruits and wholegrain cereals.[8]

Fruit and starchy vegetables vary greatly in their GI but the national 'Go for 2&5' campaign (two fruit and five vegetables) is important regardless of GI because of the many benefits provided by fruit and vegetables. One serve of fruit is equivalent to one medium sized piece (such as an apple) or two smaller pieces (such as apricots), and one serve of vegetables is equivalent to half a cup of cooked vegetables, one medium potato or one cup of salad vegetables. More information is available on the 'Go for 2&5' website, www.gofor2and5.com.au.

There are many GI checklists to help people identify high-GI foods and their lower GI alternatives.[7] Although the GI of a food is important, the glycaemic response depends more on the amount of carbohydrate in the food.[9] A high carbohydrate intake, even if low GI, is likely to cause unwanted spikes in postprandial blood glucose levels. An excessive amount of carbohydrate has also been linked to elevated triglyceride levels.

In recent years, several dietary plans have emerged based on lower carbohydrate intakes than traditionally recommended. The popular and evidence-based CSIRO Total Wellbeing Diet is one such diet.[10] In these diets, either protein or monounsaturated fat replace some of the energy from carbohydrate. These diets may be an effective approach to both weight and diabetes management. People with diabetes who are following these diets and are on insulin therapy or taking insulin secretagogues may need to adjust their medication dosages to match their carbohydrate intake. A dietitian referral might be useful in this scenario.

5. Watch the salt

A diet high in salt can contribute to hypertension, oedema, heart disease and kidney disease. Reducing sodium intake is an important dietary goal for all, but perhaps

even more so for people with diabetes because they have higher rates of sodium-related medical conditions.

There is a period of adjustment when reducing sodium intake. Once again, gradual changes are usually easier. Encourage patients to focus on reducing sodium intake from processed foods, since this makes up 75% of most people's total sodium intake. Remind them that sodium is not only from salt added during cooking or at the table, but also from salt added during the manufacture of processed foods and also from other sodium-containing ingredients such as monosodium glutamate, baking powder and sodium bicarbonate. Advise people to look for food products with less than 400 mg of sodium per 100 g, and less than 120 mg per 100 g where possible.[11]

Table 2. Healthy foods: checking the food label nutrition panel

Nutrient	Per 100 g*
Fat	
– Total	Aim for less than 10 g per 100 g For milk and yoghurt, aim for less than 2 g per 100 g Oils and margarines are all high in total fat (more than 10 g per 100 g); choose polyunsaturated and monounsaturated varieties
– Saturated	Aim for as low as possible
– Trans	Aim for as low as possible For margarines, aim for less than 1 g per 100 g
Carbohydrate	
– Sugars	Aim for less than 10 g per 100 g For foods containing fruit, aim for less than 25 g per 100 g
Dietary fibre	For breads and cereals, aim for more than 5 g per 100 g (the recommended daily intake is 30 g)
Sodium	Aim for less than 400 mg per 100 g, and if possible less than 120 mg Look for 'no added salt', 'salt reduced' and 'low salt' labels

* Remember to look at the 'per 100 g' column, not the 'per serve' column.

6. Exercise regularly

'The hardest thing is putting on my joggers' – John training for a city fun run.

Our grandparents walked much more than we do now – the equivalent of a marathon (42.2 km) or more each week. Our activity progressively decreases as we get older. Most Australians with type 2 diabetes are over 50 years of age and in a low-activity group in a low-activity population. As a nation, we pride ourselves on our Olympic performance; but as individuals, most of us are 'couch potatoes' (Figure 3).

Getting started is usually the hardest part if activity is not part of someone's daily schedule. When people do start, they may embark enthusiastically and hurt themselves. They may set unrealistic goals and then feel frustrated and disappointed. They may try and 'fail' several times and then give up for good.

Suggest to patients that they find something they enjoy, set an achievable goal and start slowly. Most people walk when they want to increase their activity. Some people find a pedometer helps them keep on track – it gives them a benchmark that they should try and achieve each day and build on every week. The guidelines listed below may be helpful:

- set the basal daily target at the current level of activity (number of steps)
- each week increase the daily target by 10% (e.g. 2000 steps to 2200)
- do this for a month then review the number of steps, the possibility of further increases and the commitment to increasing activity
- repeat the increasing activity process until a desired and/or desirable daily target is reached
- maintain the activity, meeting the daily target
- each year – birthdays and New Year are good times – review activity and consider increasing current activities and/or adding new ones.

A commonly quoted target for a healthy level of activity is the 10,000 steps per day adopted by Queensland Department of Health (www.10000steps.org.au). This goal may seem ambitious to many people whose current activity equates to 1000 to 3000 steps a day (a fairly representative activity level). However, starting at 2000 steps a day and increasing 10% each week will lead to 5000 steps in four months and 10,000 steps in six months. If weekly increases are too much, increasing second-weekly will get to 10,000 steps over one year.

Encourage extra incidental activity. For example, when parking take the first space you see and walk, don't cruise and look for closer ones; cancel the milk and paper orders and walk each morning to the shop instead; take the stairs and not the lift; and walk up and down the escalator. Remind patients to think of movement as an opportunity, not an inconvenience.

Those people who may find it too dangerous, unpleasant or uncomfortable to be active outdoors can participate in a physical activity at home. They can use a walking/jogging machine or a stationary bike, and can even read a book, watch television or listen to music while doing so. Most people spend a lot of time watching television so there is

continued

Table 3. The GIs of some carbohydrate-containing foods

Low-GI foods (GI, 55 or less)

Breakfast cereals

Generally rice bran, oat bran, porridge oats*

Specific cereal brands: Kellogg's All-Bran (all varieties), Kellogg's Guardian, Kellogg's Guardian Oat Puffs, Burgen Muesli (Fruit and Muesli, Rye, Soy Lin), Natural Muesli, Kellogg's Komplete, Freedom FoodsHi-Lite Cereal

Also: semolina (cooked)

Breads and cereals

Generally wholegrain and multigrain breads*

Specific bread brands: Tip Top 9 Grain bread and muffins, Burgen Fruit and Muesli bread, Burgen Rye bread, Burgen Soy-Lin bread, Burgen Wholemeal and Grain bread, Wonder White Low GI sandwich bread, Vogel's Original Mixed Grain, Vogel's Seven Seed, Vogel's Soy and Linseed with Oats, Continental fruit loaf

Also: pearl barley, pasta (white and wholemeal), cracked wheat (bulgur), buckwheat, rice noodles (fresh, boiled), Sunrice Doongara Clever Rice, Maggi 2 Minute Noodles

Biscuits

Specific biscuit brands: Ryvita crispbread (Pumpkin Seeds and Oats, Sunflower Seeds and Oats), Snack Right Fruit Slice, Freedom Foods Fruit Cookies (Apricot Temptation, Blueberry Bliss)

Vegetables

Sweet corn, sweet potato (baked), taro, yam

Legumes and pulses

Lentils, kidney beans, split peas, chick peas, baked beans

Dairy products

Yoghurt, milk, custard – choose low-fat varieties

Fruit

Grapefruit, dried apricots, fresh and dried apples, pears, plums, peaches, oranges, grapes, banana (average size), prunes, mango, kiwifruit

Spreads

Jam (100% fruit)

Juices

Fruit juices† (apple, orange, pineapple, grapefruit)

Moderate-GI foods (GI, 56 to 69)

Breakfast cereals

Specific cereal brands: Sanitarium Weet-Bix, Uncle Toby's Vita Brits, Kellogg's Special K, Kellogg's Just Right, Kellogg's Mini Wheats (wholewheat)

Also: porridge (regular oats with water)

Breads and cereals

Light rye bread, pita bread (white), crumpet, croissant‡

Specific bread brands: Helga's Classic Seed Loaf, Tip Top Multigrain Sandwich bread

Also: couscous, basmati rice (white, boiled Mahatma), Ricegrowers Doongara rice (white/brown), Sunrice Arborio risotto rice (boiled), wild rice (boiled), dried rice noodles (boiled), gnocchi

Biscuits

Digestive biscuits‡

Specific biscuit brands: Jatz‡, Ryvita crispbread (Original Rye, Sesame Rye), Shredded Wheatmeal, Milk Arrowroot

Fruit

Sultanas, pineapple, rockmelon, apricots, cherries, raisins

Sugars

Sugar (sucrose)

High-GI foods (GI, 70 to 100)

Breakfast cereals

Specific cereal brands: Sanitarium Puffed Wheat, Kellogg's Rice Bubbles, Kellogg's Sultana Bran, Kellogg's Bran Flakes, Kellogg's Corn Flakes, Kellogg's Coco Pops, Kellogg's Mini Wheats Blackcurrant, Uncle Toby's Instant Porridge (made with water)

Breads and cereals

Generally white and dark-rye breads, bagels (white), baguettes, rice cakes

Specific bread brands: Helga's Traditional Wholemeal bread, Tip Top Hyfibe White sandwich bread

Also: tapioca, jasmine rice (Sunrice)

Vegetables

Potatoes (most white varieties), broad beans

Biscuits

Water crackers, Sao‡, Morning Coffee

Fruit

Watermelon, dried dates, canned lychees

Snack foods

Pretzels

Drinks

Sports drinks, Lucozade

Sugars

Malt (maltose), glucose, jelly beans

* Not all brands may be low GI.
† These foods are bw in fibre.
‡ These are foods high in fat – eat only occasionally.

plenty of opportunity to use an exercise machine.

Any extra activity is better than none, but aiming to walk 'two to three times per week' may work out to be twice a week, then once a week, then once every now and again. Adopting the approach 'you only have to take exercise regularly, not seriously' encourages participation as it suggests that exercise should not be regarded as a special activity. Help patients make a commitment to make activity a part of every day by suggesting they establish a specific time of the day for activity so that they do not keep putting it off. Often in the morning before breakfast and in the evening before or after the evening meal are good times. Local Councils and Community Health Centres usually have information on opportunities for enjoyable activities in the local area.

Some patients will be motivated by written instructions, and GPs may write exercise prescriptions as recommended by

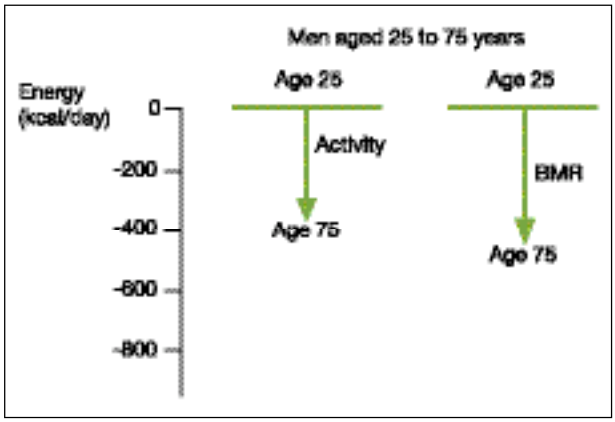

Figure 3. As we age we are less active as well as having a lower basal metabolic rate (BMR). This is equivalent to a reduction of 400 kcal/day in terms of activity and 500 kcal/day in terms of BMR.

the National Heart Foundation.[12] The RACGP provides some useful tips or health promoting behaviour as part of the SNAP framework (Smoking, Nutrition, Alcohol and Physical activity).[13] Also, people with type 2 diabetes are entitled, under a Team Care Arrangement, to five allied health visits per year under the Medicare scheme. Referral to an exercise physiologist (accredited by the Australian Association for Exercise and Sport Science) is included within this scheme. Exercise physiologists are exercise specialists with the knowledge and skills to design and deliver general physical activity advice and clinical exercise prescriptions for healthy people and those with chronic and complex diseases.

Monitoring lifestyle

People who succeed and persist in lifestyle change are often the ones who monitor their eating, activity and weight/waist. Tools include food checklists, meal plans, calorie counters, food and activity diaries, a pedometer and a tape measure. As measures of daily activity, pedometers make it harder for people to persuade themselves that they have been 'so busy' and feel 'so tired' that they must have done enough activity. Tips on how to measure waist circumference accurately are given in the box on page 5. Motivated patients may use their belts as their lifestyle monitor – the buckle monitors waist circumference and gives a clear indication of long-term overall energy balance, as long as the belt is positioned around the belly and not beneath it (see Figure 2 in the box on page 5). The pedometer gives them feedback in terms of their activity level.

Joining support groups and walking groups and seeing a dietitian helps patients maintain commitment to lifestyle change and maintenance of that change, as well as providing social interaction and peer support.

It is easy to change for a day or a week, but changing and maintaining change long term can be difficult. Encourage people to set goals and monitor their progress. These behaviours can help them make and maintain lifestyle change.

Summary

Changing lifestyle can be difficult for patients but setting small, gradual goals can make it easier. Encourage patients to work towards the 'six steps to a healthy lifestyle' one at a time, as described below.

- Step 1. Lose weight/waist
- Step 2. Eat less food
- Step 3. Eat less energy-dense food
- Step 4. Eat low-GI carbohydrates
- Step 5. Watch the salt
- Step 6. Walk more.

Where possible, provide support and access to resources, not just advice. Monitor how your patients are progressing with their six steps and encourage them to monitor and track their own progress. MT

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Ms Carapetis: None.

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The glycaemic index explained

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This, the first in a series on nutrition notes, discusses how knowledge of the glycaemic index of foods can help in the management of diabetes.

The glycaemic index (GI) is promoted as a guide to carbohydrate choice and offers a physiologically-based scale rather than the previous general categories such as simple or complex carbohydrates. This article reviews the potential value of the GI concept and its limitations in practice.

Potential value of the GI

The GI is a ranking of foods according to their glycaemic response.[1] It can tell us whether the carbohydrate in a food will raise blood glucose levels dramatically, moderately or just a little. The glycaemic response of various carbohydrate-containing foods is measured against a reference food (usually glucose). Different foods have different carbohydrate contents of differing bioavailabilities, thereby causing different postprandial blood glucose responses. Postprandial hyperglycaemia can be a short term nuisance because it affects cognitive function and may make people drowsy. The hyperglycaemia will also contribute to overall glycaemic control, as measured by the glycosylated haemoglobin (A_{1c}), and to microvascular complications.

People with diabetes, particularly those with type 1 diabetes, may find the differing glycaemic effects of different foods difficult to manage. An index such as the GI might allow them to anticipate and prevent postprandial hyperglycaemia by changing the amount and type of food they eat and/or changing preprandial bolus insulin. People with type 2 diabetes generally have different problems with controlling postprandial hyperglycaemia but might also benefit from an index like the GI.

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The theory

The preferred terms when referring to common food carbohydrates are sugars and starch.

Carbohydrate digestion depends on molecule shape and size. Consider the two main forms of starch, amylose and amylopectin: they are both glucose polymers's but amylose molecules are unbranched single chains whereas amylopectin molecules are branched chains. Unbranched chains line up closely whereas branched chains pack more loosely. Hydrogen bonding within and between molecules makes starch quite resistant to penetration by both water and the hydrolytic enzyme amylase. These hydrogen bonds are weakened by heat in the presence of water, allowing the starch to absorb water and swell (gelatinisation). Amylase can then further hydrate the molecules by splitting more hydrogen bonds and adding water molecules, breaking the starch down into smaller assimilable sugars and eventually into the individual basic glucose units.

Amylose is harder to hydrate than the relatively more open structured amylopectin because its closely packed straight chains require more water and heat to break the hydrogen bonding. An analogy is to think of high amylose carbohydrates as like tightly closed flower buds and high amylopectin carbohydrates as like open flowers (personal communication).

Figure. A food displaying the GI tested logo has had its GI tested at an accredited laboratory using the Australian standard, and meets stringent criteria for kilojoules, total and saturated fat, sodium and, where appropriate, fibre and calcium.

Cooking or processing food may change the form of the carbohydrate (level of gelatinisation) and/or the size of the molecules, thus changing its digestibility and hence its GI.

Other factors that influence the GI of a food include acidity, the amounts of fat and protein, and the amount and type of fibre.

GI testing

The GI of a food is determined *in vivo* by measuring the glycaemic response to an amount of food in question that contains 50 g of available carbohydrate. This glycaemic response (the area under the curve) is compared with a standard food, usually pure glucose or white bread. The ratio of the glycaemic response of the food to the standard is converted to a percentage. A GI of 70 or more is high, a GI of 56 to 69 is medium, and a GI of 55 or less is low.

The GI tested logo always indicates a nutritious choice, but not necessarily the lowest GI choice (Figure). A food carrying the logo has had its GI tested at an accredited laboratory using the Australian standard, and meets stringent criteria for kilojoules, total and saturated fat, sodium and, where appropriate, fibre and calcium. In theory, a high GI food could carry the GI symbol, although to date only low GI foods carry it. As with the National Heart Foundation Tick symbol, the food

manufacturer must pay to display the GI tested logo.

Not all foods making GI claims use the GI tested logo. Although most of these foods are, in fact, low GI, they may be high in fat or sodium, or low in fibre.

Potential benefits

A low GI diet may have the following benefits:

- it may assist in the management of postprandial hyperglycaemia
- it may assist with appetite control.

A healthy eating plan also allows a wide variety of foods to be eaten, including small amounts of high GI foods. When a low GI food is combined with a high GI food, the complete meal results in having a moderate GI. The GI is of most relevance to the foods that contribute the most carbohydrate to the diet. In Australia, this is usually breads and cereals, breakfast cereals, potatoes, milk and yoghurt, and, in some cases, rice and pasta. Fruits and starchy vegetables vary greatly in their GI. However, the message to eat two serves of fruit and five serves of vegetables daily, as cited in the Australian Government, State and Territory Health Initiative for adults 'Go for 2 Fruit and 5 Veg' (www.gofor2and5.com.au), is important, regardless of GI.

