Dietary Fiber: Its Role in Older Adults

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Interest in dietary fiber has resurfaced in the last few decades because of potential beneficial effects for health. Fiber in different forms and amounts is widespread in foods, mainly of vegetable origin. The metabolic and therapeutic effects of fiber have prompted debate and research relating to its role in the prevention and treatment of disease. Recommendations on the optimum consumption of fiber in dietary form or as a drug supplement carry substantial economic implications in the health industry. Based on current evidence, a discussion follows on the role of dietary fiber pertinent to the health of older adults.

WHAT IS FIBER?

Historically, fiber was defined by Burkitt and Trowell as complex carbohydrates of plant origin that escape small bowel digestion to reach the colon (1,2). An expert panel in the United States defined dietary fiber as the endogenous component of plant material in the diet that is resistant to digestion by enzymes. Simply stated, fiber is plant material in the diet resistant to digestion in the human upper gastrointestinal tract. Fiber is the ingredient providing structure and strength to plants. The mean intake of dietary fiber in the US which is 17 grams per day for males and 13 grams for females, is one of the lowest in the world; the intake is even lower in adults over age 70. Afro-Americans generally consume less fiber than Caucasians while females consume more fiber on a per Kcal basis compared to men in the US (3).

CLASSIFICATION

Fiber can be classified based on structural components or solubility characteristics. The classification that is increasingly used and popular is the one based on solubility. As suggested by the term, soluble fiber characteristically dissolves in water, while insoluble fiber does not, but instead retains water (Table 1). Examples of soluble and insoluble fiber are listed in Table 2. Differences in the physical characteristics of fiber appear to influence its physiologic and metabolic effects. Viscous fibers, e.g. gums, pectins, gels and mucilages delay gastric emptying and slow absorption of nutrients; viscosity also impacts on the metabolic effects of fiber such as glycemia and lipidemia (4). On the other hand, particulate fiber, e.g. bran, influences colonic function.

ACTIONS ON THE GUT

Several actions in the gut have been attributed to fiber. Soluble fiber is said to slow gastric emptying and
induce a feeling of satiety. In the small intestine, transit time is slowed. Soluble fiber is said to benefit glycemic control by slowing down and reducing the absorption of glucose from the intestine; the increased loss of bile in the feces prompts production of bile acids in the liver from cholesterol (5,6). On the contrary, in the large intestine, fiber hastens the colon transit time; in the bowel lumen, fiber is fermented by colonic bacteria into short chain fatty acids which constitutes a fuel for colonocytes, in addition to increasing bacterial mass and stool bulk.(4,7). Short chain fatty acids are reabsorbed from the colon and have a metabolic action in reducing synthesis of cholesterol in the liver. Insoluble fiber absorbs little water and adds bulk only in the lower intestine improving colonic transit time (8). In summary, the physical characteristics that influence actions of fiber on the gut include water holding capacity, viscosity, fermentation (in the colon), bulking effect, and binding capacity (of bile acids). Tables 2 and 3 provide the components, sources, properties and possible clinical responses of fiber (5)

**AGING, NUTRITION AND FIBER REQUIREMENTS**

By 2050 one in five Americans will be 65 or older, with the over 85 age group the most rapidly growing segment. The elderly are particularly vulnerable to nutritional problems. Older adults have decreased energy needs, mainly due to a decrease in muscle mass (sarcopenia), alteration in metabolism and appetite, coupled with poor oral intake. The term "anorexia of aging," although controversial, has been used to denote the loss of appetite and poor oral intake secondary to alterations in hormonal and neurotransmitter regulation of food intake (9). Further, comorbidities such as cognitive impairment, functional limitations and socioeconomic circumstances adversely affect nutritional status in the elderly. These circumstances may hinder the intake of fiber rich food in older adults. The fiber intake for the over 70 year old males and females was only 14–16 g/d (less than the national average for adults), according to the National Health and Nutrition Examination Surveys (NHANES III) Study (10). Affordability may be an issue for the regular ingestion of fruits and vegetables; presence or absence of dentition may

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influence the intake of certain fruits e.g. the ability to bite into an apple. Oropharyngeal dysphagia, a common consequence of cerebrovascular disease (e.g. stroke) and neurodegenerative disorders such as Parkinson’s disease, precludes the intake of large morsels of fiber rich fruits and vegetables, with individuals often resorting to puree diets or tube feeds (11).

