

Fiber-An important Dietary Constituent

Pages with reference to book, From 25 To 27

Fatima Nizami (PMRC Research Centre, Jinnah Postgraduate Medical Centre, Karachi.)

During the past 50 years fiber, a dietary constituent has been almost forgotten. This neglect was changed a few years ago, primarily as the result of epidemiologic studies by British clinicians who have shown a low incidence of “diseases of civilization” in the developing countries where the diet consists of large quantities of unrefined cereals and legumes. These studies showed a high co-relation between low fiber diets and the incidence of gastrointestinal diseases including appendicitis, diverticular diseases, hiatus hernia, hemorrhoids, irritable bowel disease, carcinoma of the colon and rectum and gallstones, of the diseases of circulatory system such as atherosclerosis, ischaemic heart disease and varicose veins and of other conditions including obesity, diabetes and dental caries (Painter and Burkitt, 1971). Dietary fiber includes all substances that are not attacked by digestive enzymes and includes not only cellulose and lignin but also hemicellulose, pectins, gums and mucilages. The fiber in food is contributed by plant materials including whole grains, legumes, nuts, fruits and vegetables. The various components that make up dietary fiber vary greatly with proportions as well as the amounts from one plant source to another. Also within given plants the fiber- contents is influenced by the level of maturity and by processing and cooking procedures.

The fibrous constituents of whole grains cereals and legumes have been stated to be more resistant to digestive enzymes than are those of fruits and vegetables (Hoppert and Clark. 1945; Trowel, 1972).

Fiber and gastrointestinal function: Until recently fiber restricted diet were the rule for conditions such as irritable colon and diverticulitis, but a high fiber diet actually prevents these conditions. When a diet is low in fiber, the mucus moving through the colon is reduced in volume, hard, dry, slow in transit, and difficult to evacuate. As a result, intraluminal pressure is increased, thus producing the uncomfortable cramping symptoms experienced in irritable colon, or leading to the formation of diverticulae.

Fiber has the capacity to hold water, thus resulting in moist, bulky, rapidly expelled stools so that intraluminal pressure is not increased (Burkitt, 1971).

Diet & Colon Cancer: Epidemiological studies support that lack of fiber and excessive fat intake have been associated with colonic cancer (Burkitt, 1971; Ackerman, 1972; Reddy and Wynder, 1973; Alcantara and Speckmann, 1976).

The fibre content of the diet and the influences and responses to various drugs and chemicals has been investigated (Ershoff, 1974). Several plausible hypothesis have been suggested for the relationship that seems to exist between low fiber diets and cancer (Burkitt, 1971). Diets high in fiber might alter the bacterial flora of the intestinal tract to types that do not form carcinogens by possibly very tight adsorption of harmful substances and increased excretion. Also diets high in fiber might reduce the transit time so that the length of exposure of any harmful substances to the intestinal mucosa would considerably reduce (Freeman et al.,1980). Because of the ability of fiber to hold water, a high fiber intake could reduce the concentration of carcinogens so that the effect on the mucosa is minimal (Spiller, 1978).

Fiber-fat relationship:- Another theory holds that a correlation exists between a high fat intake and the incidence of colonic cancer. With a high fat intake, the secretion of bile is increased and significantly greater levels of sterols are excreted than by vegetarian diets or typical oriental diets. Also a much greater proportion of the sterols have been degraded following the ingestion of high fat diets, suggesting that microbial action in the intestinal tracts was much greater (Reddy et al., 1975; Wynder, 1976; Spiller et al., 1980). A low fiber diet would facilitate any potential damage produced to the mucosa by the degradation products because of the greater concentration and the prolonged exposure

time. A high fiber diet would reverse these effects (Walker, 1976).

Fiber and Coronary heart disease: Contradictory results have been reported in the literature on the ability of fiber to lower blood lipids and hence to reduce the risk of coronary heart disease. Pectin has some cholesterol lowering effect but the inclusion of cellulose in the diet has no such effect (Keys et al., 1961). An interesting study in India showed that when Bengal gram was substituted with wheat flour or cereals, a significant decrease in cholesterol levels was observed despite the high intake of butter fat (Mathur et al., 1968). In this study the excretion of total bile acids was greatly increased. The hypothesis is advanced that the cholesterol lowering effect resulted from the binding effect of the fiber on the bile salts, thus lessening reabsorption and lowering the bile acid pool. In turn more cholesterol might be converted to bile acids, thereby reducing the circulating level of cholesterol.

Some studies have also shown that the absorption of calcium, magnesium, iron and zinc was reduced with a high fiber intake because of interference of phytic acid a component of whole grains (Person et al., 1976; Reinhold et al., 1976). It has been suggested that fiber retards and reduces the digestion of starch by amylase and therefore patients who consume a high fiber diet have been reported to experience a fall in blood glucose (Reiser, 1979; Baumeret al., 1982; Jen Kins et al., 1977).