Practical limitations of the GI

Glycaemic load

The glycaemic response to a carbohydrate food in the two hours after the meal depends on the amount of carbohydrate in the food as well as the type. The amount of carbohydrate in meals or snacks is more important than the type in terms of glycaemia.[2]

It is, however, important to consider both factors, and this can be described by the glycaemic load. The glycaemic load is the product of the GI of a food and the amount of carbohydrate in a normal serve of that food. It is calculated by multiplying the GI of a food by the amount of carbohydrate in a normal serving of that food and dividing by 100. A glycaemic load of 20 or more is high, of 11 to 19 is medium, and of 10 or less is low.

For example, a medium apple (120 g) has a low GI of 38 and contains about 15 g of available carbohydrate; the glycaemic load therefore is (38 x 15) ÷ 100 = 6. Watermelon, however, has a high GI of 72 but as an average serve (120 g) contains only about 6 g of available carbohydrate, the glycaemic load is low ([72 x 6] ÷ 100 = 4).

Postprandial glycaemia

The rate at which the carbohydrate in a food is digested is affected by the way the food is processed and prepared and by the amounts and types of other foods in the meal. Factors not related to the food also affect glycaemia. For example, a boiled potato has a lower GI (78) than a mashed potato (85), although both are in the high range. Adding mayonnaise or butter would reduce the GI of both forms of potato (obviously adding fat would not be a usual recommendation, despite the glycaemic benefit). Porridge prepared from preprocessed oats ('quick oats') has a higher GI than porridge prepared from unprocessed oats. Once again, the glycaemic response would be lower if cream were added.

For people with diabetes, postprandial glycaemia may be more dependent on the medication they are taking (or not taking) than on the carbohydrates they are eating. The glycaemic response to a particular food would be dramatically different in a patient with type 1 diabetes should a preprandial bolus of very short acting acting insulin be missed.

The absolute glycaemic response of people with diabetes is not always equivalent to the glycaemic response in healthy volunteers for GI testing. Nonetheless, the relative ranking of foods (high, medium, low) remains roughly the same.

A GI of 46 may look impressively precise, but there is variability in the glycaemic response within and between individuals. Even so, on average, on any day in a particular individual, a product with a high GI can be expected to produce a higher response than one with a low GI.

Although the GI is a significant factor affecting the glycaemic response to foods, postprandial glycaemia is affected by many other factors and is highly variable. The amount of carbohydrate consumed is the most important of these other factors.

The bottom line

Some people find controlling dietary factors with the aid of the GI helpful in their management of their diabetes. Others find this more difficult to understand and apply in practice, although there is an increasing range of tools available to make healthy food choices easy choices. Many low GI foods are high in fibre and low in fat and can be included as part of a healthy diet. A patient handout is provided on pages 13 and 14 to help patients understand how the GI of foods can be used as part of diabetes management.

In conclusion, everyone should aim to enjoy a wide variety of foods in moderation – including wholegrain breads and cereals, fruit and vegetables. MT

Acknowledgement

We are grateful to the article reviewer who made us aware of the analogy of flower buds and open flowers for amylose and amylopectin.

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Ms Carapetis and Ms Stanton: None.

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The glycaemic index and diabetes

This handout outlines how knowledge of the glycaemic index (GI) of foods can help in the management of diabetes.

Prepared by Dr Pat Phillips, Senior Director, Endocrinology, North Western Adelaide Health Service, The Queen Elizabeth Hospital, and Ms Melissa Carapetis and Ms Connie Stanton, Dietitians, Diabetes Centre, The Queen Elizabeth Hospital, Adelaide, SA.

What is the glycaemic index (GI)?

The GI is a ranking of carbohydrate foods from 0 to 100 that tells us whether a food will raise blood glucose levels just a little, moderately or dramatically. Carbohydrate foods are those that largely contain starches and sugars, such as cereals, potatoes and other starchy vegetables, legumes, bread, fruit and milk.

Why is GI useful?

There is a relation between GI and diabetes. Eating high GI foods can result in the body requiring more of the hormone insulin to be produced (or injected for those people requiring insulin) to control high blood glucose levels. Eating low GI foods can help manage established diabetes as these foods produce lower blood glucose levels and therefore less insulin is required.

Eating low GI foods can also help with weight loss and can make you feel more full, which may help in controlling appetite.

Food is not 'good' or 'bad' only on the basis of its GI. You should also consider:

- the fat content of foods – e.g. potato crisps and chocolate both have low GIs but are high in fat
- the range of carbohydrate foods that you eat – eating a wide range, such as wholegrain breads and cereals, fruit and vegetables, will ensure you are getting adequate fibre, vitamins and minerals
- the amount of food that you eat – e.g. eating a very small amount of a high GI food, such as a few dried dates, may not have a large effect on blood glucose level.

Try to incorporate GI into your meal planning

Try to include at least one low GI food at each meal. Studies show that when a high GI food is combined with a low GI food, the complete meal results in having a moderate GI.

Factors that influence the GI of food

Various factors influence the GI of a food, including the following:

- type of starch present
- physical form of the food – e.g. the particle size, ripeness of fruit (the larger the particle size, the more slowly the food is digested; the riper the fruit, the more quickly it is digested)
- amount of cooking and processing (more usually speeds up digestion)
- amount of water-soluble fibre present (more usually slows down digestion)
- type of sugar (fruit sugar is broken down more slowly than sucrose)
- amount of fat and protein (delays digestion)

The GI tested logo appears on some food packages. Similar to the Heart Foundation Tick symbol, the GI symbol is part of a licensing program and manufacturers pay for its display, so not all low GI foods will carry the symbol.

When you see the GI symbol, it means that the food is a nutritious choice within its food group and has been tested by an approved GI testing laboratory. Although theoretically a labelled food may be high, medium or low GI, to date only low GI foods carry the logo. The food's GI range and sometimes the GI value will appear separately near the nutrition panel on the packaging.

COPY FOR YOUR PATIENTS

The GIs of some popular carbohydrate-containing foods

Low GI foods (GI, 55 and below)

Breakfast cereals
Rice bran, oat bran, All-Bran, Guardian, Special K,* porridge oats, semolina (cooked)

Breads and cereals
Wholegrain and multigrain breads, fruit loaf, pearl barley, pasta, noodles (low fat), cracked wheat, buckwheat

Biscuits
Vita-Weat crispbreads

Vegetables
Sweet corn, sweet potato

Legumes and pulses
Lentils, kidney beans, split peas, chick peas, baked beans

Dairy products
Milk, low fat varieties of yoghurt, custard

Fruit
Cherries, grapefruit, pears, fresh and dried apples, plums, peaches, oranges, grapes, dried apricots, bananas, mango, prunes

Spreads
Jam (100% fruit)

Juices
Fruit juices (apple, orange, pineapple, grapefruit)*

Medium GI foods (GI, 56 to 69)

Breakfast cereals
Sustain, Weet-Bix, Vita Brits, Just Right, natural muesli, Mini-Wheats (plain)

Breads and cereals
Polenta, couscous, rye and light rye bread, wholemeal breads, pita bread, crumpets, Basmati and Doongara rice

Biscuits
Ryvita crispbreads, digestive,† oatmeal,† Shredded Wheatmeal, Milk Arrowroot

Fruit
Sultanas, pineapple, rockmelon, fresh apricots, kiwi fruit

Sugars
Sugar (sucrose)

High GI foods (GI, 70 and above)

Breakfast cereals
Puffed Wheat, Rice Bubbles, bran flakes (with and without sultanas), cornflakes, Mini-Wheats (fruit filled)

Breads and cereals
White breads, white bagels, baguettes, jasmine and most other white rices, brown rice, puffed rice cakes, tapioca

Biscuits
Water crackers, Sao,† Morning Coffee

Vegetables
Most potatoes (e.g. new boiled, Pontiac, Desiree), broad beans

Fruit
Watermelon, dried dates, canned lychees

Snack foods
Pretzels

Drinks
Sports drinks

Sugars
Malt (maltose), glucose, jelly beans

* Low in fibre – eat only occasionally. † High in fat – eat only occasionally.

- acidity of the food – e.g. adding lemon juice or vinegar (greater acidity delays digestion).

Further information

The Diabetes Centre website, www.diabetes.org.au, has further information on nutrition for patients with diabetes, including more patient leaflets.

The book, *The New Glucose Revolution*, 3rd ed, by Professor Jennie Brand-Miller, Kaye Foster-Powell and Professor Stephen Colagiuri, and published by Hodder Headline Australia, 2002, contains more information on the glycaemic index and tables of GI values of popular foods and all foods that have been tested. MT

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How to read food labels

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Knowing how to interpret the information contained on food labels allows consumers to make informed choices.

A healthy lifestyle is the cornerstone of self-management in many chronic diseases. Long lasting changes in lifestyle are, however, often difficult to make. Changing to a healthier diet may be made more difficult by conflicting messages given about foods by the media, the supermarkets and even food packaging.

In December 2002, changes increasing the amount of information on food labelling were introduced in Australia, under the Australia New Zealand Food Standards Code, developed by the Food Standards Australia and New Zealand (FSANZ).[1] The aim of these changes was to help consumers make informed choices from the vast array of foods now available, although some consumers have found the labelling more confusing than helpful (Figure 1).

This article discusses how to read food labels and provides a simple guide to help people make healthy food choices.

What's on a label?

Ingredients

Virtually all packaged foods must have on their packaging a list of ingredients in descending order of quantity. The percentage of key ingredients is also listed (e.g. the percentage of strawberries in strawberry jam).

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Nutrition information panel

Before 2002, nutrition labelling was compulsory only where a food made a nutrition claim (such as 'low salt') or was designed for a special purpose (such as infant formula or sports foods). Under the current laws, nearly all manufactured foods carry a nutrition information panel.

A nutrition information panel shows the energy content (in kilojoules and optionally in calories) and main nutrients per serve and per 100 g of the product. It also shows the number of servings per package and the serving size in grams (see the box on this page). Nutrients that must

PHOTOLIBRARY

Figure 1. Reading food labels can help in the choosing of healthier foods.

Nutrition information panel

The nutrition panel on a food label shows the energy content (in kilojoules and optionally in calories), the main nutrients per serve and per 100 g of the product, and the number of servings per package and the average serving size in grams.

Nutrition Information		
Servings per package: 2 Serving size: 125 g		
	Per serve	Per 100 g
Energy	560 kJ 134 cal	447 kJ 107 cal
Protein	14.1 g	11.3 g
Fat – total – saturated	 6.8 g 4.4 g	 5.4 g 3.5 g
Carbohydrate – total – sugars	 3.3 g 3.1 g	 2.6 g 2.5 g
Sodium	524 mg	419 mg
Calcium	75 mg (9% RDI)	60 mg

An example of a nutrition information panel (for cottage cheese).

Figure 2. Foods displaying the Heart Foundation Tick have been independently tested to ensure they are a healthier choice.

be included are protein, fat (total and saturated), carbohydrate (total and sugars) and sodium. Other nutrients that are mentioned in marketing claims must also be listed in the panel, for example dietary fibre. Information relating to the percentage daily intake of nutrients (based on an average adult diet of 8700 kJ) is a voluntary inclusion.

The 'per 100 g' column is useful for comparing different products. The 'per serve' column can be misleading because manufacturers' serve sizes might not be the same as the consumers' serve sizes and often vary significantly between brands.

Foods that are not required to bear a nutrition panel include fresh fruit and vegetables, foods not sold packaged, foods contained within small packages (surface area less than 100 cm^2), single ingredient foods and food made and packaged on the premises from which it is sold.

Date marking

Foods that should be eaten before a certain time for safety reasons are marked with a 'use by' date. These foods should not be sold or eaten after this date.

Most other foods are marked with a 'best before' date. After this date these foods lose some quality. These foods can be sold after the 'best before' date provided the food is fit for human consumption. Foods that do not have to display a date include those that have a 'best before' date of two years or more and individual portions of ice cream and confectionery.

Warnings, advisory statements and declarations

A warning statement must appear on the label or be displayed in connection with the food where royal jelly is presented as a food or as an ingredient. This should state that royal jelly has been reported to cause severe, sometimes fatal, allergic reactions, especially in people suffering from asthma or allergies.

Where a food contains a substance that presents a risk that may not be obvious to the consumer, an advisory statement is required on the food label or to be displayed in connection with the food. Examples of such substances are aspartame, quinine and added caffeine.

A declaration is required on the label or to be displayed in connection with the food where a food, food ingredient or component of an ingredient can cause severe adverse reactions in some individuals, however small the amount. Examples include peanuts, tree nuts, sesame seeds, seafood, fish, milk, gluten-containing cereals, eggs and soybeans. The involvement in a food's manufacture of any equipment that is also used in the processing of these potential allergens must also be declared.

Food additives

Additives are substances added to food but not normally consumed as foods by themselves. Many substances used as additives also occur naturally, such as vitamin C (ascorbic acid) in fruits and vegetables. Additives are used in processed foods in relatively small amounts for a variety of reasons, including restoring or improving taste or appearance, improving keeping quality and preservation. They should be listed on the package with a name or function and a number – e.g. ascorbic acid (300), citric acid (330), antioxidants (300, 330), sodium metabisulphite (223), preservative (223). Although food additives and preservatives are rigorously tested in Australia before being permitted in food products, some people (less than 5% of the population) do react adversely to them. More information on food additives, including a list of the code numbers, is available on the FSANZ website (www.foodstandards. gov.au).

Genetically modified foods

Plant and animal breeders have sought to modify or improve quality, yield and taste characteristics of produce for hundreds of years through crossbreeding. Genetic modification is a relatively new method for doing this. Wherever a genetically modified (GM) ingredient, additive or processing aid is present in the final food, the food must be labelled 'genetically modified'. More information on GM foods is available on the FSANZ website.

The Heart Foundation Tick

Foods displaying the Heart Foundation Tick have been independently tested to ensure they are a healthier choice (Figure 2).[2] These foods have met the nutrition standards set by the National Heart Foundation Australia for combinations of saturated fat, trans fat, sodium, kilojoules, fibre, protein and calcium. These standards will vary with the food category. Foods with the Tick must also meet strict labelling requirements. Because the Heart Foundation is a nonprofit organisation, manufacturers who earn the Tick are charged a license fee to participate in the Tick Program.

While the Tick is a good guide to healthier food choices, it is advisable to check the food's nutrition panel as well.

The GI symbol

The glycaemic index (GI) is a ranking of carbohydrate foods from 0 to 100 that reflects the glycaemic potential of the food.[3] A GI of 70 or more is considered high (i.e. blood glucose levels are raised dramatically), a GI of 56 to 69 is medium, and a GI of 55 or less is low. Eating low GI foods can help patients with diabetes control postprandial hyperglycaemia. They can also help with weight loss and appetite control.

Foods displaying the 'G spot' have been GI tested at an accredited laboratory using the Australian standard and meet the strict nutrition criteria set by the GI Symbol Program (Figure 3). This program is a nonprofit public health initiative led by the University of Sydney and also involving Diabetes Australia and the Juvenile Diabetes Research Foundation.

The food's GI range and sometimes the actual GI value will appear on the label near the nutrition panel. In line with the dietary guidelines for Australians, foods in the GI Symbol Program must also meet specific, category-based nutritional criteria for kilojoules, total and saturated fat, sodium and, where appropriate, fibre and calcium. Similar to the Heart Foundation Tick symbol, the GI symbol is part of a licensing program where manufacturers pay to display it, so not all low GI foods will carry the GI symbol.

Foods that make low GI claims but do not carry the GI symbol are not necessarily healthy or unhealthy choices. Consideration needs to be made of other nutritional factors, such as the fat content of the product.[4]

Other information

Food labels will also display the suppliers' names and their Australian/New Zealand business addresses, the lot identification (in most cases), any particular storage requirements and the country of origin. When 'Product of' is displayed, the country of origin claimed must be the country of origin of each ingredient and all, or virtually all, the processes of manufacture of the goods must have happened in that country. When 'Made in' is displayed, the goods must have been substantially transformed in the country claimed to be the origin and 50% of the costs of production must have been carried out in that country.

What to look for?

The nutrient content of the food

When choosing foods, consumers should look at each food's nutrition information panel for the amounts of kilojoules, fat, saturated fat, sugars and sodium (salt) within that food. Healthy food choices are those that are:

- low in total, saturated and trans fats
- low in added sugars
- low in sodium
- high in fibre.

Consumption of a range of foods should supply adequate protein for most people and therefore a guideline for protein content is not important in choosing healthy foods.

There is currently no national guideline for reading labels. The guidelines included here are those used by the Diabetes Centre at the Queen Elizabeth Hospital, Adelaide, SA.

A guide to choosing healthy foods on the basis of the information given in each food's nutrition panel is given in the Table. The patient handout on pages 19 and 20 contains guides to reading labels that can be used to help select healthy foods when shopping. Choosing healthy foods in the supermarket that meet all the above guidelines can be both time consuming and difficult, and consumers should be encouraged to exercise their own discretion when making food choices and choose foods that best meet the guidelines.

Figure 3. Foods displaying the 'G spot' have been tested at an approved GI testing laboratory and meet the strict nutrition criteria set by the GI Symbol Program.