For the over 70 age group, the food guide pyramid has been modified to emphasize fiber rich foods. The modified food guide pyramid acknowledges the role of fiber through diets high in vegetables, fruits and grain products, along with an adequate intake of water; the recommendation is to consume at least eight servings of water (2 liters) daily. Symbols for water and fiber have been added, with a flag emphasizing micronutrients calcium, vitamins D and B₁₂ (10). Dietary guidelines from the American Cancer Society and National Cancer Institute recommend a daily intake of 20 to 30 grams of fiber and at least five servings of fresh vegetables and fruits per day.

**FIBER AND DISEASE**

Fiber has been linked to gastrointestinal disease (constipation, diverticulosis, irritable bowel syndrome), cancer, coronary heart disease, and metabolic disorders such as diabetes, hyperlipidemia, and obesity. The ensuing discussion will emphasize the role of fiber in relation to specific disease states.

**Diverticular Disease**

The occurrence of diverticular disease, a disease of modern civilization, is correlated with a trend towards a lower fiber intake in the last century. Diverticular disease is one of the most common colonic disorders in the elderly, with an incidence approaching 30% in individuals over 50 years, 50% in the over 70 and 66% in those over 85 years (12). Complications of diverticulosis such as diverticulitis, bleeding, fistula formation and abscess are frequent basis for hospitalization. Long term management of diverticular disease involves dietary manipulation to include a high fiber diet. While the relationship of a low fiber diet to diverticular disease appears established, the mechanism for a cause and effect relationship is less clear. Mechanisms for a protective role of fiber may include an increase in the stool mass, decrease in colon transit time and reduction in intraluminal pressure, which protect against diverticular herniation (8,13).

Increasing dietary fiber is a management strategy for both prevention of symptoms and to possibly minimize the development of diverticula. The ingestion of 20 to 30 grams of insoluble fiber (such as bran) is necessary to achieve a therapeutic effect; coarse bran is preferred to fine bran (8). Supplementation with commercial preparations such as psyllium may be helpful if dietary fiber cannot be increased to recommended amounts.

Studies on the beneficial effect of fiber in symptomatic diverticulosis are confounded by lack of data on suitable controls. In a three month, double blind, controlled trial of 18 patients, greater symptomatic relief was
obtained in those on a high fiber regimen compared to the control group despite an initial placebo effect (14). In another prospective study involving 43,881 US male health professionals between 40–75 years of age, dietary fiber, especially the insoluble component cellulose, was associated with decreased risk of diverticular disease (15). However, in a study of symptomatic patients with diverticulosis, no subjective improvement was apparent (16).

**Constipation**

Constipation is a symptom rather than a disease, considerably dependent on subjective interpretation. The costs of management of constipation are quite high. In the US, more than $800 million are spent for laxatives with 2.5 million physician visits each year (17). The incidence of constipation increases with age, particularly over 65 years (18). Causes may be multifactorial, with inappropriate diet often playing a role. There is little to suggest that aging per se affects colonic motor function in healthy subjects, although in frail elderly there is a suggestion of altered motility (19).

The management of chronic constipation should begin with non-pharmacologic interventions. A dietary diary by recall if possible, or prospectively, will help assess fiber consumption. As stated earlier, most older patients consume inadequate fiber in their diet. If increase in fiber intake is not tolerated because of abdominal discomfort, initiating with small amounts of fiber along with sufficient fluid intake, followed by a gradual increase is recommended. Insoluble cereal fibers possess cell walls that resist digestion and retain water within their cellular structures, whereas soluble fiber from citrus fruits and legumes stimulates the growth of colonic flora and increase fecal mass (20). Wheat bran is one of the most effective fiber laxatives with a dose response correlating with fecal output (21). It is worth stressing the importance of adequate water intake while increasing the amount of fiber. Several weeks are required to relieve chronic constipation by increasing dietary fiber (20).

**Irritable Bowel Syndrome**

Around 15% of the US adult population report symptoms suggestive of irritable bowel syndrome (IBS) (22), a common diagnosis made by gastroenterologists (23). The syndrome categories include abdominal pain, constipation, diarrhea, and constipation alternating with diarrhea (24). In contrast with diverticular disease, symptoms typically start between age 30 and 50 years with the prevalence decreasing after 60 years (25).