Inflammatory bowel disease: High fiber diet has a favourable effect in the treatment of Crohn's patients (Heaton et al., 1979).

Fiber and liver disease: Plasma G.O.T. and G.P.T. activities were significantly reduced by feeding dietary fiber and fairly corresponded to the liver lipid content (Akiba and Matsumoto, 1980).

References

1. Akiba, Y. and Matsumoto, T. (1980) Effects of several types of dietary fibers on lipid content in liver and plasma, nutrient relations and plasma transaminase activities in force-fedgrowing chicks. *J. Nutr.*, 110 : 1112.
2. Ackerman, L.V. (1972) Some thoughts on Food and cancer. *Nutr. Today*, 7:2.
3. Alcantara, E.N. and Speckmann, E.W. (1976) Diet, nutrition and cancer. *Am. J. Clin. Nuts.*, 29 : 1035.
4. Baumer, JR., Drakeford, J.A., Wadsworth, J. and Savage, D.C. (1982) Effects of dietary fiber and exercise on midmorning diabetic control - controlled trial. *Arch. Dis. Child.*, 57 : 905.
5. Burkitt, D.P. (1971) Epidemiology of cancer of the colon and rectum. *Cancer*, 28:3.
6. Ershoff, B.H. (1974) Antitoxic of plant fiber. *Am. J. Clin. Nutr.*, 27:1395.
7. Freeman, HJ., Spiller, G.A. and Kim, Y.S. (1980) A double-blind study on the effects of differing purified Cellulose and pectin fiber diets on 1, 2-dimethyl hydrazine-induced rat colonic neoplasia. *Cancer Res.*, 40:2661.
8. Hoppert, C4. and Clark, AJ. (1945) Digestibility and effect on laxation of crude fiber and cellulose in certain common foods. *J. Am. Diet Assoc.*, 21:157.
9. Jen-Kins, D.J., Leeds, A.R. and Gassoll, M.A. (1977) Decreases in post prandial insulin and glucose concentrations by guar and pectin. *Ann. Intern. Med.*, 86 20.
10. Keys, A., Grande, F. and Anderson, J.T. (1961) Fiber and Pectin in the diet and serum cholesterol concentration in man. *Proc. Soc. Exp. BioL Med.*, 106:555.
11. Mathur, K.S., Than, M.A. and Sharma, R.D. (1968) Hypocholesterolaemic effect of Bengal gram, a long-term study in man. *Bri. Med. J.*, 1:30.
12. Painter, N.S. and Burkitt, D.P. (1971) Diverticular disease of the colon,; a deficiency disease of western civilization. *Br. Med. J.*, 2:450.
13. Person, I., Roby, K., Fonss-Bech, P. et al. (1976) Effect of prolonged bran administration on serum levels of cholesterol, Ionized calcium, and hon in the elderly. *J. Am. Geriatr. Soc.*, 24: 334.
14. Reddy, B.S. and Wynder, E.L. (1973) Large-bowel carcinogenesis; fecal constituents of populations

with diverse incidence rates of colon cancer. *J. Nat. Cancer Inst.*, 50: 1437.

15. Reddy, B.S., Weisburger, J.H. and Wynder, E.L. (1975) Effects of high risk diets for colon carcinogenesis on fecal microflora and steroids in man. *J. Nutr.*, 105:878.

16. Reinhold, J.G., Faradji, B., Abadi, P. et al. (1976) Decreased absorption of calcium, magnesium, zinc, and phosphorus by humans due to increased fibr and phosphorus consumption as wheat bread. *J. Nutr* 106: 493.

17. Reiser, S. Effect of dietary fiber on paraperless of glucose tolerance in human “From” “Dietary fiber-chemistry and Nutrition” by hnglett GE, Falkehag SI. N.Y. Academic Press 1979, P. 173. Spiller, G.A. (1978) Interaction of dietary fiber with other components: a possible factor in certain cancer etiologies. *Am. J. Clin. Nutr.*, 31:5231.

18. Spiller, G.A., Chernoff, M.C., Hill, R.A., Gates, J.E., Nassar, J.J. and Shipley, E.A. (1980) Effect of purified cellulose, pectin, and low-residue diet in fecal volatile fatty acids, transit time, and fecal weight in humans. *Am. J. Clin. Nutr.*, 33: 754. S

19. Thornton, J.R. and Emmett, P.M. (1979) Treatment of Crohn’s disease with an unrefined-Carbohydrate, fiber-rich diet. *Br. Med. J.*, 2:764.

20. Trowel, H. (1972) Ischemic heart disease and dietary fiber. *Am. J. Clin. Nutr.*, 25 : 926.

21. Wynder, E. L. (1976) Nutrition and cancer. *Fed. Proc.*, 35 :1309.

22. Walker, A.R.P. (1976) Colon cancer and diet, with special reference to intakes of fat and fiber. *Am. J. Clin. Nutr.*, 29: 1417.