Total, saturated and trans fats

Intakes of saturated fats and trans fats should be limited.[5] Saturated fats can increase LDL cholesterol and the risk of

Table. Reading food label nutrient panels: healthy food choices*

Fat

Total fat

Low is best, i.e. less than 10 g per 100 g†

For milk and yoghurt, aim for less than 2 g per 100 g

Oils and margarines are all high in total fat; choose poly- and monounsaturated varieties

Saturated fats

As low as possible is best

Trans fats

As low as possible is best

For margarines, aim for less than 1 g per 100 g

Carbohydrate

Sugars

Low added sugar is best but added sugar is not itemised on nutrition panels

Aim for less than 10 g sugar (natural plus added) per 100 g‡

For foods containing fruit, aim for less than 25 g per 100 g

Dietary fibre

High is best, i.e. above 5 g per 100 g for breads and cereals (the recommended daily intake is 30 g per 100 g)

Sodium

Low is best, i.e. less than 120 mg per 100 g

Otherwise, aim for less than 400 mg per 100 g

Look for 'No added salt', 'Salt reduced' and 'Low salt' labels

Protein

Consumption of a range of foods should supply adequate protein for most people.

* There is currently no national guideline for reading labels. The guidelines included here are those used by the Diabetes Centre at the Queen Elizabeth Hospital, Adelaide, SA.
† There are FSANZ labelling requirements that relate to low fat foods having a fat content of <3%. However, the authors believe that only including those foods would limit choices unnecessarily.
‡ This guideline for sugar may exclude some non-fruit based low fat yoghurts, yet they may still be considered a healthy choice.

heart disease. Consumers should compare products and choose those with the lowest amounts of total fat and saturated fats.

Trans fats increase LDL cholesterol in much the same way as saturated fats, and can also lower HDL cholesterol. Trans fats are created by the process of hydrogenation that is used by food manufacturers to improve the stability of vegetable oils and to convert liquid oils into solid forms. Although data are scarce, it is currently believed that Australians do not have a very high trans fat intake, unlike North Americans. Trans fats are found mainly in deep-fried fast foods and processed foods made with some margarines or shortening. They also occur naturally in the rumen of cows and sheep, so beef, lamb and dairy foods also contain small amounts of trans fats. The amount of trans fats must be listed on the food label when a claim is being made about the fatty acid content of the food (e.g. it is high in omega-3 fatty acids). Otherwise, the displaying of the trans fat content is optional.

All margarines and oils are high in total fat. Mono and polyunsaturated margarines and oils should be sought, and margarines with less than 1% trans fats chosen where possible. Margarines displaying the Tick are a good choice.

Low in added sugars

The total carbohydrate of a food is the sum of the sugars and starch. Sugar may be a natural part of ingredients (such as fructose in fruit, and lactose in milk or milk products), but extra sugar is often added to processed foods, particularly in the form of sucrose (table sugar) or glucose. Consumers can be advised that avoiding all sugar is not only impossible but also unnecessary.[6] However, foods that are lower in added sugars are generally healthier choices (e.g. wholegrain bread, oats, fruits, vegetables and low fat milk). Foods containing large amounts of added sugars (e.g. chocolates, cakes, sweet biscuits, soft drinks and lollies) have little nutritional value and can be energy dense.

The sugar entry in a nutritional panel shows the total amount of sugars – that is, added and natural. The ingredients list can help in deciphering the source of sugar.

Low in sodium (salt)

Salt (sodium chloride) is listed on the nutrition panel as sodium. In both normotensive and hypertensive individuals, a reduction in sodium intake can lower blood pressure.[6] On average, less than 25% of an individual's sodium intake comes from salt added while preparing the food or at the table. The rest is hidden in processed foods that have had salt or other sodium containing ingredients added during their manufacture. As sodium must now be listed on the nutrition panel, consumers are able to compare products and choose those lower in sodium.

High in fibre

All Australians are advised to follow a high fibre diet.[5] The benefits of fibre are varied and include bowel regularity, protection against bowel cancer, improved glycaemia in diabetes, cholesterol reduction and appetite/weight control. Fruit and vegetables are naturally good sources of dietary fibre. For breads, cereals and other products containing fibre, a content of more than 5% dietary fibre should be aimed for whenever possible.

Hidden fats, added sugars, hidden sodium

Consumers should look at the ingredients list to search for sources of excess total and saturated fats, added sugars, and salt and other sodium containing compounds. This may not always be easy since the ingredients may be listed by a name that is unfamiliar. Hidden fats include shortening, lard, tallow, coconut oil and palm oil. Added sugars include glucose, sucrose, syrups, molasses and modified carbohydrate. Hidden sodium includes monosodium glutamate (MSG), meat/ vegetable extract, baking powder, sodium bicarbonate and stock cubes.

Summary

Knowing how to read food labels and interpret the information enables people to make healthier choices regarding the food they eat. The key points in reading labels are:

- check the nutrition information panel for amounts of fats (total, saturated and trans), sugars, sodium and fibre
- compare products 'per 100 g'
- as the ingredients list is in decreasing order of quantity, look for products where sources of fats and sugar are lower on the list
- become familiar with hidden fats (particularly saturated fats), added sugars and hidden sodium (mainly as salt).

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Ms Carapetis and Ms Stanton: None.

Choosing healthy foods: how to read food label nutrition panels

Prepared by Dr Pat Phillips, Senior Director, Endocrinology, North Western Adelaide Health Service, The Queen Elizabeth Hospital, and Ms Melissa Carapetis and Ms Connie Stanton, Dietitians, Diabetes Centre, The Queen Elizabeth Hospital, Adelaide, SA.

This handout outlines how to read and interpret the nutrition panel on food labels.

Knowing how to interpret the nutrition panel on food labels enables you to make healthier food choices.

When reading the nutrition information on a food label you should:

- check the nutrition information panel for the amounts of total, saturated and trans fats, sugars, sodium and fibre – see the guides below.
- compare products 'per 100 g'.

The ingredients list is in order of decreasing quantity and therefore provides additional information about the amounts of fats and sugars in a food. Look for foods where sources of fats and sugars are lower on the list of ingredients, and be aware of hidden fats (particularly saturated fats), added sugars and hidden sodium (mainly as salt).

Hidden fats include shortening, lard, tallow, coconut oil and palm oil.

Added sugars include glucose, sucrose, syrups, molasses and modified carbohydrate.

Hidden sodium includes monosodium glutamate (MSG), meat and vegetable extracts, baking powder, sodium bicarbonate and stock cubes.

Label reading guides

The guides over the page can be used to help select healthy foods when shopping. Cut them out and keep them at home and in your wallet for easy reference.

As with all guides, there are some exceptions – for example, some low fat yoghurts (less than 3% total fat) that are not fruit-based may be excluded using the guideline shown for sugars, yet they may still be considered a healthy choice. Also, fats and oils are all high in total fat and will not meet these guidelines: look for monounsaturated and polyunsaturated sources, and aim for less than 1% trans fat for margarines.

Choosing healthy foods in the supermarket that meet these guidelines can be both time consuming and difficult. Exercise your own discretion when making food choices, and choose foods that best meet the guidelines.

Further information

The guidelines included here are those used by the Diabetes Centre at the Queen Elizabeth Hospital in Adelaide, SA.

Further information on reading food labels and nutrition for patients with diabetes is available on the Diabetes Centre website, www.diabetes.org.au.

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For the home

Healthy foods: reading nutrition panels
Remember to look at the 'per 100 g' column, not the 'per serve' column

Nutrient	Per 100 g
Fat – Total	Aim for less than 10 g per 100 g For milk and yoghurt, aim for less than 2 g per 100 g Oils and margarines are all high in total fat (more than 10 g per 100 g); choose polyunsaturated and monounsaturated varieties
– Saturated	Aim for as low as possible
– Trans	Aim for as low as possible For margarines, aim for less than 1 g per 100 g
Carbohydrate – Sugars	Aim for less than 10 g per 100 g For foods containing fruit, aim for less than 25 g per 100 g
Dietary fibre	For breads and cereals, aim for more than 5 g per 100 g (the recommended daily intake is 30 g per 100 g)
Sodium	Aim for less than 400 mg per 100 g, and if possible less than 120 mg Look for 'No added salt, 'Salt reduced' and 'Low Salt' labels

For your wallet or purse

Healthy foods: read the label!

Nutrient	Per 100 g
Total fat	Aim for less than 10 g For dairy foods, aim for less than 2 g Exception: oils and margarines are all high in total fat – choose polyunsaturated and monounsaturated varieties
Sugars	Aim for less than 10 g For foods containing fruit, aim for less than 25 g
Sodium	Aim for less than 400 mg
Fibre	For breads and cereals, aim for more than 5 g

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Fat facts: dietary fats

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Knowing the various types of dietary fat will help you advise patients on how to modify their fat intake so they do not become overweight, with the associated cardiovascular and metabolic problems.

Fat plays a major role in all the components of the 'WXYZ syndrome', which affects many Australians and puts them at risk of cardiovascular and metabolic problems, including diabetes. The components of this syndrome are:[1]

- W = the weight/waist factor. Fat is the most energy dense nutrient (9 calories or 36 kJ versus 4 calories or 16 kJ per gram for both carbohydrate and protein). Overconsumption of energy dense food and drinks can contribute to an expanding waistline.
- X = syndrome X, or the metabolic syndrome as it is more often known. Over-waist or central overweight is associated with metabolic problems and high cardiovascular risk.
- Y = why a particular person develops the metabolic syndrome. The syndrome is associated with the 'f' words (forty, family and fat). The fixed risk factors of age and genes set the scene, but it is the modifiable risk factor of fatness that usually precipitates the cardiovascular and metabolic problems. Fatness is also the usual target for lifestyle interventions and sometimes also for medical interventions.
- Z = sleep apnoea, or not getting enough zzz's, is associated with the other cardiometabolic factors and further increases risk of cardiovascular and metabolic problems. Night-time sleep disturbance adversely affects the hormone profile and daytime tiredness reduces capacity and motivation for lifestyle change.

These cardiovascular and metabolic risk factors will become more common in the future.

Depending on the type and amount consumed, fat can contribute to excess weight and lifestyle diseases, including diabetes.[2] This article reviews the types of dietary fats and aims to provide a simple framework for understanding what the various fats are, what they do to us and how we can advise patients to modify their fat intake. Cholesterol and plant sterols are also discussed.

The chemistry of fats

Triglycerides are the major form of plant and animal fat – what we eat and what is under our skin, around our organs and in our blood. Their chemical structure is three 'zigzags' of carbon (fatty acids) attached to a 'coat hanger' (glycerol) – hence triglyceride. The specific fatty acids in a triglyceride gives the fat its specific flavour, texture and melting point.

Fatty acids differ in the length of their carbon chains and the number, position and type of double bonds in the molecule. Common fatty acids range in length from 12 to 24 carbon atoms. All fatty acids need bile salts to be emulsified into micelles. After lipolysis, all short chain fatty acids are directly absorbed into the portal system while longer chain acids are re-esterified into triglycerides that combine with proteins (forming chylomicrons) and are then absorbed via the lymphatic system.

Saturated fatty acids do not contain any double bonds as all the carbon bonds are occupied (saturated) with hydrogen. Saturated fats are straight zigzag molecules and can stack up and bind to each other. They are likely to be solid at room temperature (22°C).[3]

Unsaturated fatty acids have double bonds along the carbon chain that cause 'kinks' in the molecule. There are two kinds of double bonds in unsaturated fats, cis and trans, leading to different geometric configurations. In a cis fatty acid, the hydrogen atoms are present on the same side of the double bond, whereas in the trans configuration, they are on opposite sides. Cis bonds cause big kinks in the carbon chain whereas trans bonds result in the chain remaining fairly straight. Although the molecules of both cis and trans unsaturated fatty acids do not stack up as easily as those of saturated fats, this is more pronounced with the cis fatty acids. Both cis and trans fats are likely to be liquid at room temperature but trans fatty acids more closely resemble saturated fatty acids. Almost all naturally occurring unsaturated fatty acids have cis bonds. Fatty acids with trans bonds are found naturally in small amounts in dairy products and the meat of ruminants (such as cows and sheep) but most are formed during food processing or cooking.

The position of any double bond is important. Position is usually defined in terms of the distance from the methyl end (also known as the omega end) of the fatty acid molecule. Thus the two major classes of unsaturated fatty acids, omega-3 (or n-3) fatty acids and omega-6 (or n-6) fatty acids, have their first double bonds between the third and fourth or sixth

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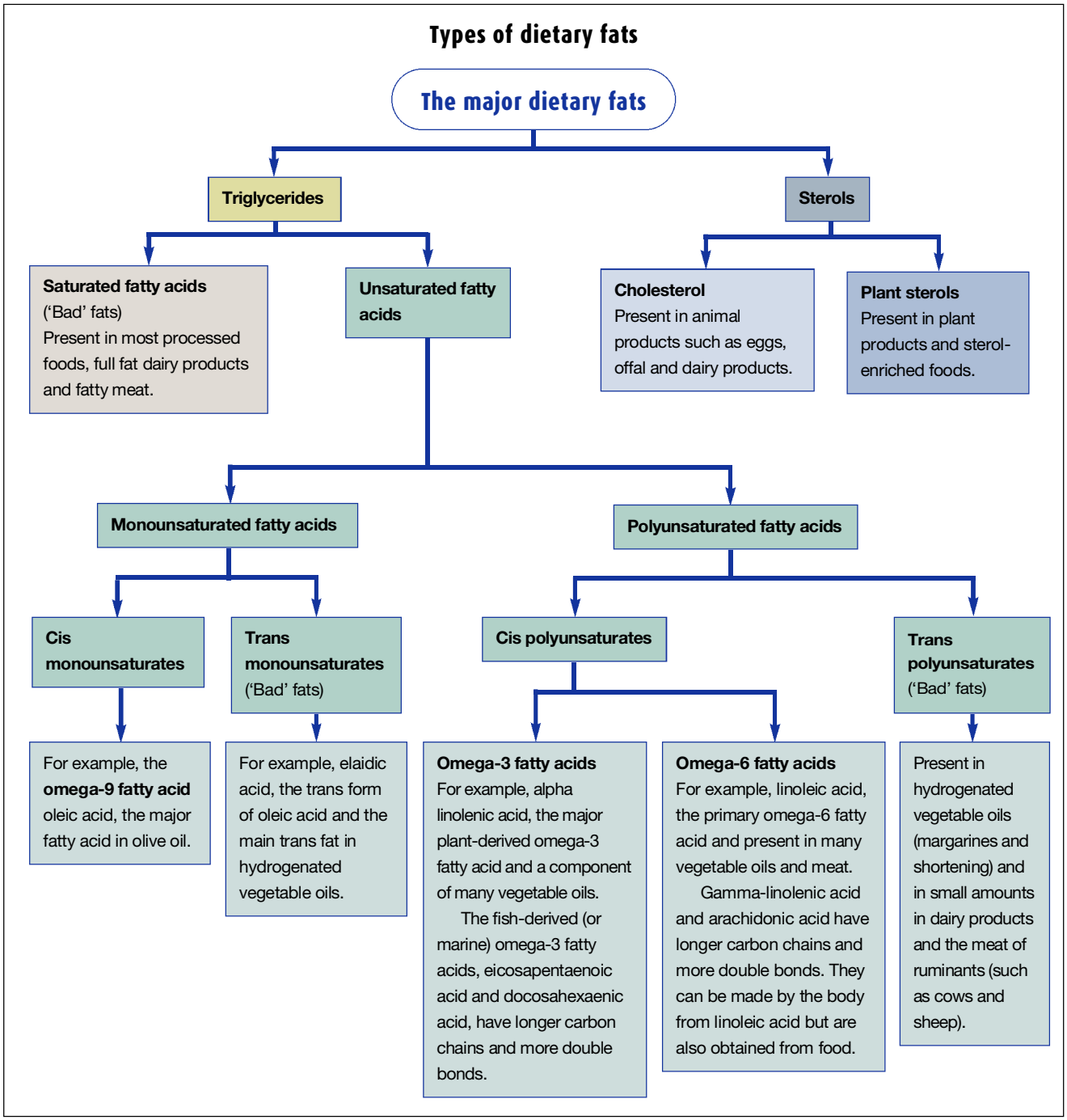
continued

and seventh carbon atoms, respectively, from the methyl end.[3]

The human body can make its own saturated fatty acids and monounsaturated fatty acids with a double bond at the omega-9 position, but not the polyunsaturated fatty acids as it does not have the enzymes necessary to introduce double bonds at the omega-3 and omega-6 positions. These fatty acids have to be obtained from the diet, making them essential fatty acids.

Most, but not all, of the vegetable fats we eat are monounsaturated or polyunsaturated fatty acids. During processing at high temperatures into solid or spreadable fats (shortenings and margarines), these largely unsaturated oils acquire extra



hydrogen atoms to become saturated fats (hydrogenation). Although hydrogenation increases the stability of the fat so it does not go rancid, the change of nature of the fatty acids to saturated and trans unsaturated makes the fat more harmful to our health. (Trans fat formation is a side effect of incomplete or partial hydrogenation – the remaining unsaturated cis bonds are converted to lower energy trans bonds.) High temperature catalyst mediated hydrogenation of polyunsaturated fat is rarely used now.

The chemistry of the dietary fatty acids is summarised in the boxes on page 22 and this page.