The efficacy of dietary fiber is unproven partly because of placebo effects and also based on variability of symptoms over time. However, management initially focuses on dietary modification including the elimination of certain gas forming foods such as legumes or lactose containing items to minimize symptoms (26). Addition of 20 to 30 grams of fiber per day as diet or supplements such as bran, psyllium, and ispaghula husk may help relieve constipation (27–29) and occasionally improve diarrhea. Caution is suggested, as symptoms of abdominal pain, bloating and flatulence may indeed worsen in some individuals with addition of fiber.

**Cancer**

Approximately 35% of all cancers are at least partially attributable to diet alone (30). Epidemiologic studies suggest that increased consumption of fruits and vegetables is associated with a reduced risk of cancers at various sites (7), while increased consumption of fat in general appears to increase the incidence of various cancers.

**Colorectal Cancer (CRC)**

CRC is the fourth most common cancer in the US and accounts for the second highest cancer related deaths following lung cancer (31). Some general associations of diet and colon cancer are listed in Table 4; dietary fiber intake has a negative association (32). Dietary habits have been incriminated in the etiology of CRC, with fiber content of the diet and its role in colorectal carcinogenesis well researched. The fiber hypothesis introduced by Burkitt recognized the rarity of CRC in African populations and related this observation to high fiber consumption (33).

The possible mechanisms for the health promoting benefit of fiber with reference to CRC are complex and speculative. Possible theories are discussed in Table 5 (7). While epidemiologic and case control studies seem to validate the fiber hypothesis showing an inverse relationship between dietary fiber consump-
tion and colorectal cancer, it is worth reiterating that the evidence evaluating the protective effects of fiber against CRC is at best conflicting (34).

Of the 28 published international and US studies on CRC and dietary fiber involving intake of vegetables, grains, fruits and cereals, 23 showed either a strong or moderate protective effect of fiber rich food or at best equivocal results. Sixteen of the 24 case control studies demonstrated the protective effect of dietary fiber, particularly for vegetables, against colorectal neoplasia (35). A combined analysis of 13 case control studies suggests that fiber rich food was inversely associated with the risk of colorectal cancers (36). A recent large prospective study (Cancer Prevention Study II) involving more than a million subjects showed a significant inverse relationship, with a 30% reduction in CRC mortality in subjects consuming the highest amount of fiber compared to those on the lowest amount (37). Dietary wheat bran, but not oat or corn bran, significantly decreased the levels of several tumor promoters in the colon independent of stool bulk (38). Promoters are influential factors that cause the initiated cell to progress through the carcinogenic process and change phenotypically (39).

Table 4
Diet and Colon Cancer (32)

<table>
<thead>
<tr>
<th>Positive association</th>
<th>Negative association</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Red meat</td>
<td>• Dietary fiber</td>
</tr>
<tr>
<td>• Animal and saturated fats</td>
<td>• Vegetables and fruits</td>
</tr>
<tr>
<td>• Refined carbohydrates</td>
<td>• Antioxidants</td>
</tr>
<tr>
<td>• Alcohol</td>
<td>• Calcium and folic acid</td>
</tr>
</tbody>
</table>

Table 6
Data from Select Studies of Fiber and Colorectal Cancer

Thun MJ et al, 1992 (37)
- 764,343 subjects, 6 years
- Consumption of citrus fruits, vegetables and high fiber grains
- Significant inverse relationship

Toronto Polyp Prevention Trial, 1994 (40)
- 201 subjects, 2 years
- Low fat, high fiber diet vs western diet with placebo fiber
- No significant difference

Steinmetz KA et al, 1994 (41)
- 41,837 middle aged women, 5 years
- Prospective study
- Increased risk of colon cancer with cruciferous vegetables/potatoes

Australian Polyp Prevention Project, 1995 (42)
- 424 subjects, 4 years
- Reduction in dietary fat; added wheat bran and beta carotene supplement
- No reduction in CRC recurrence

Fuchs CS et al, 1999 (43)
- 88,757 women, 16 years
- Prospective study, no intervention
- No significant relationship between dietary fiber and CRC

