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VIEWPOINT

Possible implications for health of the different definitions of dietary fibre

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Abstract There is impressive evidence from epidemiological and experimental studies that dietary fibre derived form vegetables, fruit and wholegrain cereals protects against and may be useful in the treatment of a wide range of diseases. However, while there is some evidence of benefit of extracted and synthetic fibres in terms of lowering levels of cardiovascular risk factors, improving measures of glycaemic control and gastrointestinal function, epidemiological confirmation of clinical benefit and long term safety are lacking. An appropriate definition of dietary fibre is essential, given that claiming a food is high in dietary fibre is in effect making a health claim, without formally doing so. The new Codex definition acknowledges the difference between naturally occurring carbohydrate polymers which are neither digested nor absorbed in the human small intestine and synthetic or extracted polymers. However the latter two groups may also be defined as dietary fibre provided ''beneficial physiological effect has been demonstrated by generally accepted scientific evidence''. Given the need for a definition of dietary fibre which can be used for food labelling, setting nutrient reference values and decisions relating to health claims it is important to achieve agreement as to what constitutes a meaningful physiological effect and the level of evidence required to be certain of such effect.

The suggestion that dietary fibre is beneficial to human health is not new. Hippocrates is quoted as observing that ''to the human body it makes a great difference whether the bread be made of fine flour or coarse, whether of wheat with the bran or without the bran''. There are many other historical references in the medical literature to the benefits of bran, wholemeal bread and ''natural foods'' in terms of digestive health and the treatment of gastrointestinal disease. However, the concept that dietary fibre

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may protect against, and be beneficial in, the treatment of many apparently unrelated diseases is more recent. Over half a century ago Surgeon Captain TL Cleave suggested that ischaemic heart disease, diabetes and other diseases of western civilisation could, like many gastrointestinal disorders, be attributed to excessive consumption of refined carbohydrate foods and of sugar in particular. Cleave's hypothesis was later extended to include the possibility that removal of the fibre component of flour might also be a contributory cause of this group of conditions, which he described as the saccharine diseases. These theories were unattractive to most scientists who regarded his figures for disease incidence as unreliable and an all embracing hypothesis for the aetiology of many apparently unrelated diseases as implausible. Subsequently Walker in South Africa and Burkitt and Trowell in Uganda, first on the basis of clinical observation and later using more reliable data relating to disease frequency, provided evidence for striking differences in the rates of many of these ''western diseases'' (see Table 1) amongst those consuming the traditional African diets and Europeans and Africans consuming a western type diet, low in dietary fibre [1].

Of course it is conceivable, and indeed likely, that factors other than dietary fibre explain some, if not much of the difference in disease frequency amongst populations and groups. Diets that are low in fibre are often also low in some essential micronutrients and are high in sugars, salt, rapidly digested starches and fats. Other lifestyle related factors such as lack of physical activity and cigarette smoking are other potentially confounding factors. However, using several different research approaches, Walker, Burkitt and Trowell and the many researchers who succeeded them have gathered an impressive body of data, which, when considered in aggregate, provide evidence for an important role for dietary fibre in the prevention and management of the major diseases listed in Table 1. In addition to comparisons using reliable data sources which suggest that high rates of these diseases parallel low intakes of dietary fibre, there are confirmatory data from more sophisticated epidemiological studies as well as clinical and laboratory investigations.

Prospective cohort studies have related dietary fibre intake assessed by means of repeated validated food frequency questionnaires to subsequent disease outcomes. The studies have demonstrated that high intakes are associated with reduced risk of type 2 diabetes and coronary heart disease and that these associations are not confounded by other risk factors. Experimental studies have shown that dietary fibre can favourably influence cardiovascular risk factors, notably total and LDL cholesterol, as well as blood glucose and insulin levels. Randomised controlled trials confirm the potential of a lifestyle programme that includes an increased intake of dietary fibre to reduce the risk of progression to diabetes amongst those with impaired glucose tolerance and of further cardiovascular events in those with established heart disease. Similarly epidemiological evidence relating to the potential of dietary fibre to protect against gastrointestinal diseases is strengthened by experimental investigations demonstrating the effects of fibre on gut transit times, stool weights, bile acid metabolism, intraluminal pressures and fermentation by colonic microflora. Table 1 provides an indication of the strength of evidence for each of the suggested benefits of dietary fibre [2].

Given this remarkable range of benefits ascribed to dietary fibre there is clearly a need for an agreed definition, which can be used for food labelling, setting nutrient reference values, determining appropriate analytical methods and decisions relating to health claims. Some of the definitions, which have been proposed, are listed in Table 2. The original definition was by Trowell in 1972 who suggested that dietary fibre be defined as ''the proportion of food which is derived from the cellular walls of plants which is digested very poorly in human beings''. This was later modified to specify plant polysaccharides and lignin and finally in 1985 to list the polysaccharides as cellulose, hemicellulose and pectin-like substances.

In the light of the increasing importance of dietary carbohydrates to health, in 1997 FAO and WHO convened a Consultation on Carbohydrates in Human Nutrition, which recommended that carbohydrate classification and terminology should be based primarily on chemical divisions and proposed using the terms sugars, oligosaccharides and

Table 1 Evidence for preventive or therapeutic role of dietary fibre in frequently occurring chronic diseases.

	Comparisons between countries/population groups or over time	Case control or cohort studies	Experimental studies	Randomised controlled trials
Type 2 diabetes/prediabetes	++	+++	+++	++
Coronary heart disease	++	++	++	++
Obesity	++	++	++	++
Constipation	++	−	+++	+++
Diverticular disease	++	++	++	++
Colon cancer	++	++	++	−
Appendicitis	+	+	−	−
Gallstones/cholecystitis	+	+	−	−
Peptic ulceration	−	−	−	−
Ulcerative colitis/Crohn's disease	−	−	−	−
Varicose veins/haemorrhoids	+	−	−	−

+ = Protective or therapeutic effect; +++ = Strongly protective or beneficial; − = No or inadequate data (the grading of the evidence is based somewhat arbitrarily upon the authors' assessment of the published literature).