The 'bad' fats

Saturated fats

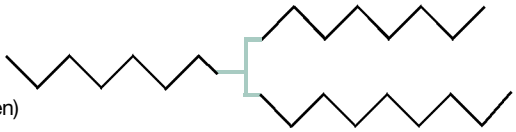
Saturated fats are found in both animal and plant foods (Table 1). Long chain saturated fatty acids (more than 14 carbon atoms) are the predominant type. These fatty acids are found in almost all fast foods, takeaways, fried processed foods, commercial pastries, cakes and biscuits, full fat dairy products and fatty meats.

An increase in the consumption of saturated fatty acids is associated with increased total and LDL cholesterol levels and increased risk of coronary heart disease. Saturated fat should be limited in the diet to reduce the risk of elevated cholesterol and LDL cholesterol. Limiting saturated fat in the diet can lower the risk of coronary heart disease.[4]

'Partially hydrogenated vegetable oil' listed on food labels normally has a higher concentration of saturated fat than the original oil it was made from. Consumers often believe vegetable oils (unhydrogenated and partially hydrogenated) are better than solid fats such as butter, lard (rendered pig fat) and beef dripping because the products display the word 'vegetable' on their packaging, but these oils are often higher in saturated fat than the solid fats (Table 2). Also, when heated to high temperatures, as in frying, the polyunsaturated fatty

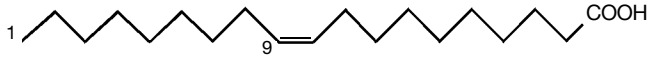
Simplified structural formulae of some fatty acids and sterols*

Triglyceride
– three fatty acids (zigzags) attached to glycerol (shown in green)

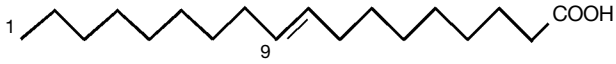


Saturated fatty acid

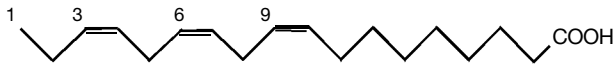
Oleic acid – a cis monounsaturated fatty acid (omega-9)



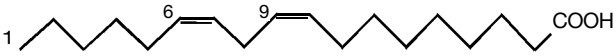
Elaidic acid – a trans monounsaturated fatty acid



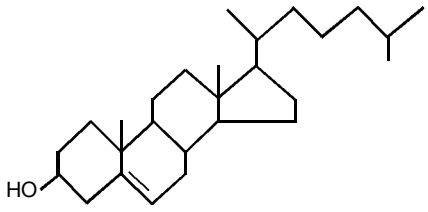
Alpha linolenic acid – an omega-3 fatty acid (polyunsaturated, cis)



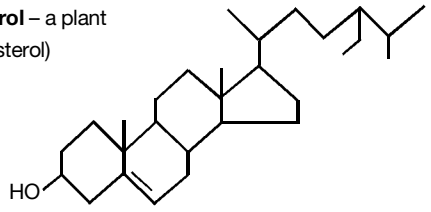
Linoleic acid – an omega-6 fatty acid (polyunsaturated, cis)



Cholesterol



Beta sitosterol – a plant sterol (phytosterol)



* The large bends at the cis bonds in cis fatty acids are not shown in these simplified structural formulae.

continued

acids are changed into saturated and trans fatty acids. Most frying fat is unhydrogenated palm oil, which is naturally rich in saturated fatty acids and therefore less susceptible to the harmful effects of heating.

Trans fats

As previously mentioned, trans fatty acids are monounsaturated and polyunsaturated fatty acids that behave in similar ways to saturated fatty acids and are mainly formed when polyunsaturated fatty acids such as vegetable oils are hydrogenated (hardened) to make margarine and shortening for processed foods.

Studies indicate that a 2% increase in energy intake from trans fatty acids is associated with a 23% increase in the incidence of coronary heart disease.[5]

Some food products (mainly margarines) now list the amount of trans fatty acids on the nutritional panel. Currently manufacturers only have to list trans fatty acids on the nutritional panel if they are making a nutritional claim about cholesterol or unsaturated fat, such as 'cholesterol free'. When choosing margarines, care should be taken to choose those with the least amount of trans fats. In general, the eating of processed and fast foods should be limited.

Recently, the National Heart Foundation has worked with the food industry to reduce the levels of trans fats in spreads. Since the end of 2006, all spreads carrying the Heart Foundation Tick should have a maximum level of 1% of their total fat as trans fat. The Heart Foundation recommends that saturated and trans fats contribute no more than 8% of total energy intake.[4]

The 'better' fats

The 'better' fats are the naturally occurring unsaturated fats, almost all of which have cis bonds.

Monounsaturated fats

The major sources of monounsaturated fats are listed in Table 1. Oleic acid is the

Table 1. Sources of different fats

Saturated fats	Monounsaturated fats	Polyunsaturated fats
Fats	**Oils and margarines**	**Oils and margarines**
Butter, lard, copha, cooking margarine, ghee, dripping, dairy blends, vegetable shortening	Canola	Sunflower
Cream, sour cream	Olive	Safflower
	Macadamia	Corn
Meat and dairy products	Sunola (a sunflower oil high in oleic acid)	Soybean
Fatty meat (chops, poultry skin, chicken wings, fatty mince)	Peanut	Sesame
Smallgoods (sausages, saveloys, fritz/devon, salami, bacon, metwurst)	Sunflower	Cottonseed
Full fat dairy products (milk, cheese, cream cheese, yoghurt, ice cream)	**Vegetables**	Grapeseed
Paté	Avocados	**Nuts and seeds**
Plant sources	Olives	Walnuts
Coconut oil, cream and milk	**Nuts**	Pine nuts
Palm oil (used in many fast foods, takeaway foods, cakes and biscuits)	Almonds	Brazil nuts
Toasted breakfast cereal, e.g. muesli	Peanuts	Sesame seeds
Takeaway foods	Cashews	Sunflower seeds
Commercial cakes, pastries, biscuits and chocolates	Hazelnuts	Linseeds
Deep fried or battered foods	Macadamias	**Spreads**
Pies, pasties, sausage rolls	Pecans	Tahini
Pastries – shortcrust and puff pastry	**Spreads**	**Fish and other seafood**
Potato crisps, hot chips	Peanut butter	Sardines, mackerel
	Almond spread	Salmon, tuna, mullet
		Calamari
		Gem fish
		Blue eye cod

most widespread of all fatty acids and the most common monounsaturated fatty acid.

Monounsaturated fats have become famous because of their association with Mediterranean diets. There is good evidence that total cholesterol and LDL cholesterol are lowered when saturated fatty acids are replaced with monounsaturated fatty acids, although not to the same extent as with polyunsaturated fatty acids. There is little evidence that monounsaturated fatty acids have an independent effect on coronary end points.

The Heart Foundation recommends reducing saturated fat intake by replacing a proportion with monounsaturated fats.[4]

Table 2. Fat content of vegetable oils and animal fats[3]

Food	Fat content (g per 100 g)		
	Saturated fat	Monounsaturated fat	Polyunsaturated fat
Vegetable oils			
Canola oil	7	63	30
Coconut oil	92	6	2
Olive oil	12	76	12
Palm oil	51	39	10
Peanut oil	19	46	35
Soybean oil	15	23	62
Sunflower oil	11	23	66
Animal fats			
Butter*	54	20	3
Dripping (beef)	51	42	7
Lard	40	45	15

* Butter contains about 20 g water per 100 g.

Polyunsaturated fats

Polyunsaturated fatty acids fit into two major classes, omega-3 and omega-6, as discussed above. Dietary sources are listed in Table 1. The dietary balance of these two types of fats has changed over the last 20 to 30 years because of increased consumption of linoleic acid (an omega-6 fatty acid) in margarines and oils. Omega-3 fatty acids are less readily available in the food we eat. Vegetables, some seeds, canola oil and some soy-bean oils contain small amounts of the omega-3 fatty acid alpha-linolenic acid, while fish and other seafoods are excellent sources of other omega-3 fatty acids.

Replacing saturated fat with omega-6 polyunsaturated fatty acids reduces LDL cholesterol, total cholesterol and triglycerides levels and the risk of coronary events.

There is some evidence that marine omega-3 polyunsaturated fatty acids reduce coronary heart events and that fish intake reduces the risk of coronary death.[6] There is also good evidence that marine omega-3 fatty acids reduce the concentration of plasma triglyceride levels.[4]

The Heart Foundation recommends that at least two fish meals (preferably oily fish) be consumed each week. It also recommends that both plant and marine omega-3 fatty acids be consumed because these may reduce coronary heart disease by different mechanisms.[4]

The sterol family

Cholesterol

Cholesterol belongs to the class of fats called sterols, and the levels of it circulating in the blood are influenced by the diet, particularly the amount and type of fat eaten. It is a constituent of cell membranes and is used in the production of some hormones, vitamin D and bile acids. The body produces its own cholesterol in the liver and other tissues but some is also obtained as dietary cholesterol from foods of animal origin, such as meat, eggs and dairy products.

Cholesterol biochemistry is complex. Cholesterol is transported in the blood bound to various lipoproteins. Of these, high density lipoprotein (HDL) carries cholesterol from cells to the liver, and low density lipoprotein (LDL) carries oxidised cholesterol from the liver to cells. High levels of HDL cholesterol are cardioprotective and it is therefore considered the 'good' cholesterol. Elevated LDL cholesterol is associated with increased cardiovascular risk and LDL cholesterol is therefore considered the 'bad' cholesterol.

Cholesterol is an antioxidant and free radical scavenger; however, when oxidised it is a free radical generator. Although the mechanism of how cholesterol affects the body is unclear, it is likely that free radical damage caused by unhealthy foods such as processed fat and processed (i.e. oxidised) cholesterol is involved (free radical damage to our blood vessels is one of the primary causes of atherosclerosis). Commercially processed and fast foods contain animal fats that are usually high in oxidised cholesterol when cooked. Foods cooked in animal fat and fried in hydrogenated vegetable oils also have high oxidised cholesterol content.

The Heart Foundation recommends that, although people at low risk of coronary heart disease can eat moderate amounts of cholesterol rich foods, those

with plasma cholesterol above 5 mmol/L or with other cardiovascular risk factors should limit the intake of cholesterol rich foods.[4] Foods that are rich in cholesterol include egg yolks, offal meats and full fat dairy products.

Plant sterols

Plant sterols (phytosterols) and stanols are found naturally in small amounts in vegetables, fruit, leaves, nuts and cereals. They are also available in large amounts in sterol-enriched margarines. Plant sterols are chemically similar to cholesterol except for a methyl or ethyl group in their side chains. Stanols are the same as plant sterols but without double bonds (i.e. they are saturated). Although, in comparison to cholesterol, plant sterols are not or only minimally absorbed, they do have the effect of reducing the absorption of cholesterol when eaten in sufficient quantities. When less dietary and biliary cholesterol is absorbed, less cholesterol is returned to the liver. This stimulates LDL cholesterol receptor formation, which in turn increases the hepatic uptake of LDL cholesterol and thus decreases the serum LDL cholesterol levels.[7]

A daily intake of 2 to 3 g of plant sterols can reduce LDL cholesterol levels by about 10%.[7,8] There is no increase in the cholesterol lowering effect of plant sterols when eaten in amounts greater than 3 g. In addition to lowering cholesterol absorption,[8] plant sterols may also lower the absorption of fat soluble vitamins such as beta-carotene.[7] Including orange coloured fruit and vegetables as well as dark green leafy vegetables which are high in beta-carotene can minimise this problem.

An intake of 2 to 3 g of plant sterols can be achieved by including 1 to 1.5 tablespoons of sterol-enriched margarine daily. The intake of plant sterols is complementary to a cholesterol lowering eating plan and has an additive effect to statin therapy. General healthy eating principles and the importance of weight management should be highlighted to patients wishing to add sterol-enriched margarines to their diets. An Australian and New Zealand food standard was passed in November 2006 that allows a range of foods to be supplemented with plant sterols.[9] These foods include low fat milks, low fat yoghurts and breakfast cereals as well as the previously allowed margarines.

Fat facts – a final word

- Fatty acids differ in the length of their carbon chain and the number, position and type of double bonds.
- Saturated and trans fats should be limited in the diet to reduce the risk of elevated total cholesterol and LDL cholesterol and lower the risk of coronary heart disease.
- Saturated fat intake can be reduced by replacing a proportion with monounsaturated fats.
- Replacing saturated fat with omega-6 polyunsaturated fatty acids reduces LDL cholesterol, total cholesterol and triglyceride levels and the risk of coronary events.
- Both plant and marine omega-3 fatty acids should be consumed because they may reduce coronary heart disease by different mechanisms. At least two fish meals (preferably oily fish) should be consumed each week.
- People with elevated plasma cholesterol or with other cardiovascular risk factors should limit their intake of cholesterol-rich foods.
- A daily intake of 2 to 3 g of plant sterols (achievable by consuming 1 to 1.5 tablespoons of sterol-enriched margarine) can reduce LDL cholesterol levels by about 10%.

Patient handout

A patient handout entitled 'Eating well to improve your blood fats' is provided on pages 27 to 30. MT

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Further reading

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DECLARATION OF INTEREST: Dr Phillips has received research and travel grants, acted on advisory boards and been involved with clinical trials and seminars sponsored by a range of pharmaceutical companies. He does not think that these associations have influenced the content of this article. Ms Stanton and Ms Carapetis: None.

Eating well to improve your blood fats

This handout provides information on fats found in foods and some suggestions for improving blood cholesterol levels.

Prepared by Ms Connie Stanton and Ms Melissa Carapetis, Dietitians, Diabetes Centre, The Queen Elizabeth Hospital, and Dr Pat Phillips, Senior Director, Endocrinology, North Western Adelaide Health Service, The Queen Elizabeth Hospital, Adelaide, SA.

Fat is a major source of energy but eating a diet high in fats may contribute to excess weight and lifestyle diseases, including diabetes, heart disease and stroke. Food can contain several different types of fat, some more harmful than others. The amount and types of fat that you eat can influence the level of cholesterol circulating in your blood, affecting your risk of cardiovascular disease (heart disease and stroke).

Fats found in food

Saturated and unsaturated fats

The major form of fat eaten is made up of fatty acids, of which there are several different types.

- **Saturated fatty acids (or 'saturated fats').** These are 'bad' fats as they can raise the level of the 'bad' low density lipoprotein (LDL) cholesterol that increases the risk of developing heart disease.
- **Polyunsaturated fatty acids (or 'polyunsaturated fats').** These are 'good' fats as they lower total cholesterol and LDL cholesterol levels. There are two main types, omega-3 fatty acids and omega-6 fatty acids. Both improve the blood fat profile and reduce the risk of cardiovascular disease.
- **Monounsaturated fatty acids (or 'monounsaturated fats').** These are 'good' fats as, like polyunsaturated fats, they lower total cholesterol and LDL cholesterol levels.
- **Trans fatty acids (or 'trans fats').** These are 'bad' fats as they increase the 'bad' (LDL) cholesterol level and lower the 'good' (high density lipoprotein, or HDL) cholesterol level. Trans fats are found in most foods containing saturated fats and are also found in some margarines.

The total fat and saturated fat contents of manufactured foods are listed in the nutrition information panels on food packaging. Often the amounts of the other types of fat are also listed. Table 1 lists some foods that are major sources of the various fats in the Australian diet. There are, of course, many other foods that are rich sources of these fats.

Saturated fat has more effect on blood cholesterol levels than monounsaturated or polyunsaturated fats. It is present in many foods of animal and plant origin and also in manufactured foods that contain hydrogenated vegetable oil (often listed on the food label as vegetable fat or shortening), such as commercial biscuits and cakes.

Cholesterol

Cholesterol is a type of fat found in foods of animal origin. Major sources of dietary cholesterol are egg yolks, offal, fatty meats, full fat dairy products and some shellfish. Dietary cholesterol can increase LDL cholesterol levels, but much less so than saturated and trans fats. Moderate amounts of cholesterol-rich foods can be included in

The National Heart Foundation recommends the eating of at least two serves of fish a week to help reduce the risk of heart disease.

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Table 1. Food sources of different fats

Saturated fats

Fats
Butter, lard, copha, cooking margarine, ghee, dripping, dairy blends, vegetable shortening
Cream, sour cream

Meat and dairy products
Fatty meat (chops, poultry skin, chicken wings, fatty mince)
Smallgoods (sausages, saveloys, fritz/devon, salami, bacon, metwurst)
Full fat dairy products (milk, cheese, cream cheese, yoghurt, ice cream)
Paté

Plant sources
Coconut oil, cream and milk
Palm oil (used in many fast foods, takeaway foods, cakes and biscuits)
Toasted breakfast cereal, e.g. muesli

Takeaway foods
Commercial cakes, pastries, biscuits and chocolates
Deep fried or battered foods
Pies, pasties, sausage rolls
Pastries – shortcrust and puff pastry
Potato crisps, hot chips

Monounsaturated fats

Oils and margarines
Canola
Olive
Macadamia
Sunola (a sunflower oil high in oleic acid)
Peanut
Sunflower

Vegetables
Avocados
Olives

Nuts
Almonds
Peanuts
Cashews
Hazelnuts
Macadamias
Pecans

Spreads
Peanut butter
Almond spread

Polyunsaturated fats

Oils and margarines
Sunflower
Safflower
Corn
Soybean
Sesame
Cottonseed
Grapeseed

Nuts and seeds
Walnuts
Pine nuts
Brazil nuts
Sesame seeds
Sunflower seeds
Linseed

Spreads
Tahini

Fish and other seafood
Sardines, mackerel
Salmon, tuna, mullet
Calamari
Gem fish
Blue eye cod

your diet if your blood cholesterol levels are well controlled. The cholesterol content of a food does not have to be listed on the food label unless a claim regarding cholesterol is being made. All plant foods contain virtually no cholesterol so claims such as 'no cholesterol', 'low cholesterol' and 'cholesterol free' on the packaging of plant-derived foods such as margarines and oils are meaningless.