Schatzkin A et al, 2000 (44)
- 2,079 subjects, 4 years
- Diet low in fat, high in fiber, fruits, vegetables vs standard healthy eating
- No influence on the risk of recurrence of colorectal adenomas

Alberts DS et al, 2000 (45)
- 1,429 subjects, 3 years
- Dietary supplement with 13.5 g vs 2 g per day of wheat bran fiber
- No protection against recurrent colorectal adenomas

Terry P et al, 2001 (46)
- 61,463 women, 9.6 years
- Prospective study
- Greatest risk of CRC in low fruit/vegetable intake group but risk not diminished in high cereal group.
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The above studies did not always account for confounding variables in diet such as non-fiber vegetable components, nutrients and micronutrients which might well have anti-carcinogenic properties. Interestingly, one study demonstrated an increase in CRC with the intake of cruciferous vegetables. The accuracy of the dietary fiber estimate has also been questioned in several of these studies. Data from a select sample of human intervention and prospective studies are presented in Table 6 (37,40–46).

While interpreting the data, several aspects are worth keeping in mind. The dietary intervention period might not have been of sufficient duration to demonstrate benefits. It is conceivable that a lifetime intake of fiber or perhaps an intervention earlier in life with dietary fiber may have prevented or altered the course of a neoplasm. Dietary intervention methods are not always reliable and responses of participants in terms of quantification of fiber intake may be subjective. The size of adenomas, tendency of large adenomas to recur or transform into cancer over time and relation to quantity of fiber intake is extremely hard to correlate.

Stomach Cancer
High intake of cereal fiber has been shown to lower the risk of gastric cancer (47). In a large scale population based case control study of risk factors for adenocarcinoma of the gastric cardia, a strong inverse correlation was found between the dose of cereal fiber intake and risk of gastric cardia cancer; a decrease in the incidence of esophageal adenocarcinoma was also noted, but no correlation was observed with esophageal squamous cell carcinoma (47).

Prostate Cancer
Epidemiologic and clinical studies support the role of fiber in prevention and progression of prostate cancer. Asian men have a lower incidence of prostate cancer compared to men in the west. Asian food is characteristically low in fat and high in fiber providing a rich supply of weak dietary estrogens. Estrogens supposedly interfere with steroid metabolism and enzymatic processes involved in cell growth (48). Another study in middle aged vegetarian men (49–62 years) demonstrated decreased risk of prostate cancer associated with a higher intake of beans, lentils and peas (49). However in a recently published human intervention study, Shike, et al found that a diet high in fruits, vegetables, and fiber had no impact on serum PSA levels in men (50).

Breast Cancer
Higher fiber intake has been hypothesized to reduce the risk of breast cancer by interrupting the enterohepatic circulation of estrogens (51). This relationship between fiber intake and breast cancer risk has not been substantiated by prospective studies (52).

Cardiovascular Disease
Coronary heart disease (CHD) is the leading cause of death in older adults in most developed countries. Evidence from epidemiologic studies suggests a significant inverse relationship between dietary fiber consumption and coronary artery disease; a high fiber intake has been associated with 20% to 40% reduction in CHD risk (53). The exact mechanisms are not fully elucidated, but include lowering of serum cholesterol (through soluble fiber) and reduction in absorption of clotting factors (through insoluble fiber) (54). Fiber rich foods such as fruits, vegetables, legumes and whole grain cereals are also rich sources of vitamins, minerals, phytochemicals, antioxidants and other micronutrients, possibly a basis for cardiovascular benefits. The American Heart Association recommends a dietary fiber intake of greater than 25 grams a day (55).

A prospective six year study involving 39,876 female health professionals with no prior history of cardiovascular disease correlated higher intake of fiber with lower incidence of CHD (53). A ten year study involving 68,782 women between 37 and 64 years of age with no prior history of angina, myocardial infarction, stroke, cancer, hyperlipidemia or diabetes at baseline again supported the hypothesis that high fiber intake, particularly from cereal sources, reduced the risk of cardiovascular disease (56). Examination of the relationship of fiber intake to serum concentrations of plasminogen activator inhibitor (PAI-1) and fibrinogen, found an inverse relationship between high fiber intake and PAI-1 levels but not with fibrinogen concentrations. High concentrations of PAI-1 and fibrinogen increase

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the risk of cardiovascular disease. Once again, these studies were affected by confounding variables (54).

