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THERAPEUTIC FUNCTIONS OF DIETARY FIBRE IN DEGENERATIVE DISEASES

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Dietary fibre, the indigestible cell wall component of plant material, is considered to play an important role in human diet and health. Dietary fibre is that part of plant material in the diet which is resistant to enzymatic digestion which includes cellulose, non-cellulosic polysaccharides such as hemi-cellulose, pectin substances, gums, mucilage and a non-carbohydrate component lignin. The diets rich in fibre such as cereals, nuts, fruits and vegetables have a positive effect on health since their consumption has been related to decreased incidence of several diseases. Dietary fibre means carbohydrate polymers with ≥10 monomeric units, which are not hydrolyzed by the endogenous enzymes in the small intestine of humans. (Codex Alimentarius Commission)

Health Benefits and Sources of Dietary Fibre :

Types of Fibre	Soluble or Insoluble	Sources	Health Benefits
Cellulose, Hemi-cellulose	Insoluble	Nuts, whole wheat, whole grains, bran, seeds, edible brown rice	"Nature's laxative“, Reduces constipation, lowers risk of diverticulitis and help in weight loss.
Inulin oligofructose	Soluble	Extracted from onions & by products of sugar production, Added in processed foods to fibre	May increase "good" bacteria in the gut and enhance immune function.
Lignin	Insoluble	Found naturally in flax, rye, some vegetables.	Good for heart & immune function. Use caution in celiac disease/gluten intolerant.
Mucilage, beta-glucan	Soluble	Oats, oat bran, beans, peas, barley, flaxseed, berries, soybeans, bananas, oranges, apples , carrots.	Lower LDL, cholesterol, reduces risk of coronary heart disease & non insulin dependent diabetes. Use caution in celiac disease/glute n intolerant.
Pectin and gums	Soluble	fruits, berries & seeds. extracted from citrus peel and added in processed food to boost	Slows the passage of food through the gastrointestinal tract, lower blood cholesterol

		fibre	
Psyllium	Soluble	Extracted from husks of plantago ovata plant. Used in supplements, drinks & foods to fibre.	Helps to lower cholesterol and prevent constipation.
Resistant starch	Soluble	Starch in plant cell walls, unripene bananas, oatmeal, and legumes , added to processed foods to boost fibre.	May help manage weight by increasing fullness; helps control blood sugars.
Wheat dextrin	Soluble	Extracted from wheat starch, widely used to add fibre in processed foods.	Lower cholesterol (LDL and total cholesterol), reduces risks of coronary heart disease & non insulin dependent diabetes. Avoid in celiac disease or gluten intolerant

Mechanisms of action :

Dietary fibre have three primary mechanisms of action. Many dietary fibre exhibit more than one of these actions.

- Bulking: Bulking fibres can be soluble or insoluble. They absorb water & increase stool weight and regularity. (Cellulose, wheat bran & psyllium have excellent bulking effect but minimum fermentation property)
- Viscosity: Viscous fibres thicken the contents of gastrointestinal tract & may reduce the absorption of sugar after eating & reduce lipid absorption (Cholesterol). (Psyllium provides bulking as well as viscosity)
- Fermentation: Some viscous fibres may partially or fully fermented within the gastrointestinal tract (guar gum, beta-glucan, gluco-mannan and pectins), but some viscous fibres are minimally or not fermented (methylcellulose and psyllium).

Therapeutic functions for prevention of diseases:

Dietary fibre has emerged as a leading dietary factor in the prevention and treatment of chronic diseases. High fibre intakes are associated with lower serum cholesterol concentrations, lower risk of coronary heart diseases, reduced blood pressure, enhanced weight control, better glycemic control, reduced risk of certain forms of cancer and improved gastrointestinal functions. Dietary fibre can be categorized into water soluble and water-insoluble components. Dried bean, oats products and certain fruits and vegetables are good sources of soluble fibre. Most plant foods are good source of insoluble fibre and wheat bran is a concentrated form of insoluble fibre.