Types of blood fats

The levels of the various fats in your blood are measured by blood tests. The results are listed as total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides. Target levels for these blood fats for people who are at high risk of cardiovascular disease (such as those with diabetes) are given in Table 2.

The cholesterol family

Cholesterol is a fatty substance made by the liver and some other tissues and circulated around the body in the blood. Some cholesterol is obtained from certain foods – this is known as dietary cholesterol.

Cholesterol has many important functions but too much of it can cause fatty

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deposits to build up in the blood vessels. These deposits make it harder for blood to flow through the vessels and can cause blockages that may lead to heart disease or stroke.

Factors that contribute to high cholesterol levels in the blood are being male, having a family history of high cholesterol, being overweight, having a high dietary intake of saturated fat, and being physically inactive. The first two of these factors are fixed (or nonmodifiable), while the other three can be changed (are modifiable).

Cholesterol blood tests

- **Total cholesterol.** The total cholesterol includes HDL and LDL cholesterol.
- **HDL cholesterol.** HDL cholesterol (or high density lipoprotein cholesterol) is 'good' cholesterol and can remove 'bad' cholesterol from the lining of the arteries. The higher your level of HDL cholesterol, the better it is for your heart.
- **LDL cholesterol.** LDL cholesterol (or low density lipoprotein cholesterol) is 'bad' cholesterol and can be deposited in the inner lining of the arteries and eventually lead to a heart attack or stroke. The higher your level of LDL cholesterol, the worse it is for your heart.

Triglycerides

High levels of triglycerides in the blood are bad as they can lower HDL ('good') cholesterol and therefore increase your risk of heart disease.

Your body turns any extra energy (calories/kilojoules) from the food you eat into triglycerides and these are transported by the blood to fat cells for storage. A high level of triglycerides in your blood may be caused by eating more food than you need for your energy requirements or by a disorder such as diabetes, renal failure or alcohol dependence. When high triglycerides are not caused by another disorder, they are often seen together with high cholesterol.

What can you do to improve your blood fats?

You can improve your blood fats by following the suggestions in Table 3.

Table 4 lists good food choices that are low in fat, and foods that are high in fat and should be avoided.

Frequently asked questions

Should I use food products that contain 'plant sterols', such as Logicol and Proactive margarines?

Plant sterols occur naturally in plants. There is evidence that they are effective in reducing 'bad' (LDL) cholesterol. Small quantities are obtained naturally by eating fruit and vegetables, and larger amounts by eating plant sterol enriched margarines such as Logicol and Proactive. Recently, plant sterol enriched milks and yoghurts have become available.

As part of a healthy balanced diet, plant sterol enriched products may be beneficial in lowering cholesterol levels by an average of 10%. Manufacturers of the enriched margarines encourage an intake of 2 to 3 g of plant sterols a day (equivalent to about one to one and a half tablespoons of the margarine a day) to achieve maximum benefit in lowering LDL cholesterol. Be careful of unwanted weight gain that may result from using extra margarine. Discussion with a dietitian may be useful.

Table 2. Blood fat targets

The National Heart Foundation targets for blood fats in people at high risk of cardiovascular disease (such as those with diabetes) are:

- total cholesterol < 4 mmol/L
- LDL cholesterol < 2.5 mmol/L
- HDL cholesterol >1 mmol/L
- triglycerides <1.5 mmol/L.

Table 3. Suggestions for improving your blood fats

- Maintain a healthy weight
- Limit intake of takeaway foods and fatty snack foods, e.g. chocolate, crisps, cakes, pastries and high fat biscuits – choose healthy alternatives
- Eat lean meats, trimmed of visible fat, and remove skin from poultry
- Drink low fat milk and eat low fat yoghurts and cheeses
- Eat only small amounts of polyunsaturated or monounsaturated oils and margarines
- Increase intake of dietary fibre by eating more fruit, vegetables, pulses, wholemeal or wholegrain bread and cereals
- Eat fish two or three times a week, preferably deep-sea fish, which is rich in omega-3 fats – e.g. tuna, salmon, sardines, mackerel and herring
- Limit alcohol intake to fewer than four standard drinks for men and two for women a day, with two alcohol-free days a week
- Exercise regularly – aim for at least 30 minutes daily
- Quit smoking

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Should I be adding psyllium to my food?

Psyllium is a seed husk high in soluble fibre. There is a link between dietary fibre and protection against heart disease. Cholesterol can be lowered by increasing soluble fibre intake from foods such as rolled oats, oat bran, barley bran, legumes, lentils, fruits, vegetables, grains, rice and pasta.

When it is included as part of a healthy balanced diet, psyllium may be beneficial in lowering cholesterol levels. Manufacturers mainly add psyllium to breads and cereals. It can also be bought in powder form and added at home to breakfast cereals, drinks and casseroles. Aim for a fibre intake of about 30 g a day.

Should I be having soy milk and soy products?

Soy products are plant derived and hence free of cholesterol. The protein found in soy products is thought to assist in lowering 'bad' (LDL) cholesterol. Soy products can be part of a healthy diet as long as they are low fat and calcium enriched. About 25 g of soy protein a day, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease (this is equivalent to three cups of soy milk per day).

Should I be avoiding eggs if my cholesterol is high?

A moderate intake of eggs (about three a week) is suitable if your cholesterol is high. Although eggs contain reasonable amounts of dietary cholesterol and saturated fat, they also contain several valuable nutrients, such as protein, zinc and vitamins. Use low fat cooking methods, such as boiling or poaching.

Should I avoid margarine and oil completely?

It is not necessary to avoid eating margarine and oil completely. Read margarine food labels and choose polyunsaturated or monounsaturated varieties with less than 1 g trans fat per 100 g of the margarine (less than 1%). Spread margarine thinly on bread. Use small amounts of oil in cooking (e.g. one teaspoon per person). Try low fat cooking methods such as grilling or roasting on a rack, poaching and boiling.

Table 4. Fat checklist

No or low fat foods

- Low fat mayonnaise, low calorie/kilojoule salad dressings, vinegar, lemon juice, low calorie/kilojoule gravy mixes, plain yoghurt, fish sauce, soy sauce, homemade stock
- Reduced fat cheese, ricotta cheese, cottage cheese, low fat cream cheese
- Lean cuts of meat, e.g. ham, beef, chicken and turkey breast – trim any fat and remove chicken skin
- Foods cooked without fat or with a minimal amount of monounsaturated or polyunsaturated vegetable oil, e.g. grilled fish or meat, rotisserie chicken (no skin), dry fried meats
- Fruit, vegetables (raw, steamed, roasted with oil spray), plain popcorn, low fat cracker biscuits, oven baked chips
- Oil or margarine – limit to one tablespoon per day, preferably polyunsaturated or monounsaturated varieties
- Nuts – limit to one-third of a cup a day or in cooking occasionally.

High fat foods – avoid these

- Ordinary mayonnaise, oily salad dressings
- Full fat milk, cream, yoghurt
- Full fat cheese, cream cheese
- Fat on meat, duck and chicken skin
- Fatty meats, e.g. sausages, bacon, fritz/devon, salami
- Deep fried or battered foods, e.g. fried dim sims, spring rolls, pies, pasties
- Crisps, hot chips, prawn crackers
- Large amounts of margarine, butter, oil, cream, peanut butter, dripping, lard, ghee, coconut cream, nuts and seeds

Fatty meats such as salami should be avoided

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Sugar and salt: a recipe for problems

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Reducing dietary salt intake is beneficial for most people, and especially for those who have diabetes. Guidance on adopting a low salt diet is provided here and in an accompanying patient handout.

For most people with diabetes, salt is not an issue; they are concerned about sugar, not salt. However, salt – or sodium chloride – can pose special problems for people who have diabetes because they have much higher rates of sodium-related medical conditions and are more likely to be taking medications affecting sodium metabolism.

This article discusses sodium-related problems associated with diabetes and identifies some strategies to address them.

Sodium-related medical conditions

Several medical conditions are associated with a high intake of sodium (Table 1). These conditions are commonly found in people who have diabetes.

Hypertension

About 60% of people with type 2 diabetes have high blood pressure. Excess sodium increases blood pressure, particularly in those with renal impairment. High blood pressure and diabetes cause 'double trouble' for cardiovascular disease.

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Oedema

Peripheral neuropathy causes shunting of arterial blood and increases venular and capillary pressure. This is a particular problem in the feet and lower legs where neuropathy is worse and the forces of gravity are highest. It is, therefore, no surprise that people with diabetes often have oedema. Excess salt makes this worse.

Heart failure

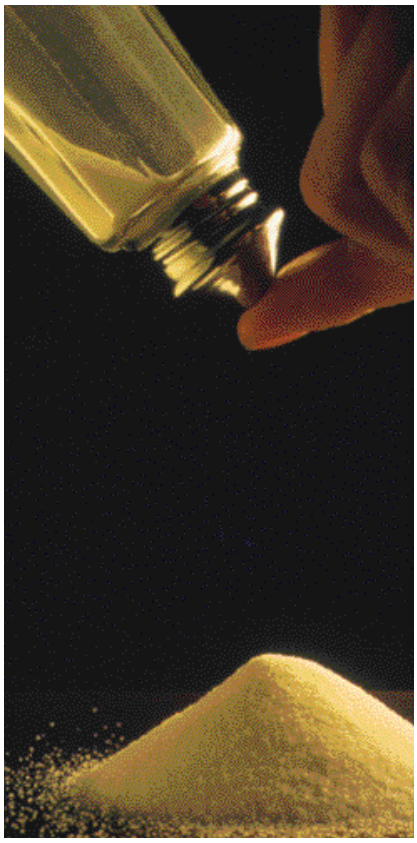
Whether ischaemic or cardiomyopathic, heart failure is common in people who have diabetes. By day gravity increases central venous pressure, increasing capillary pressure and filtration of fluid from capillaries into interstitial spaces, causing peripheral oedema. At night, when the influence of gravity is much less and excess peripheral fluid is absorbed into the general circulation, pulmonary oedema can occur. Salt makes the oedema worse.

Medications and sodium metabolism

Three types of medication are especially important in relation to salt: diuretics, NSAIDs and glitazones (Table 2).[1] They are all commonly used by people with diabetes.

Diuretics

A high sodium intake reduces the effectiveness of diuretics in the treatment of



PHOTOLIBRARY

Table 1. Sodium-related medical conditions

Hypertension
- High salt intake can raise blood pressure
- Associated with metabolic syndrome, diabetes and CVD, and with ageing

Oedema
- High salt intake can worsen oedema
- Associated with hypertension, cardiac failure and neuropathy

Cardiac failure
- High salt intake worsens peripheral and pulmonary oedema
- Associated with higher incidence of coronary heart disease, and with diabetic cardiomyopathy

Table 2. Medications and sodium metabolism

Diuretics

- Effectiveness of diuretics in reducing body sodium (as in treatment of hypertension, cardiac failure, oedema) reduced by high sodium intake

NSAIDs

- NSAIDs increase renal sodium retention
- Associated with overweight and ageing

Glitazones

- Possible glitazone side effect of oedema reduced by lower/no salt intake

hypertension, heart failure or oedema. If the person skips the salt, they may be able to skip the diuretic as well.

NSAIDs

NSAIDs are potentially dangerous drugs for people with diabetes. In addition to causing gastritis and potentially increasing cardiovascular risk, they also increase renal sodium retention and can damage the kidney directly. As NSAIDs are available over the counter as well as on prescription, and some are also contained in preparations such as cold and flu tablets, GPs may not even realise that their patients are taking them. Patients should be asked whether they are taking any medications for arthritis, pain or colds.

Arthritis Australia (www.arthritisaustralia.com.au; Australia-wide contact number 1800 011 041) has useful guidelines to control discomfort without using NSAIDs. Some alternatives to NSAIDs for arthritis and pain management are listed in Table 3.

Glitazones

Glitazones are very effective in controlling blood glucose but may result in fluid retention, especially in combination with insulin, which is itself salt-retaining. Those patients taking glitazones who are having problems with peripheral or pulmonary oedema may benefit considerably by avoiding salt in their diet.

Recommended daily intake of salt/sodium

'I don't get much salt. I don't add much salt in cooking or at the table. Anyway we need salt, especially in hot, humid climates like in Australia.'

This is a common response. It is both right and wrong.

- It is wrong in that we do get much more sodium than we need. The recommended adequate intake of sodium is 460 to 920 mg/day (20 to 40 mmol/day) and the recommended upper limit is 1600 mg/day (70 mmol/day) for older, overweight and hypertensive patients and for those wishing to maintain low blood pressure over the lifespan.[2] The average Australian consumes up to 4600 mg sodium/day (200 mmol/day) – i.e. five to 10 times the recommended amount.[3] See the box on this page for more on milligrams and millimoles.
- It is right in that we only add 15% of the total sodium in our food during cooking or at the table. Most (75%) of the sodium in our diet comes from processed foods (mainly added salt but also other sodium-containing ingredients such as monosodium glutamate, baking powder and sodium bicarbonate). About 10% of our sodium intake is naturally present in fruit, vegetables and meat.
- It is wrong in that for almost all Australians, food provides much more sodium than we need. Most of us do not spend our lives working vigorously in tropical heat, and even if we did, we would still get enough sodium from our food. The Australian

Table 3. Alternatives to NSAIDs for arthritis and pain management

Non-medication strategies

- Exercise (low impact, such as walking, cycling, swimming) – to maintain mobility and general fitness
- Resistance training – strengthens muscle groups around joints
- Alternative therapies – acupuncture, homoeopathy, massage*

Medication strategies

- Low risk analgesics – such as paracetamol in adequate doses†
- Topical analgesics – such as NSAID gels, especially for superficial discomfort

* There are no rigorous placebo-controlled trials for these therapies but they may work.

† Slow release forms of paracetamol are available on the PBS. Also, patients should be aware that paracetamol may be a constituent of preparations such as cold and flu tablets.

What's in a name? Milligrams and millimoles

The different conventions used for referring to sodium and salt can be confusing. Laboratories refer to millimoles (mmol) of sodium, recipes refer to teaspoons or grams of salt (sodium chloride), and food labels refer to milligrams of sodium.

Millimole and milligram equivalents can be calculated. When considering an element, 1 mole is the element's atomic mass in grams, i.e. for sodium, atomic mass 23, 1 mole is 23 g. When considering a compound, 1 mole is the compound's molecular mass in grams, i.e. for sodium chloride, molecular mass 58.5, 1 mole is 58.5 g. Therefore for sodium, 1 mmol is 23 mg, and for salt, 1 mmol is 58.5 mg.

continued

Table 4. Hints on reducing dietary salt intake

- Avoid adding salt to food while cooking
- Avoid putting the saltshaker on the table
- Use fresh or dried herbs, spices, lemon or citrus juice, wine, mustard or vinegar to flavour food instead of salt or salty sauces
- Choose 'no added salt', 'low salt' or 'salt reduced' versions of products such as margarines, tinned baked beans and stock powders
- To retain the flavour of vegetables, cook them by steaming, microwaving or baking instead of boiling
- Replace salty snacks such as crisps, corn chips and pretzels with low salt crispbreads, fresh fruit and vegetable sticks

Army stopped using salt tablets for combat troops in tropical climates long ago.

Reducing salt intake

Most people, and especially those with diabetes, could benefit from reducing their salt intake. Some hints on how to do this are given in Table 4 and in the patient handout on pages 37 and 38 of this issue of *Medicine Today*. Several consumer resources are listed in the box on page 35.

People often complain that low salt foods taste awful. As we reduce our salt intake our taste buds adapt to lower sodium levels, the perceived intensity of salt in food increases and the 'preferred saltiness' of food reduces. This taste change is usually noticed within a week of reducing the salt intake.[2]

Seeking salt – read the label

Having decided to reduce their salt intake, most people can think of ways to use less salt in food preparation and at the table. This is a good start but does not address processed food, the main source of salt.

The widespread use of salt in the food industry is related to its cheap price and its sensory and preservative properties. Fortunately food manufacturers are now obliged to include sodium contents in the nutrition information panels on food labels (see the box on this page). People should read these panels to check the sodium content of the food. Foods with sodium contents of 400 mg or less per 100 g of the food are a good choice in terms of sodium content, and those with less than 120 mg per 100 g an excellent choice.[4]

Lower salt versions of some popular products are available. Foods labelled 'low salt' must contain 120 mg or less of sodium per 100 g. 'Reduced salt' or '20% less salt' labels do not necessarily mean that the product is a healthy choice as the food may still have a sodium content above that recommended for a 'good choice' and/or may be high in total and saturated fat and added sugar.

Choosing processed foods with low or lower sodium contents is essential when trying to reduce sodium intake but may not be enough. Processed foods can have very high sodium contents and in some cases truly low sodium versions may not

Salt and food labels

Salt is listed on the nutrition panel of packaged food labels as sodium. Although most of the sodium in the diet comes from salt, which is used for both flavour and preservation in many processed foods, some comes from other sodium-containing ingredients such as monosodium glutamate (MSG), meat and vegetable extracts, stock cubes, baking powder and sodium bicarbonate. These hidden sources of sodium should be looked for on the ingredients list on packaged foods.