**Hypertension and Stroke**

Hypertension is another common disorder with nutritional risk factors playing a role (57). The Dietary Approaches to Stop Hypertension (DASH) multicenter trial demonstrated that a diet rich in fruits, vegetables, whole grains and nuts, but low in fat and salt favorably impacted on high blood pressure in adults (58). Burke, et al in a randomized controlled study also found that dietary protein and soluble fiber supplements lowered blood pressure additively in hypertensives (59). In another clinical trial involving 459 adults, a diet rich in fruits, vegetables and low-fat dairy foods but low in saturated and total fat, substantially lowered blood pressure (60). Diet high in fiber has also been noted to play a role in prevention of stroke. A prospective study involving 43,738 US men 40 to 75 years of age, over eight years, demonstrated that high cereal diet was inversely associated with the risk of stroke, particularly in hypertensive men (61). In another study of 832 men aged 45 to 65, followed for 20 years, intake of fruits and vegetables protected against development of stroke (62).

**Metabolic Disorders**

**Fiber, Diabetes Mellitus and Hyperlipidemia**

It is well recognized that diabetes mellitus (DM) and hyperlipidemia are major risk factors for coronary artery disease. Diet high in fiber, particularly soluble fiber, has been shown to be a safe and practical manner to manage the plasma glucose concentrations in diabetics as well as for hyperlipidemia. Diabetes associations recommend that diabetics ingest a diet high in fiber containing foods. It appears that large amounts of fiber are necessary to confer metabolic benefit (63). Such amounts may not be acceptable to many, considering the gastrointestinal side effects of fiber and issues with palatability of supplements required to meet these requirements. In spite of the beneficial effects of a fiber rich diet in diabetics, according to NHANES III data, the average intake of fiber in diabetics was only 16 grams per day.

The mechanisms by which dietary fiber has beneficial effect on cholesterol and blood sugar levels are not fully understood, but may entail:

1. Soluble fiber binds to bile acids and cholesterol during intraluminal micelle formation, resulting in reduced cholesterol content of hepatocytes; this in turn leads to upregulation of LDL receptors and increased clearance of LDL cholesterol (64).

2. Bile acid loss in stools causes production of hepatic bile acids from cholesterol (unlikely to be the full explanation) (5,6).

3. Products of fermentation of dietary fiber, e.g. SCFA (acetate, butyrate, propionate), may have an inhibitory role in hepatic fatty acid synthesis (65).

4. Fiber with high viscosity properties impedes absorption of macronutrients resulting in increased insulin sensitivity, increased satiety and decreased energy intake (66).

Data from select studies on the metabolic role of fiber is presented in Table 7 (6, 63, 67–72).

**Fiber and Obesity**

Obesity has reached epidemic proportions in the United States and incurs considerable health care expenditure. Achieving an energy deficit is the cornerstone in management, with roles for life style modification and a fiber rich diet. Though controversial, dietary fiber may decrease dietary intake by a feeling of satiety, perhaps by delaying gastric emptying, and diminished absorption of macronutrients from the gut (4). Soluble fiber may alter the post prandial insulin response; insulin is an appetite stimulant (73).

**Fiber, Nutrients and Drug Interactions**

Fiber in excessive amounts may interfere with the absorption of micronutrients and medications. This is particularly relevant in the elderly who are on multiple medications and prone to nutrient deficiency (74). Fiber can bind to calcium, iron and magnesium in the diet, interfering with absorption; in particular, phytates and oxalates bind to minerals. Overall, insoluble fiber has a greater effect on the bioavailability of minerals; up to 25 grams of insoluble fiber per day does not cause this effect. Interestingly, vegetarians, who traditionally...