Dietary fibre and cardiovascular disease

There is good evidence that soluble fibre reduces blood cholesterol levels by binding bile acids & excreting them. Guar gum, a water-soluble polysaccharide that is almost

completely fermented in the colon, has been studied extensively in humans. It decreases serum cholesterol 11% and LDL-cholesterol 17% (Anderson *et al*., unpublished data). Xanthan gum. locust bean gum. karaya gum, and gum arabic, in general. have significant cholesterol-lowering effects in humans, but appear to be slightly less hypocholesterolemic than guar. Pectin, which is water-soluble and completely fermented in the colon, also has been studied extensively in humans. It decreases serum cholesterol 11% (Anderson et al., unpublished data). Pectin administration does not significantly affect serum HDL-cholesterol or triglycerides; the effects on serum LDL-cholesterol are not well documented (Anderson et al., unpublished data). Psyllium. a hydrophilic mucilloid that is water-soluble and fermentable, has been used for >50 years as a faecal bulking agent. Psyllium might lower serum cholesterol significantly. This is the protective effect of dietary fibre on risk of cardiovascular disease and coronary heart disease.

Dietary fibre and obesity: The intake of high-fibre foods, usually low in fat and energy, protects from obesity, is useful in weight loss, and facilitates weight maintenance. Person on a high-fibre diet can consume the same amount of food, but with fewer Kcal. Fibrous foods are often bulky. Soluble fibre forms a gel that slows down the gastric emptying and the transit time of food through gastrointestinal tract. Thus, person feels satisfied or 'full'.

Dietary fibre and diabetes mellitus : It also delays the absorption of sugars from the intestines and helps to maintain lower blood sugar levels. It prevents a rapid rise in blood insulin levels, which has been linked with obesity and increased risk of diabetes. Diet high in carbohydrate and fibre improve glucose metabolism without increasing insulin secretion. They lower fasting serum and peripheral insulin concentrations in response to oral glucose administration in both diabetic and non-diabetic individuals. Fenugreek seed contain high fibre which is useful for diabetic. In addition, it also contain trigonelline-an alkaloid known to reduce blood sugar level.

Dietary fibre and gastrointestinal diseases

Dietary fibre (especially insoluble) may reduce risk of diverticulitis, haemorrhoids, irritable bowel syndrome, gall stones and kidney stones. Inulin present in substances like onion increases stool frequency and has mild bulking effect by increasing bacterial mass. Inulin prevents constipation and act as prebiotic. Adequate intake of dietary fibre may prevent the formulation of diverticula by providing bulk in the colon so that less forceful contractions are needed to propel it.

Dietary fibre and cancer:

Diets with high fibre are associated with decreased prevalence of cancer, particularly cancers of the colon and breast. The fibre dilutes bile acids or binds to it thereby preventing its role in mutation or cell proliferation. Fermentation of dietary fibre results in production of short chain fatty acids lowering the intestine pH. This inhibits conversion of primary bile acids to secondary bile acids. The secondary bile acids are believed to promote mutation in intestine. At low pH, the solubility of free bile acids is reduced, diminishing their availability for carcinogenic activity. Fermentation of dietary fibre results in production of butyrate which has been shown to be antineoplastic. Additionally the bulk and water of the faeces may dilute the carcinogen to a non-toxic level.

Dietary fibre recommendation:

- United States National Academy of Sciences & Institute of Medicine suggest that adults should consume 20–35 g DF/ day.
- Academy of Nutrition and Dietetics (AND) recommends a minimum of 20–35 g/day for a healthy adult depending on calorie intake. No guidelines have yet been established for the elderly or very ill.
- The British Nutrition Foundation has recommended a minimum fibre intake of 18 g/day for healthy adults.
- ICMR dietary fibre recommendation 40g/ 1000Kcal. Indian diets provide 50-100g/day, when the whole grain cereals, pulses and vegetables are consumed daily.

Conclusion:

Dietary fibre provides important health benefits by reducing risk of degenerative diseases among people and protects from development of cardiovascular diseases, certain types of cancer, gastrointestinal disorders, obesity and diabetes mellitus. Furthermore, increasing fibre intake provides therapeutic advantages for management of all common and diseases.

References :

Anderson, J. W., Smith, B. M., Gustafson, N. J. (1994). Health benefits and practical aspects of high-fibre diets. *The American Journal of Clinical Nutrition*, **59**(5) : 1242S-1247S. https://doi.org/10.1093/ajcn/59.5.1242S

Anderson, J. W. (1990). Dietary Fibre and Human Health. *Hortscience*, **25**(12) **:** 1489-1495.

Dhingra, D., Michael, M., Rajput, H. and Patil, R. T. (2012). Dietary fibre in foods: a review. *Journal of Food Science and Technology*, **49**(3): 255–266.

Srilakshmi, B. (2016). Carbohydrates-part II Dietary fibre, Book- Nutrition Science, *New age International* (P) *Limited Publishers*, Pg 42-57.