Foods that have a sodium content listed on the nutrition panel of 120 mg or less per 100 g of the food are an excellent choice in terms of sodium content; foods with 400 mg or less sodium per 100 g are a good choice. Other nutrients, such as saturated fat and fibre, should also be considered when making a food choice. An example of a nutrition information panel is given below – the food in this case is a particular brand of cracker biscuit that has a high sodium content.

Nutrition information panel

Servings per package: 33
Serving size: 30 g

	Quantity per serving	Quantity per 100 g
Energy	570 kJ	1630 kJ
Protein	4.7 g	13.5 g
Fat		
– total	0.6 g	1.7 g
– saturated	0.1 g	0.3 g
Carbohydrate		
– total	26.4 g	75.5 g
– sugars	0.3 g	0.9 g
Dietary fibre	2.2 g	6.3 g
Sodium	371 mg	1060 mg

Table 5. Sodium content of various breakfast cereals

Cereal	Sodium (mg per 100 g)
Bran, oat/rice/wheat	0
Freedom Foods Corn Flakes with Psyllium	109
Freedom Foods Rice Flakes with Psyllium	110
Kellogg's All-Bran	380
Kellogg's All-Bran Wheat Flakes	330
Kellogg's Corn Flakes	720
Kellogg's Guardian	215
Kellogg's Just Right Original	30
Kellogg's Mini-Wheats	10
Kellogg's Nutri-Grain	600
Kellogg's Special K	536
Kellogg's Sustain	97
Muesli, average	133
Porridge/ rolled oats	10
Sanitarium Light 'n' Tasty Apricot	240
Sanitarium Lite-Bix	20
Sanitarium Weet-Bix Kids	110
Sanitarium Weet-Bix Multigrain	367
Sanitarium Weet-Bix Original	290
Uncle Tobys Plus Bran	395
Uncle Tobys Plus Fibre	105
Uncle Tobys Plus Sultanas'n Bran	385
Uncle Tobys Vita Brits	400
Uncle Tobys Vita Weeties	405

be available. Much of the salt intake of the Australian population comes from 'recommended' foods such as bread, cereals and cheese. Most commercially available breads have a sodium content of more than 400 mg (about 17 mmol) per 100 g (which is about 120 mg or about 5 mmol sodium per slice). It is virtually impossible to purchase a low salt bread from an ordinary supermarket or bakery; it can usually only be found in specialty stores. People should be encouraged to use fresh unprocessed foods and to prepare their own low salt bread, soups, savouries and sauces. Low salt breakfast cereals are also difficult to find, with some popular cereals containing more salt per serve than potato chips. Examples of cereals with sodium contents below 30 mg per 100 g include oats, Sanitarium Lite-Bix, Kellogg's Mini-Wheats and Kellogg's Just Right (Table 5). Most types of muesli are also low in salt.

If there is concern about a patient's adherence to a low sodium diet, a 24- or 48-hour urine output collection may be considered to check sodium turnover.

Consumer resources

Useful websites

- www.saltmatters.org – for shopping lists, cookbooks and the Salt Skip Newsletter
- www.nutritionaustralia.org/Food_Facts/FAQ/salt_faq.asp

A useful book

Salt matters: a consumer guide, by Dr Trevor C Beard, Lothian Books, Melbourne; 2004.

Several consumer resources of use when shopping and cooking for low salt diets are listed in the box on this page.

Salt substitutes

There are several salt substitutes on the market, such as No Salt and Lite Salt. Most of these still contain sodium, and are not recommended. Other commercially available salts are just sodium chloride in disguise, such as rock salt and sea salt, or salt mixed with other ingredients, such as onion salt, celery salt, garlic salt and ordinary stock powders and cubes.

Potassium chloride salt substitutes contain almost no sodium but should be avoided in patients with renal dysfunction, or in those who are taking potassium-sparing diuretics.

Managing oedema – salt and stockings

Often people are taking diuretics because they have peripheral oedema. Skipping salt will help but support stockings are often very useful too.

As mentioned earlier, extracellular fluid accumulates in the areas where the pressure is highest – the feet, ankles and lower legs. Diuretics are often prescribed to 'squeeze' the excess salt and fluid out of the body. However, if the problem occurs because of lower limb venous hydrostatic pressure associated with gravity, reducing

continued

the total extracellular fluid volume will not solve the problem. What is needed is to stop fluid in the high pressure areas from leaking into the extracellular space. Support stockings do this.

Encourage patients to put the stockings on before they stand up in the morning. If they wait until later, some oedema may have accumulated, making their legs thicker and the stockings more difficult to put on. If the patient has problems putting on the stockings, another person may be able to help. Also, there are various devices and techniques to make stockings easier to put on. Community nurses are often good sources of advice for 'tricks of the trade'.

Key points

- Excess sodium intake can pose particular problems for people with diabetes because they are at high risk of hypertension, oedema and heart failure compared with people who do not have the condition.
- Diuretics, NSAIDS and glitazones are three medications commonly used in diabetes. A high salt intake may reduce the effectiveness of diuretics or further contribute to fluid retention resulting from NSAIDs or glitazones.
- The recommended adequate adult intake for sodium is 460 to 920 mg per day. The average Australian consumes up to five to 10 times the adequate amount (75% from processed foods, 15% added at the table and 10% naturally in foods).
- People should be encouraged to use fresh foods where possible, to check the nutrition information labels of processed foods for sodium and to look for 'no added salt', 'reduced salt' and 'low salt' foods.
- A gradual reduction in salt use allows taste buds to adapt.
- Many salt substitutes still contain some sodium. Potassium chloride substitutes should be avoided in patients with renal dysfunction and in those taking potassium-sparing diuretics.
- Support stockings are a useful way of improving peripheral oedema. MT

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Ms Stanton and Ms Carapetis: None.

Reduce salt in your diet

Adapted with permission from a patient resource prepared by the Diabetes Centre, The Queen Elizabeth Hospital Diabetes Centre, Adelaide, SA.

Most people, and especially those with diabetes, could benefit from reducing their salt intake. This handout provides hints on how to cut back on salt in the diet.

What is salt?

Salt (sodium chloride) is a chemical compound that consists of sodium and chlorine. It is a flavour enhancer and also a preservative. It is found naturally in foods such as fruit, vegetables and meat, and is also added to foods during processing. Although salt flavour is one of the basic tastes, overconsumption of salt can cause a number of health problems including excessive fluid retention, high blood pressure, heart disease and kidney disease. It is the excessive sodium that is responsible for the increased risk of these chronic diseases.

How much salt do we need?

A recommended adequate intake of sodium to reduce the risk of chronic disease is about 460 to 920 mg per day for adults (this is about 1.2 to 2.3 g of salt), and not more than 1600 mg (about 4.1 g of salt). The sodium that occurs naturally in foods provides this amount of sodium. The average Australian consumes up to 4600 mg of sodium per day (about 12 g of salt) from the following sources:

- 15% added in cooking or at the table
- 10% naturally present in fruit, vegetables and meat
- 75% from processed foods.

Who needs to cut back on salt?

Everyone, regardless of age, should cut back on salt in their diet. A low salt intake can reduce the risk of health problems. For people with existing high blood pressure, heart disease or kidney problems, a low salt intake can assist in the control and management of these conditions.

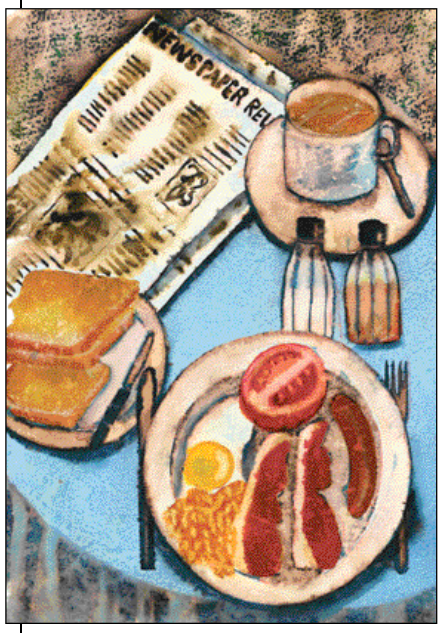
How do we cut back on salt?

Step 1: Skip the salt

- Avoid adding salt while preparing food and at the table.
- Steam, microwave or bake your vegetables without adding salt (these cooking methods retain the natural flavour of the food much better than cooking by boiling).
- Cook pasta, rice and potatoes without salt.

Step 2: Choose low salt foods

- Choose 'low salt', 'no added salt' or 'reduced salt' products where possible.
- Avoid or at least limit processed foods such as processed meats, commercial sauces, packet soups, packet seasonings, gravy powder, stock cubes and stock powder.
- Look for salt reduced stock powders.
- Avoid potato chips/crisps and high salt takeaway foods.
- Use unsalted nuts.



About three-quarters of the salt in our diet comes from processed foods. Avoiding eating meals such as a cooked breakfast of bacon, which is high in salt, plus eggs, to which salt is likely to be added, is one of many ways to cut back on salt in the diet.

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- Eat a wide variety of foods from different food groups.
- Try making your own sauces, pickles and chutneys without added salt.
- Read food labels to check the salt (sodium) content of various foods – see the box on this page. Choose packaged foods with less than 120 mg sodium per 100 g (excellent choice) or less than 400 mg per 100 g (good choice).

Step 3: Savour the flavour without salt

- Add garlic, onion, horseradish, mustard or ginger to dishes for flavour.
- Use fresh or dried herbs to flavour food, e.g. add rosemary or oregano to baked lamb or beef, team chicken with thyme, add coriander to Asian dishes, and add parsley and dill to scrambled eggs.
- Use lemon or other citrus fruits to flavour meats or for salad dressings.
- Use fruit juices to add a different taste to savoury dishes.
- Use spices to flavour your dishes, e.g. cumin, cardamom, cloves, paprika and cinnamon.
- Add dry wine while cooking (most of the alcohol disappears and the flavour remains).

Salt and food labels

Salt is listed on the nutrition panel of packaged food labels as sodium. Although most of the sodium in the diet comes from salt, which is used for both flavour and preservation in many processed foods, some comes from other sodium-containing ingredients such as monosodium glutamate (MSG), meat and vegetable extracts, stock cubes, baking powder and sodium bicarbonate. These hidden sources of sodium should be looked for on the ingredients list on packaged foods.

Foods that have a sodium content listed on the nutrition panel of 120 mg or less per 100 g of the food are an excellent choice in terms of sodium content; foods with 400 mg or less sodium per 100 g are a good choice. Be sure to check also the amounts of other nutrients in foods (such as saturated fat). An example of a nutrition information panel is given below – the food in this case is rolled oats, a particularly low sodium product used in mueslis and for porridge.

Nutrition information panel

Servings per package: 33
Serving size: 30 g

	Quantity per serving	Quantity per 100 g
Energy	460 kJ	1540 kJ
Protein	3.8 g	12.8 g
Fat		
– total	2.3 g	7.6 g
– saturated	0.5 g	1.5 g
Carbohydrate		
– total	7 g	56.7 g
– sugars	0.3 g	1.0 g
Dietary fibre	3 g	10 g
Sodium	Less than 5 mg	10 mg

Step 4: Be aware of salt in disguise

There are a number of salt substitutes on the market (e.g. No Salt or Lite Salt). Most of these still contain significant amounts of sodium and are not recommended. Others contain compounds that are not suitable for people with particular health conditions, especially high blood pressure or kidney problems. Consult your doctor before using any salt substitute.

There are many types of salt available that should be avoided. These include vegetable salt, celery salt, garlic salt, onion salt, rock salt and sea salt, which are all the same as ordinary table or cooking salt. Stock powders and monosodium glutamate (MSG) are also sources of sodium. The best and safest option is to avoid all types of salt and salt substitutes and to use reduced salt stock powders. Look for hidden sources of sodium on food packaging.

There is a period of adjustment in taste when reducing salt intake. It may be easier to cut back slowly to allow your taste buds to adapt. Remember to be patient!

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Alcohol and diabetes

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In people with diabetes, alcohol consumption can have particular adverse effects and is commonly associated with hypertriglyceridaemia, fatty liver and weight gain.

It has been said that alcohol '*…improves the lipid profile, is one of the few interventions to increase HDL cholesterol, improves quality of life and has been shown to reduce the risk of heart disease… Take two doses each night with your evening meal.*' It could be good medicine for people with diabetes who commonly have dyslipidaemia, a low HDL cholesterol and increased risk of cardiovascular disease.

It has also been said that alcohol '*…increases weight, triglyceride, blood pressure and the risk of hypoglycaemia… and is a major cause of marital disharmony and violent death.*' Perhaps not so good after all.

Both these statements are true. Alcohol consumption is associated with decreased cardiovascular risk – the so-called 'French paradox' of a lower risk of cardiovascular disease despite a high prevalence of smoking – and, when consumed in moderation, it is a great social lubricant. However, the drinking of alcohol has the potential for adverse metabolic effects and is a major contributor to motor vehicle accidents, domestic and other violence, morbidity and mortality.

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Like the general population, people with diabetes may derive some health benefits from a modest intake of ethanol, and are also likely to suffer from the well-known adverse effects of excess consumption. They are, however, more likely to experience particular adverse metabolic effects. This article focuses on the particular potential adverse effects of ethanol in patients with diabetes and provides information, in the form of a handout for patients, on sensible drinking.

Alcohol metabolism

Alcohol (ethanol) metabolism starts in the liver with conversion of alcohol to acetaldehyde by the enzyme alcohol dehydrogenase and then conversion of acetaldehyde to acetate by acetaldehyde dehydrogenase, with the production of energy via the co-enzyme NAD^+/NADH (see the box on page 40). Acetate can then be metabolised to energy (via NADH) and carbon dioxide, or converted to ketones and triglycerides and exported for metabolism or storage elsewhere in the body. Alcohol is not metabolised directly to glucose.

The NADH produced in the metabolism of alcohol can be converted back to its oxidised form (NAD^+) through the electron transport chain, generating energy that is stored as ATP (adenosine triphosphate).

If the acetyl CoA production from the metabolism of alcohol exceeds immediate liver demands, NADH accumulates and must be converted to NAD^+ by the reduction of other substrates, which are then exported for use elsewhere. Examples of such reactions are the conversion of pyruvic acid to lactic acid and the production of triglycerides (see the box on page 40). The conversion of pyruvic acid to lactic acid effectively inhibits the production of glucose by the liver, leading to hypoglycaemia when food sources and liver stores of glucose are used up.

The production of triglycerides leads to hypertriglyceridaemia and fatty liver.

Metabolic effects of alcohol

The apparently complex metabolic effects of alcohol are now more easily understood. These occur in both people with and without diabetes.

Common effects

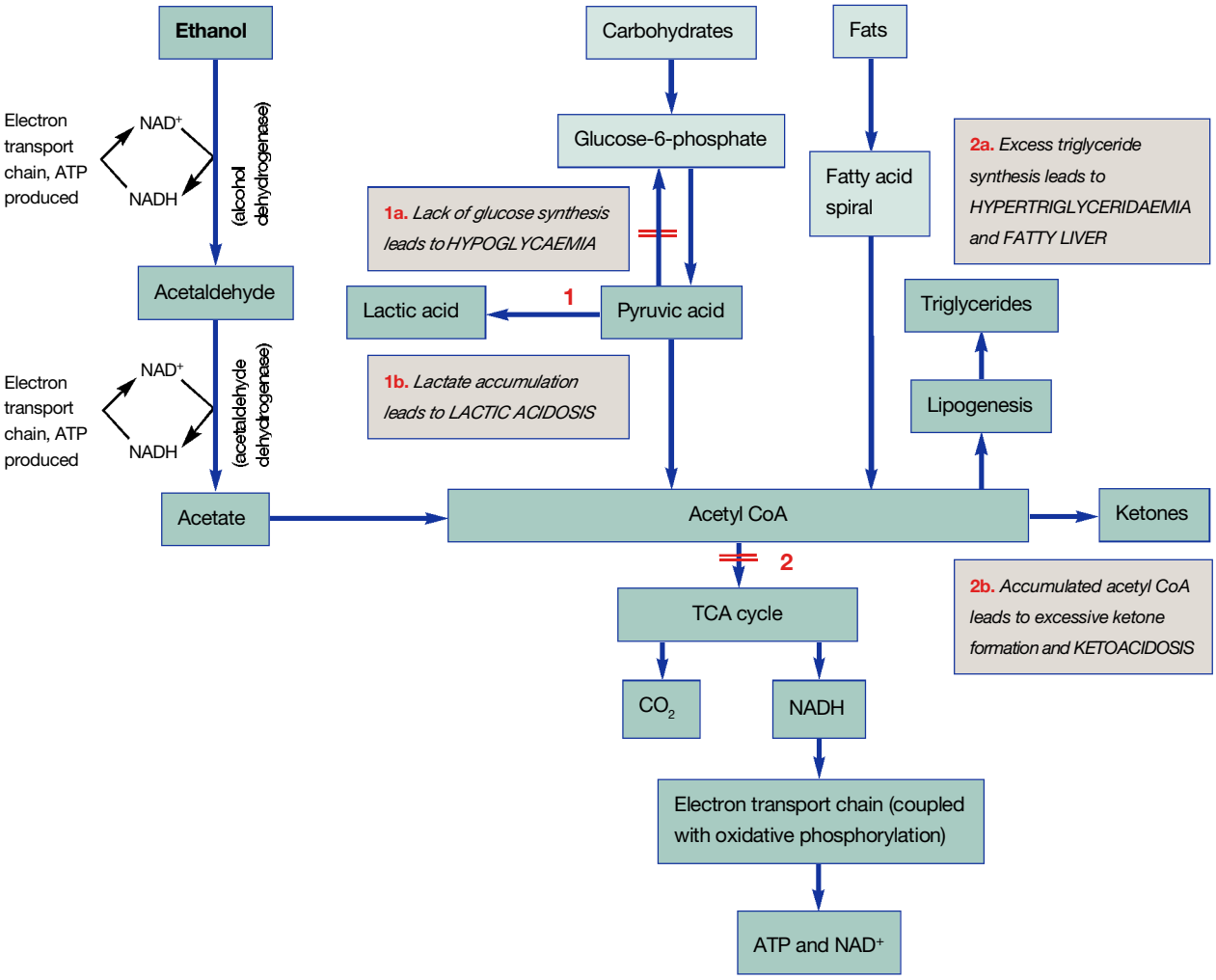
- Hypertriglyceridaemia – from the conversion of acetyl CoA to triglycerides, which are secreted into the blood as very low density lipoproteins (VLDLs).
- Fatty liver – from excess triglyceride production and fat storage in the liver.
- Weight gain – from energy derived from alcohol (29 kJ or 7 cal per g alcohol, second only to fat [37 kJ/g or 9 cal/g]).

