Fibre facts: dietary fibre

CONNIE STANTON APD, BSc, MND, DipEd
MELISSA CARAPETIS APD, BHSc, MND
PAT PHILLIPS MB BS, MA(Oxon), FRACP, MRACMA, GradDipHealthEcon(UNE)

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.

PHOTOLIBRARY

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.

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).

Ms Carapetis and Ms Stanton are accredited practicing Dietitians, Diabetes Centre, The Queen Elizabeth Hospital; Dr Phillips is Senior Director, Endocrinology, North Western Adelaide Health Service, The Queen Elizabeth Hospital, Woodville, SA.

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. MT

A list of references is available on request to the editorial office.

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 these associations have influenced the content of this article.
Ms Stanton and Ms Carapetis: None.

Medicine Today 2007; 8(10): 63-68

Fibre facts: dietary fibre

CONNIE STANTON APD, BSc, MND, DipEd **MELISSA CARAPETIS** APD, BHSc, MND
PAT PHILLIPS MB BS, MA(Oxon), FRACP, MRACMA, GradDipHealthEcon(UNE)

References

1. Bolin T, Cowen A, Korman M, Stanton R. Dietary fibre for health. An information booklet. Sydney: The Gut Foundation; 2002.
2. Food Standards Australia New Zealand (FSANZ). Standard 1.2.8: Nutrition information requirements. In: Australia New Zealand Food Standards Code. Anstat, Canberra: Commonwealth of Australia, 2007. Available online at: www.foodstandards.gov.au/_srcfiles/FSC_Amend_Standard_1_2_8_Nutrition_Info_v91.doc (accessed Feb 2008).
3. Lindström J, Peltonen M, Eriksson JG, et al. High-fibre, low-fat diet predicts long-term weight loss and decreased type 2 diabetes risk: the Finnish Diabetes Prevention Study. Diabetologia 2006; 49: 912-920.
4. Brennan CS. Dietary fibre, glycaemic response, and diabetes. Mol Nutr Food Res 2005; 49: 560-570.
5. Australian Government Department of Health and Ageing, NHMRC. Food for health. Dietary guidelines for Australians. A guide to healthy eating. Canberra: Commonwealth of Australia; 2005. Available online at: www.nhmrc. gov.au/publications/synopses/_files/n31.pdf (accessed Feb 2008).
6. Truswell AS. Dietary fibre and blood lipids. Curr Opin Lipidol 1995; 6: 14-19.
7. Glore SR, van Treeck D, Knehans AW, Guild M. Soluble fibre and serum lipids: a literature review. J Am Diet Assoc 1994; 94: 425-436.
8. Brown L, Rosner B, Willett WW, Sacks FM. Cholesterol-lowering effects of dietary fibre: a meta-analysis. Am J Clin Nutr 1999; 69: 30-42.
9. National Heart Foundation of Australia's Nutrition and Metabolism Advisory Committee. Position statement on the relationships between carbohydrates, dietary fibre, glycaemic index/glycaemic load and cardiovascular disease. NHF; 2006. Available online at: www.heartfoundation.org.au/document/NHF/PP-584_Nutr_CHO_06_Feb28_Final.pdf (accessed Feb 2008).
10. Australian Bureau of Statistics. National Nutrition Survey. Nutrient intakes and physical measurements. Australia, 1995. Canberra: Commonwealth of Australia; 2007. Available online at: www.abs.gov.au (accessed Feb 2008).
11. Australian Government Department of Health and Ageing, NHMRC. Nutrient reference values for Australia and New Zealand. Canberra: Commonwealth of Australia, 2006. Available online at: www.nhmrc.gov.au/publications/synopses/_files/n35.pdf (accessed Feb 2008).
12. NHMRC. Dietary guidelines for Australian adults. Canberra: Commonwealth of Australia; 2003. Available online at: www.nhmrc.gov.au/publications/synopses/_files/n33.pdf (accessed Feb 2008).
13. Priebe MG, Vonk RJ, de Vos R, van Binsbergen JJ. Whole grain foods for the prevention of type 2 diabetes mellitus (Protocol). Cochrane Database Syst Rev 2006; (2): CD006061.
14. Giacco R, Clemente G, Riccardi G. Dietary fibre in treatment of diabetes: myth or reality? Dig Liver Dis 2002; 34 Suppl 2: S140-S144.
15. American Diabetes Association. Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications. Diabetes Care 2002; 25: 202-212.
16. Thomas DE, Elliott EJ, Baur L. Low glycaemic index or low glycaemic load diets for overweight and obesity. Cochrane Database Syst Rev 2007; (3): CD005105.