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<table>
<thead>
<tr>
<th>Study</th>
<th>Objective</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chandalia M et al (63)</td>
<td>Role of dietary (soluble) fiber at above the ADA recommended level in DM2</td>
<td>Improves glycemic control&lt;br&gt;Decrease hyperinsulinemia&lt;br&gt;Lower plasma lipid levels</td>
</tr>
<tr>
<td>Giacco R et al (67)</td>
<td>High fiber diet in DM1, long term</td>
<td>Improved glycemic control, less hypoglycemic episodes</td>
</tr>
<tr>
<td>Salmeron J et al (68,69)</td>
<td>Diets with high glycemic load and low in cereal fiber</td>
<td>Increased the risk of DM 2</td>
</tr>
<tr>
<td>Brown L et al (6)</td>
<td>Quantifying lipid lowering effect of soluble fiber</td>
<td>Soluble fibers reduce TC and LDLCL by similar, but small amounts</td>
</tr>
<tr>
<td>Meyer KA et al (70)</td>
<td>Dietary carbohydrates and risk of diabetes</td>
<td>Whole grains and cereal fiber beneficial in prevention of DM2</td>
</tr>
<tr>
<td>Liu S et al (71)</td>
<td>Whole vs. refined flour and risk of DM</td>
<td>Whole grain products decrease risk of DM</td>
</tr>
<tr>
<td>EURODIAB IDDM Complications study (72)</td>
<td>High fiber diet and lipid profile in men and women</td>
<td>Higher HDLC in both sexes and lower LDLCL in men.</td>
</tr>
</tbody>
</table>


tionally consume more fiber than non-vegetarians, do not demonstrate a higher likelihood for mineral deficiency (4). Pectins and gums, both viscous fibers, bind to digoxin and acetaminophen (4). Non-specific adsorption of wheat bran to levothyroxine decreases bioavailability of thyroxine (75). Where possible, it is advisable to separate in time the consumption of medications and fiber intake as diet or supplement.

How Much and What Kind?
The precise daily requirement of dietary fiber recommended for protective benefits is not clear. Given the lack of adequate scientific evidence, it is difficult to advise patients with absolute certainty on the amount or type of dietary fiber to be consumed. In general, it is advisable to consume fiber from natural sources as a first choice before resorting to fiber supplements. Most case controlled, prospective and intervention studies have assessed the beneficial effect of total fiber intake at 3 to 3.5 times the actual mean dietary fiber intake (11.1–13.1 g/day) in US adults. It is reasonable to recommend a total fiber intake of about 30–35g/day. Dietary fiber should be derived from several sources (to include soluble and insoluble types), including 5–7 servings of vegetables and fruits daily and generous portions of whole grain cereal, as recommended by the World Health Organization and National Cancer Institute (Table 8) (55,76,77).

The food choices that should be emphasized include whole fruits rather than juice, legumes (instead of meat) at least twice a week, cooked vegetables, fresh salad, whole grain breads (rather than breads from refined flour), brown rice rather than white rice and most importantly, the use of a high fiber cereal for breakfast to add to fiber content. Bran is the residue following conversion of cereal and flour; wheat bran, with substantial lignin, effectively increases stool mass. Fruits and vegetables are high in pectins and hemicellulose. Table 9 provides fiber con-

<table>
<thead>
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<th>Study</th>
<th>Objective</th>
<th>Conclusion</th>
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<tr>
<td>Table 8 Recommendations for Fiber Intake: (55,76,77)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• American Heart Association (AHA): &gt;25 grams per day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• American Dietetic Association : 20–35 grams per day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• National Cancer Institute / National Cancer Society: 20–30g per day</td>
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</table>
The importance of adequate fluid intake along with a fiber rich diet cannot be over emphasized. One should aim for around 8 glasses of water (about 2 liters) in a day. Excessive fiber intake (50–60 g/day) may result in gastrointestinal intolerance with bloating, flatulence or diarrhea and malabsorption of nutrients and drugs (74).

Commercial preparations are an alternative when adequate fiber cannot be consumed in dietary form. Psyllium a component of commercial preparations is derived from plantago seed; it undergoes fermentation in the colon, increasing bacterial mass. Methycellulose and polycarbophil, semi-synthetic celluloses are poorly fermentable and absorb water, increasing fecal bulk. Table 10 provides a select list of preparations available without a prescription.