Less common effects

- Hypoglycaemia – from conversion of pyruvic acid, the substrate for glucose production, to lactic acid.

continued

A summary of ethanol metabolism



Ethanol metabolism and toxic effects

Alcohol (ethanol) is metabolised in the liver to acetaldehyde and then acetate, which then is metabolised via the TCA cycle (tricarboxylic acid cycle, also known as the citric acid or Krebs' cycle) to energy and carbon dioxide. The redox reactions involve the reduction of NAD^+ to NADH and conversion back to the oxidised state by the electron transport chain coupled with oxidative phosphorylation (with production of ATP). When acetyl CoA production exceeds immediate demands, acetyl CoA and NADH accumulate.

Several metabolic effects of alcohol are due to excess acetyl CoA and NADH.

Excess NADH is disposed of by conversion to NAD^+ by means other than the electron transport chain, i.e. reducing substrates of various metabolic pathways, such as reduction of pyruvic acid to lactic acid.

1. Excess NADH drives conversion of pyruvic acid to lactic acid. The resulting lack of pyruvic acid as a substrate for gluconeogenesis causes hypoglycaemia (1a). The build up of lactic acid may lead to lactic acidosis (1b).
2. Excess NADH produced by the electron transport chain inhibits the TCA cycle. The accumulated acetyl CoA can be used for lipogenesis, leading to excessive triglyceride production, hypertriglyceridaemia and fatty liver (2a). The excess acetyl CoA can also be converted to ketones, and this may lead to excessive ketone production (ketosis) and, in very high levels, ketoacidosis (2b).

Rare effects

- Ketoacidosis – from excess production of ketones.
- Lactic acidosis – from excess production of lactic acid.
- The disulfiram reaction – from inhibition of acetaldehyde dehydrogenase by sulfonylureas, resulting in accumulation of acetaldehyde, which causes flushing of the skin, gastrointestinal upset and other ill effects.

Ketoacidosis is usually associated with another precipitant, such as insulin deficiency, which causes the excess acetyl CoA to be diverted from lipogenesis to ketone production (2a and 2b in the box on page 40). Lactic acidosis is also usually associated with another precipitant, such as hypoxia or metformin use, which themselves increase lactic acid production (1b in the box on page 40).

The disulfiram reaction is so named because the medication disulfiram (Antabuse), which is used to help manage alcohol dependence, inhibits acetaldehyde metabolism. The same reaction occurs in some people who are naturally deficient in acetaldehyde dehydrogenase (e.g. those of Asian extraction).

Table. Lifestyle changes and effects on hypertension[2]

Lifestyle change	Target	Benefit (systolic blood pressure reduction)
Increase activity	30 to 40 min, 3 to 4 times per week	4 mmHg
Lose weight	BMI: <25 kg/m^2 Waist circumference: <94 cm, men <80 cm, women	2 mmHg per kg loss
Limit sodium intake	<100 mmol/day	6 mmHg
Limit alcohol intake	<40 g/day, men* <20 g/day, women	3 to 4 mmHg
Limit saturated fat intake	<10% energy	2 to 3 mmHg

* One standard drink contains 10 grams of alcohol.

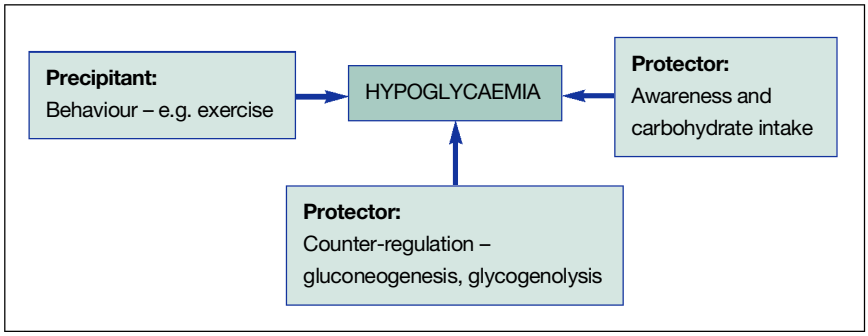


Figure. Hypoglycaemia – precipitants and protectors.

Alcohol and type 2 diabetes

Weight gain

Australia has one of the most overweight populations of all developed nations and Australians with diabetes are more overweight than the average Australian. Being overweight (particularly centrally overweight) underlies the disturbed metabolism of people with diabetes. Any excess energy intake, particularly of high-energy foods like alcohol, leads to further weight/waist gain and worsens the metabolic disturbance.

Dyslipidaemia

Apart from dyslipidaemic affects through worsening central overweight, alcohol metabolism directly increases triglyceride levels (see the box on page 40). Although moderate alcohol intake is associated epidemiologically with increased levels of high density lipoprotein cholesterol (HDL-C), this potential benefit can be outweighed by high triglyceride levels, which are associated with lower HDL-C levels.

Alcohol can, therefore, potentially worsen the lipid profile, particularly in those who already have high triglyceride or low HDL-C levels (as is the case with 20.5% and 11.9%, respectively, of Australians with type 2 diabetes).[1]

Hypertension

Moderating alcohol intake is one of the lifestyle changes that can reduce systolic hypertension (Table).[2]

Drug interactions

Polypharmacy is common in Australians with type 2 diabetes. Apart from their hypoglycaemic medication and medications for hypertension, dyslipidaemia and prothrombosis, individuals with type 2 diabetes may be taking the other prescription medications generally taken by the general population and an equal or greater number of complementary and OTC medications and health foods.

Alcohol has many drug interactions, including several related to hypoglycaemic medications. It interacts with sulfonylureas acutely or chronically. Acutely, there is competition for metabolism such that the action of sulfonylureas are augmented, thereby predisposing patients to hypoglycaemia, and also causing skin flushing, gastrointestinal upset and other adverse effects due to the disulfiram reaction.

Chronically, alcohol induces the metabolism of sulfonylureas, reducing their therapeutic effect. Alcohol also interacts with metformin, increasing the risk of lactic acidosis.

Apart from interactions with hypoglycaemic agents, alcohol can reduce insulin secretion, predisposing patients to hyperglycaemia.[3] It can also increase the risk of, or worsen, hypoglycaemia by reducing hepatic glucose production.[3]

Impaired judgement

Alcohol is a valued contributor to the pleasure associated with food, friends and social activities but may impair judgement, predisposing individuals to less healthy food choices, less recognition of hyper- or hypoglycaemia and omission or misdosing of medication.

Alcohol and type 1 diabetes

Hypoglycaemia

Alcohol can affect all three of the factors predisposing to and protecting against hypoglycaemia – behaviour, awareness and counter-regulation (Figure). Impaired judgement may predispose to behaviours that cause hypoglycaemia and impair corrective responses. Alcohol can also reduce recognition of hypoglycaemic symptoms. As noted earlier, alcohol metabolism may divert glucose precursors to lactate synthesis, reducing gluconeogenesis and worsening hypoglycaemia.

The sedative effect of alcohol may mean that a person continues to sleep through hypoglycaemia that would otherwise have roused them and prompted corrective action.

Certain groups of people with diabetes are at particular risk of dangerous and potentially life threatening hypoglycaemia. These include:

- for those with type 1 diabetes – young men who get drunk
- for those with type 2 diabetes – older women taking sulfonylureas that have renally excreted active metabolites (glimepiride, glibenclamide)
- for all people with diabetes – when there is loss of hypoglycaemia awareness; participation in activities where mistakes may have fatal consequences; presence of comorbidities or use of medications that increase the depth or ill effects of hypoglycaemia; cold climate (which reduces the liver's capacity for gluconeogenesis); and sleeping alone (which increases the likelihood of not being found unconscious for a long time).

Ketoacidosis

In patients with ketoacidosis, insulin deficiency increases glucose and ketoacid production, causing an osmotic diuresis, dehydration, acidosis and the risk of life-threatening collapse.

As with hypoglycaemia, the combination of the metabolic, cognitive and sedative effects of alcohol may lead to dangerous and potentially life-threatening ketoacidosis.

Alcohol and diabetes – recommendations

Diabetes Australia and the RACGP have endorsed the NHMRC Australian Alcohol Guidelines.[4,5] The current recommendations are two standard drinks (each 10 g of alcohol) per day for men and women.[5] The American Diabetes Association recommends abstinence in those with high triglyceride levels.[6,7]

The patient information sheet accompanying this article (pages 43 to 45) is consistent with the Diabetes Australia, RACGP and NHMRC guidelines for alcohol use, which are the same as those for the general population. The information sheet suggests that people with diabetes and other individuals who are trying to lose weight or who have high triglyceride levels or high blood pressure should limit their alcohol intake to one or two drinks on special occasions only.

Generally beer, wine and spirits are low in carbohydrate (sugar) and are more likely to cause hypoglycaemia than hyperglycaemia when consumed on their own.

Key points for sensible drinking include:

- drink low alcohol rather than high alcohol drinks
- avoid alcoholic drinks high in sugar
- eat low fat, high carbohydrate foods when consuming alcohol. MT

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Ms Stanton and Ms Carapetis: None.

Alcohol and diabetes

How can you raise your glass and keep control of the situation?

This handout provides information for people with diabetes about consuming alcohol, including recommended intakes and tips for sensible drinking. The information applies also to the general population.

Modified with permission from the 'Healthy eating and diabetes' kit (4th edition), produced by the Diabetes Centre, The Queen Elizabeth Hospital, Adelaide, SA.

Alcohol intake recommendations

A standard drink is any drink containing 10 grams of pure alcohol. Different alcoholic drinks contain different numbers of standard drinks, as shown in the Figure and Table 1. The alcohol content (the percentage of alcohol by volume) and approximate number of standard drinks in a can, bottle or other package of an alcoholic drink are stated on the package's label.

Standard drinks are a simple and effective way of keeping track of how much alcohol is consumed. The alcohol consumption limits in the Australian guidelines to alcohol consumption are based on this concept, and are:

- for men and women, a maximum of two standard drinks a day.[1]

The recommendations are the same for people with diabetes and for the general population. However, if you are trying to lose weight, your triglyceride levels are high, or you have poor glucose control or high blood pressure, try to drink alcohol on special occasions only, and limit your intake then to one or two standard drinks.

If you are finding it difficult to reduce your alcohol intake, discuss this with your doctor, diabetes nurse or dietitian.

Tips for sensible drinking are given in the box on the last page of this handout.

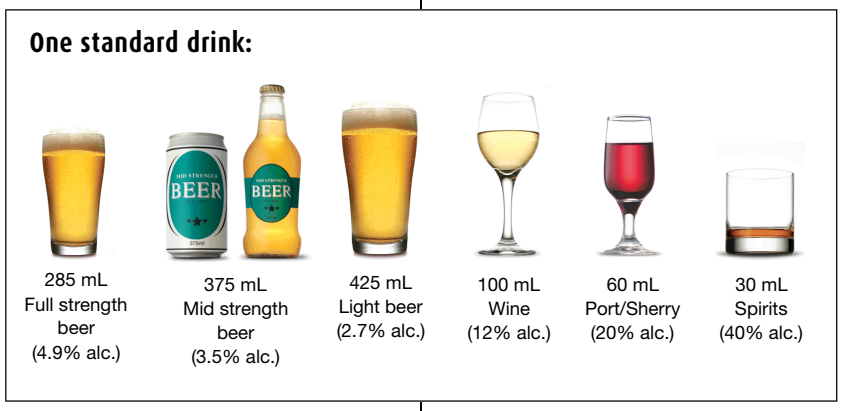

Figure. Standard drinks guide.

How can alcohol affect you?

- **Weight gain.** Alcoholic drinks are usually high in energy (calories/kilojoules), contain few vitamins or minerals and can contribute to weight gain.
- **Hypoglycaemia (low blood glucose levels).** Alcohol in large amounts, and particularly when consumed on an empty stomach, stops the liver from releasing glucose. This may cause hypoglycaemia if you take insulin or some types of diabetic medications. Always drink alcohol with a carbohydrate-based meal or snack, such as bread or fruit.
- **Raised triglyceride levels.** Alcohol can increase the levels of triglycerides (a type of bad fat) in your blood. High triglyceride levels increase your risk of heart disease. When you have raised triglyceride levels, your good (HDL) cholesterol is often too low, which is unhealthy.

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Table 1. Alcohol contents and standard drink equivalents of some alcoholic drinks

Type of drink	Serving portion size	Standard drinks in one serve*	Typical alcohol content
Full strength beer	1 can (375 mL)	1.5	4.9%
Mid strength beer	1 can (375 mL)	1	3.3%
Light beer	1 can (375 mL)	0.7 to 0.8	2.8 to 2.9%
Diet or low joule beer	1 can (375 mL)	1 to 2	4 to 6%
Low carbohydrate beer	1 can (375 mL)	1.4 to 1.5	4.6 to 4.8%
Low alcohol beer	1 can (375 mL)	Virtually zero	0.5%
Wine, red and white	1 wine glass (160 mL)	1.5	12%
Port	1 port/sherry glass (60 mL)	1	20%
Liqueurs	1 nip (30 mL)	1 (if 40% alcohol)	7 to 55%
Spirits	1 nip (30 mL)	1	40%
Pre-mix spirits	1 bottle (300 mL)	1.2	5%

* Approximate; based on *Australian Alcohol Guidelines,* 2009.[1]

Table 2. Low and higher energy alcoholic and non-alcoholic drinks

Low energy (calorie) content drinks – sensible choices

Beers – reduced alcohol (also called light), low alcohol (both of these beer types have a lower alcohol content than regular full strength beer)*

Dry wines – dry whites, dry reds, brut champagne, dry sherry

Spirits – brandy, whiskey, vodka, gin, rum, dry vermouth

Mixers – plain soda or mineral water, low joule and diet soft drinks, low joule tonic water, vegetable juice (also bitters, lemon juice)

Higher energy (calorie) drinks

Sweet wines – late harvest, dessert, Lambrusco, muscat, 'stickies', moselle, spätlese

Beers – full strength, mid strength, diet (diet beers, also called low joule beers, have a lower carbohydrate content than regular full strength beer but similar alcohol and energy contents)

Liqueurs – all, e.g. Galliano, Cherry Brandy, Tia Maria, Cointreau, Curaçao, Baileys

Fortified wines – port, sweet sherry

Wine coolers – e.g. Coolabah Tropical, West Coast, Tropicana

Premixed drinks – e.g. Vodka Cruiser, Bourbon and coke mixes, Bacardi Breezer

Non-alcoholic wines

* Light (low alcohol) beers are generally a better choice than diet (low carbohydrate) beers because they are lower in energy due to the lower alcohol content.

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- **Impaired judgement.** Impaired judgement can lead to less recognition of hyperglycaemia or hypoglycaemia and omission or misdosing of medications, as well as less healthy food choices.
- **Toxic effects.** Alcohol in large amounts has toxic effects on the body, such as damage to the brain, liver, gut and nerves.
- **Drug interactions.** Alcohol can interact with various medications – check with your doctor.
- **Hypertension.** Alcohol can increase blood pressure, causing hypertension.

How can the carbohydrate content of alcoholic drinks affect you?

- **Hyperglycaemia (high blood glucose levels).** Consuming large amounts of alcoholic drinks containing carbohydrate (e.g. spirits or other alcoholic drinks with non-diet soft drink mixers, premixed drinks and liqueurs) may raise blood glucose levels, causing hyperglycaemia.
- **Weight gain.** The carbohydrate and alcohol content in alcoholic drinks provides extra energy, which may contribute to weight gain.

Examples of low energy and higher energy drinks are given in Table 2.

Are there any benefits from drinking alcohol?

Some research has suggested that there may be a cardiovascular benefit from drinking moderate amounts of alcohol, particularly red wine. If you do not already drink alcohol, it is not recommended that you start for this reason.

Reference

1. NHMRC. Australian guidelines to reduce health risks from drinking alcohol. Canberra: Commonwealth of Australia; 2009.

Tips for sensible drinking

These tips apply particularly to individuals with diabetes but also to the general population.

Everyday tips

- Drink low alcohol rather than high alcohol drinks (look at the package labels for the alcohol content and approximate number of standard drinks per package).
- Eat low fat, high carbohydrate foods, such as bread, crispbread or fruit, when consuming alcohol.
- Avoid alcoholic drinks high in added sugar, such as wine coolers, alcoholic sodas, premixed drinks, sweet wines, liqueurs, port and sweet sherry. Generally beer, wine and spirits are low in carbohydrate (sugar), and in people on insulin or certain diabetic medications are more likely to cause hypoglycaemia than hyperglycaemia when consumed on their own.
- Use plain soda or mineral water, low joule and diet soft drinks, low joule tonic water as mixers.
- Talk to your friends about your diabetes and the possible risks of a 'hypo' as a result of drinking alcoholic drinks. People may mistake a hypoglycaemic episode with being drunk.

Party tips

- Count how many standard drinks you have, as the numbers add up over a long evening out.
- Skip salty foods like chips and salted nuts, which make you thirsty.
- The best drink to quench your thirst is water.
- Drink slowly from a small glass and have non-alcoholic drinks as 'spacers' between alcoholic drinks.

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Fibre facts: dietary fibre

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Australians generally consume less than the recommended amounts of fibre. Knowledge of the various types of fibre and their sources can help you advise patients on increasing their fibre intake, with the benefits of improved cardiovascular and bowel health, and weight and blood glucose control.

Dietary fibre is essential for the proper functioning of the gut and has also been shown to help protect against a number of chronic diseases, including diabetes, heart disease and certain cancers.

There is no single definition for dietary fibre. The Gut Foundation defines fibre as the remains of the edible part of plants and other carbohydrates that are not digested in the small intestine but pass to the large bowel (colon) where most are completely or partially broken down by bacteria.[1] Food Standards Australia New Zealand (FSANZ) defines dietary fibre as: 'the fraction of the edible parts of plants or their extracts, or synthetic analogues, that are resistant to the digestion and absorption in the small intestine, usually with complete or partial fermentation in the large intestine. Dietary fibre includes polysaccharides, oligosaccharides (degree of polymerisation >2) and lignins, and promotes one or more of the following beneficial physiological effects: laxation, reduction in blood glucose and modulation of blood glucose.'[2]

Resistant starch – starch that is not digested in the small intestine – comes within the FSANZ definition of fibre. It is also broken down by bacteria in the bowel, and contributes to bulkiness of the faeces. As its content in foods is only partially determined by the currently used methods for assessing food fibre contents, its intake cannot be measured. Therefore there are estimated targets for its intake in addition to other fibre.

Types of fibre

Soluble fibre

Soluble fibre forms a gel that slows both stomach emptying and the absorption of sugars from the intestine. The pectins, hemicelluloses, mucilages and gums are all soluble fibres. Sources of soluble fibre include (Table 1):

- pectins – fruits and seeds
- hemicelluloses – cereals, fruits, nuts
- mucilages – seeds and bulking supplements
- gums – seeds and cereals. Gums are also a type of food additive.

PHOTOLIBRARY

Insoluble fibre

Insoluble fibre passes through the colon unchanged, increasing stool weight by its own mass and by its ability to hold water. Having bulky soft stools increases the regularity and comfort of passage. Sources of insoluble fibre include (Table 1):

- lignin – wheat bran, legumes, vegetables and some fruit
- cellulose – vegetables, legumes, cereals, fruits and nuts.

Resistant starch

Resistant starch is the part of starchy foods that is tightly bound by fibre and resists normal digestion. The quantity of resistant starch in food depends on the ripeness of the grain, vegetable or fruit, the type of processing it has undergone, the timing and method of cooking, and other factors such as the presence of other foods and the intestinal microflora. Bacteria ferment fibre and produce short chain fatty acids, particularly butyric acid, that stimulate colonic muscular activity, provide a source of energy and may protect against cancer.[1]

Sources of resistant fibre include starchy foods such as bread, cereals, rice, pasta, potatoes and legumes (Table 1).

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continued

Table 1. Sources of fibre

Soluble fibre
Fruit
Vegetables
Oat bran
Barley
Legumes
Psyllium seed husks
Flax seed
Nuts

Insoluble fibre
Wheat bran
Corn bran
Rice bran
Wholegrain/wholemeal cereals and breads
Legumes
Nuts
Seeds
Skins of fruit
Skins of vegetables

Resistant starch
Rice (cooked by absorption method)
Pasta (cooked al dente)
Breads
Cereal foods (rolled oats, cornflakes)
Potato (cold cooked)
Sweet potato
Yam
Peas
Legumes
Sweet corn
Green bananas
Custard apples
Products containing Hi-maize

Hi-maize is a food ingredient that is a rich source of resistant starch. It is a high amylose maize starch derived from a variety of maize developed in Australia, and is currently added to various foods such as certain breads, hamburger buns, breakfast cereals, crisp breads, beverages and yoghurts. Foods containing Hi-maize include Wonder White bread and Up & Go Liquid Breakfast.

What are the benefits of fibre?

Fibre is thought to have many benefits, including those listed below.

- Fibre aids faecal bulking and softening, which is useful in conditions such as diverticular disease, haemorrhoids and constipation.
- The fatty acids produced by fermentation in the large intestine may help protect against colon cancer.
- Foods high in soluble fibre increase satiety, reduce food intake and help maintain or reduce weight.
- Increasing fibre intake and reducing energy density and dietary fat were shown by the Finnish Diabetes Prevention study to be significant factors in preventing diabetes and reducing weight.[3]
- Soluble fibre can slow the rate and extent of starch digestion and absorption and favourably affect blood glucose levels in people with diabetes.[4]
- Soluble fibre can lower LDL cholesterol; fibre from cereals and wholegrains are more protective than fibre from vegetables and fruits.[5-9]

Do we get enough fibre?

The recommended intakes of fibre per day for health are 30 g for men and 25 g for women, and for prevention of chronic disease 38 g for men and 28 g for women.[10] The 1995 National Nutrition Survey showed that Australian men and women consumed 87% and 80% respectively of the recommended fibre intake for health, and 68% and 71% respectively of the intake recommended to prevent chronic disease.[10] Of the fibre consumed, 45% came from bread and other cereal foods, 10% from fruit and 30% from vegetables.[10]

It is recommended that fibre intake should be increased through a replacement of nutrient poor energy dense foods and drinks with vegetables, fruits and wholegrain cereals.[11] Examples of low fibre and high fibre meal plans are given in Table 2. The Australian dietary guidelines recommend that all Australians eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain.[5]

What about wholegrains foods?

Wholegrain refers to cereal foods that contain all the parts of the natural grain – that is, the endosperm, the germ and the bran of the grain.[9] Foods that contain at least 51% by weight of any combination of wholegrains can be described as wholegrain foods.[12] Wholemeal breads and crispbreads, many high fibre breakfast cereals, oatmeal, wholemeal pasta, brown rice and popcorn are, therefore, considered wholegrain foods.

The decrease in wholegrain consumption associated with the increased intake of refined carbohydrate foods has been linked to the development of type 2 diabetes and other chronic diseases. The protective effects of wholegrains with respect to type 2 diabetes are currently being evaluated.[13] (In refined grain products, the bran and germ, which contain most of the micronutrients, phytochemicals and dietary fibre, have been removed and only the starchy endosperm is used.)

The National Heart Foundation recommends that Australians consume at least 6 g of wholegrain fibre per day, which is equivalent to one serve of a high fibre cereal and two slices of wholegrain bread (i.e. bread made from whole or kibbled grains, wholemeal or stoneground flour or rye flour).[9] Wholegrain cereal-based foods are recommended: wholemeal/grain breads, crispbreads and rice cakes, wholegrain or high fibre breakfast cereals, rolled oats or porridge, brown rice and wholemeal pasta.[9]

Should people with diabetes have a high fibre diet?

People with diabetes are encouraged to follow a high fibre diet and choose a variety of fibre-containing foods (such as wholegrain products, fruits and vegetables).

Table 2. Low and high fibre meal plans

Low fibre meal plan	Fibre (g)	High fibre meal plan	Fibre (g)
Breakfast		**Breakfast**	
Refined cereals (e.g. cornflakes, rice and wheat flakes), 1 cup	1	Bran-based cereals with added fruit (e.g. bran flakes with sultanas), 1 cup	7
Milk, 200 mL	0	Milk, 200 mL	0
Orange juice, 250 mL	0	Banana, 1 medium	2.5
White bread, 1 slice	1	Wholemeal bread, 1 slice	2
Morning tea		**Morning tea**	
Coffee	0	Coffee	0
Chocolate coated biscuit, 1	0	Fruit bread, 1 slice	1.5
Lunch		**Lunch**	
Sandwich, white bread	2	Sandwich, wholemeal bread	4
Turkey and mayonnaise filling	0	Turkey and salad filling	3
Tub of fruit yoghurt	0	Orange, 1 medium	4.5
Can of soft drink	0	Fruit yoghurt, 200 g tub	0
Afternoon tea		**Afternoon tea**	
Tea	0	Wholegrain crispbread biscuits, 2	3
Chocolate bar, 60 g	0	Cheese	0
Dinner		**Dinner**	
Grilled steak	0	Grilled steak	0
Chips, 100 g	1.9	Jacket potato, 100 g	2.3
Coleslaw, 1/2 cup	2	Mixed frozen vegetables, 1 cup	6
Jelly	0	Fruit salad, 1 cup	3
Ice-cream, 1 scoop	0	Ice-cream, 1 scoop	0
Supper		**Supper**	
Coffee	0	Coffee	0
Apple, 1 medium	3	Almonds, 25 to 30	4.5
Total fibre	10.9 g	**Total fibre**	43.3 g

Although a high fibre diet improves glycaemic control,[4,14] there is no reason to recommend that people with diabetes consume more fibre than others.[15]

A high fibre diet can help people to maintain or lose weight by increasing satiety, decreasing the energy density of the meal, slowing gastric emptying and affecting the gastrointestinal hormones that influence food intake.[12]

What about glycaemic index?

The glycaemic load of a serving of a food is the product of the glycaemic index (GI) of the food and the amount of carbohydrate (in grams) in a normal serve of that food. It is a means of assessing the impact of the consumption of different carbohydrates on blood glucose, and therefore of use in planning diets to keep blood glucose under control, which is especially important for people with diabetes and also for those who are overweight. As well as having beneficial effects on postprandial glucose levels, the glycaemic index or load of a diet has effects on lipid levels: a high glycaemic index or load diet increases triglyceride levels and a low glycaemic index or load diet decreases triglyceride levels, particularly in people with elevated triglycerides and a high BMI.[9]

A recent Cochrane review noted that loss of weight and fat mass was greater in overweight and obese people given a low glycaemic index or load diet than in those given an equicaloric conventional diet. Furthermore, total and LDL cholesterol were lower.[16]

Many wholegrain foods have a low glycaemic index and when incorporated in the diet can assist in enhancing weight loss.

A final word

Dietary fibre plays an important role in health. Recent reviews support the beneficial effects of the various types of fibre on cardiovascular and bowel health, weight and blood glucose control.

A patient handout on dietary fibre is provided on pages 51 and 52. MT

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Dietary fibre

Modified with permission from a resource produced by the Diabetes Centre, The Queen Elizabeth Hospital, Adelaide, SA.

This handout provides information about fibre in the diet and some hints on increasing your fibre intake.

What is fibre?

Dietary fibre is the part of plant foods that cannot be digested in the small intestine. It is found in the skins, seeds and stalks of fruit and vegetables, and in legumes, pulses, nuts and the bran or husk of cereal grains. There is no dietary fibre in animal foods.

Types of fibre

There are two main types of fibre in foods: soluble and insoluble fibre. Resistant starch is a starch that acts like dietary fibre. It is important to have a variety of foods in your diet so you eat enough fibre.

- **Soluble fibre.** Soluble fibre forms a 'gel' solution in the gut, which slows down digestion and absorption of food. It can also help to lower blood cholesterol and may assist in controlling blood glucose levels if you have diabetes. Good sources include fruit, vegetables, legumes, oats and oat bran, barley and barley bran, rice bran, psyllium husks, nuts and seeds.
- **Insoluble fibre.** Insoluble fibre helps regulate bowel function by absorbing water in the gut, forming softer bulkier stools and thus assisting in preventing constipation. Good sources include wheat bran, wheat based breakfast cereals, wholegrain breads and cereals, wholemeal pasta, brown rice, fruit and vegetables.
- **Resistant starch.** About 10% of the starch in food resists digestion in the small intestine and reaches the large bowel where it acts like dietary fibre in improving bowel health. Here it stimulates the growth of 'good' bacteria, which keeps the cells of the bowel healthy and may help prevent bowel cancer. It may also assist in controlling blood glucose levels if you have diabetes. Good sources include wholegrain, wholemeal and high fibre white breads, breakfast cereals such as muesli, oats and those that are bran-based, wholegrain and/or contain added fruit, lentils and other legumes, barley, rice, pasta, cracked wheat, cold cooked potato, green bananas, custard apples, peas and corn.

Cereal foods (especially wholegrain types), fruits and vegetables are good sources of dietary fibre.

Why is fibre so important?

Fibre is important for good health and is effective in treating and preventing the disorders listed below.

- **Constipation.** Dietary fibre, in particular insoluble fibre, is effective in preventing and treating constipation. Insoluble fibre acts as a laxative by softening and 'bulking' the stools. Remember to drink adequate fluid (6 to 8 glasses each day) and exercise regularly for healthy bowel function.
- **Diverticular disease.** Diverticulae are sacs or pouches that occur at weak points in the digestive tract. They sometimes become inflamed, resulting in diverticulitis. The biggest cause of diverticular disease is a low fibre diet, and an increase in dietary fibre usually helps improve the condition. Consult your doctor or dietitian for more information.
- **Diabetes.** Most starches are digested to glucose in the small intestine. People with

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diabetes will have better control over their blood glucose levels when these starches are digested slowly. Soluble fibre in food slows down the digestion of starch and, therefore, the release of glucose into the blood stream.

- **Weight control.** Fibre can help in weight management. A high fibre diet provides bulk and a feeling of fullness. Soluble fibre can slow down the digestion of your meal, making you feel more satisfied and less likely to eat more.
- **Cholesterol.** Soluble fibre has been shown to reduce the levels of cholesterol in the blood.

How much fibre?

The recommended intake of dietary fibre for adults is about 30 g each day. The table shows the fibre content of some common foods.

Hints for increasing fibre intake

- Use wholemeal flour when baking. For cakes, muffins, biscuits and pastries, use half wholemeal and half white flour, or add 1/3 cup oat bran to one cup of white flour (you will need to add a little extra liquid). You can also include dried or fresh fruit and vegetables such as grated carrots.
- Add extra vegetables when cooking. Substitute some of the meat in stews or casseroles with cooked lentils, split peas, kidney beans or chickpeas, and add extra vegetables. When making spaghetti bolognaise substitute half of the lean mince with kidney beans or lentils. Include grated vegetables (e.g. carrot, zucchini) and cracked wheat in homemade rissoles or hamburger patties.
- Use more oats when cooking. Use rolled oats ('quick cook') to bind rissoles or meat loaf. Use processed oat bran or mashed beans as a thickener in soups or casseroles.
- Make high fibre salads. Base salads on beans, rice, pasta, cracked wheat or barley mixed with vegetables.
- Don't peel fruit and vegetables; eat the skins where possible. Leave skin on potatoes.
- Eat whole fruit rather than drink fruit juice. There is no fibre in fruit juice.
- When shopping, choose products with the highest amount of dietary fibre per 100 g (aim for more than 5 g per 100 g).

Table. Dietary fibre content of some foods*

Food	Serve size	Fibre (grams)
Bread		
Wholemeal	2 slices	4.0
Mixed grain	2 slices	3.0
Wholemeal with grain	2 slices	6.0
White high fibre	2 slices	2.4
White	2 slices	1.5
Dark rye	1 slices	5.0
Cereals		
Allbran	1/2 cup	9.5
Muesli	1/2 cup	6.0
Weetbix, Vitabrits	2 biscuits	3.0-3.5
Rolled oats/porridge	1 cup cooked	3.4
White pasta	1 cup boiled	3.0
Wholemeal pasta	1 cup boiled	8.0
White rice	1 cup boiled	1.2
Brown rice	1 cup boiled	2.4
Nuts and seeds†		
Almonds	50 g	4.5
Peanuts	50 g	4.0
Vegetables		
Broccoli	1 floret	2.0
Carrot	1/2 cup	2.4
Peas	1/2 cup	5.4
Potato with skin	100 g	2.3
Baked beans	1 cup	10.6
3-bean mix	1 cup	11.2
Fruit		
Apple with skin	1 medium	3.0
Banana	1 medium	3.0
Orange	1 medium	3.2
Sultanas	50 g	2.0

* Figures taken from: Food Standard Australia New Zealand *Nutritional values of Australian foods*, Canberra; Commonwealth of Australia; 1991 (out of print); Stanton R. *Find out about fibre*, St Leonards: Allen and Unwin; 1998 (out of print); and Borushek A. *Pocket calorie, fat and carbohydrate counter*, 2007 ed, Perth: Dietclub; 2007.
† As nuts and seeds are high in fat, limit their intake if you are trying to lose weight.

Important facts

- Cooked, frozen and canned fruits and vegetables are valuable sources of fibre. Cooking foods containing fibre only softens the fibre; it does not destroy it.
- Drink plenty of fluid, preferably water, each day. About 2 litres or 8 glasses are recommended.
- Increase your fibre intake gradually, distributing it evenly throughout the day. Increasing fibre intake suddenly may lead to gastrointestinal discomfort.
- Exercise regularly and maintain a healthy weight. MT

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