### Table 9: Source of Dietary Fiber

<table>
<thead>
<tr>
<th>Source of Dietary Fiber</th>
<th>Approximate grams Per Serving</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>High (&lt;5 g)</td>
</tr>
<tr>
<td>Cereals</td>
<td></td>
</tr>
<tr>
<td>All bran</td>
<td>9</td>
</tr>
<tr>
<td>Cheerios</td>
<td>1</td>
</tr>
<tr>
<td>Cornflakes</td>
<td></td>
</tr>
<tr>
<td>Crispy Wheat n Raisins</td>
<td>1</td>
</tr>
<tr>
<td>Honey bran</td>
<td>3</td>
</tr>
<tr>
<td>Oat bran</td>
<td>4</td>
</tr>
<tr>
<td>Oat meal</td>
<td></td>
</tr>
<tr>
<td>Rice Krispies</td>
<td>5</td>
</tr>
<tr>
<td>Raisin Bran</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
</tr>
<tr>
<td>Apricots</td>
<td>3</td>
</tr>
<tr>
<td>Apple with peel</td>
<td></td>
</tr>
<tr>
<td>Apple without peel</td>
<td></td>
</tr>
<tr>
<td>Apple juice</td>
<td></td>
</tr>
<tr>
<td>Banana (medium)</td>
<td>2</td>
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<tr>
<td>Figs, dried</td>
<td>9</td>
</tr>
<tr>
<td>Grapefruit (medium)</td>
<td>4</td>
</tr>
<tr>
<td>Grapes</td>
<td>3</td>
</tr>
<tr>
<td>Orange (medium)</td>
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</tr>
<tr>
<td>Orange juice</td>
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</tr>
<tr>
<td>Pear with skin</td>
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</tr>
<tr>
<td>Pear without skin</td>
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</tr>
<tr>
<td>Raspberries</td>
<td>8</td>
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<tr>
<td>Strawberries</td>
<td>4</td>
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<tr>
<td>Watermelon</td>
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</tr>
<tr>
<td>Legumes</td>
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<tr>
<td>Baked beans with tomato</td>
<td>9</td>
</tr>
<tr>
<td>Chick peas</td>
<td>10</td>
</tr>
<tr>
<td>Kidney beans, cooked</td>
<td>7</td>
</tr>
<tr>
<td>Lentils, cooked</td>
<td>7</td>
</tr>
<tr>
<td>Rice/pasta</td>
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<tr>
<td>Rice, brown</td>
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<td>Vegetables</td>
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<td>Broccoli</td>
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<td>Carrots</td>
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<td>Corn, canned/cooked</td>
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<tr>
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<tr>
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<td>Spinach, cooked</td>
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<tr>
<td>Nuts</td>
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</tr>
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<td>Almonds</td>
<td>1</td>
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Table 10
A Sample of Commercial Fiber Preparations*

<table>
<thead>
<tr>
<th>Name</th>
<th>Marketed by</th>
<th>Fiber</th>
<th>Amount/Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefiber</td>
<td>Novartis Consumer Health</td>
<td>Guar gum</td>
<td>3.0 g/serving</td>
</tr>
<tr>
<td>Citruccel</td>
<td>Smith Kline-Beecham</td>
<td>Methyl cellulose</td>
<td>2.0 g/tablespoon</td>
</tr>
<tr>
<td>FiberCon</td>
<td>Wyeth</td>
<td>Calcium polycarbophil</td>
<td>500 mg/tab</td>
</tr>
<tr>
<td>Konsyl</td>
<td>Konsyl</td>
<td>Psyllium</td>
<td>6.0 g/teaspoon</td>
</tr>
<tr>
<td>Metamucil</td>
<td>Procter &amp; Gamble</td>
<td>Psyllium</td>
<td>3.4g/teaspoon</td>
</tr>
</tbody>
</table>

*the list is for illustration only and not necessarily complete

SUMMARY

The western civilization has one of the lowest per capita fiber intake in the world.

The challenge for health professionals is to educate adults about the values of adequate fiber intake, and regenerate interest in ingesting a healthy diet. Although many of the health benefits of fiber are controversial, a fiber first diet indirectly reduces the total calorie and fat intake with well documented health benefits. Increasing fiber in the diet is relatively less expensive and associated with few side effects, making it a feasible option. Even a small health benefit from the use of fiber favorably impacts on disease, translating into better health and economic benefits. Diet indeed was deemed to play a pivotal role in medicine even hundreds of years back; Hippocrates had rightly stated "Let food be your medicine."

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