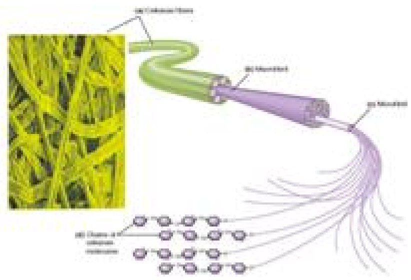
Fiber Dynamics part 2



Researched and Composed by Gabriel "Venom" Wilson, BSc. (Hons), CSCS

Abstract

In dietary fiber part 1, we completely analyzed what fiber is, and many of its surrounding attributes. It is imperative that you have a strong grasp of these concepts before you proceed. If this is the case, let's get to it!

Anabolism and Health

And now, the part of the article you've all been waiting for. How fiber can help you the reader become pure freak! Read on for this, and many more benefits regarding dietary fiber, including preservation of a healthy physique.

Hydration and Viscosity

Let us begin our journey into the realm of anabolism, with a quote from the President and CEO of Hyperplasia Magazine, Jacob Wilson:

"Viscosity refers to the relative thickness of a fluid. That is-the thicker it is, the higher its measure of viscosity would be. For example, our blood is affected by the amount of red blood cells housed within it. A person who lives in the mountains would contain a greater amount of RB cells, than one who is at sea level. Therefore, the former would be considered to have more viscous blood than the latter."

Water-holding or hydration capacity of foods refers to the ability of fiber in food to bind water. Think of fiber as a dry sponge moving through the digestive tract hydrating or soaking up water and digestive juices as it moves through the digestive tract. Many of the water-soluble fibers such as pectins, gums, and some hemicelluloses have a high water-holding capacity in comparison with fibers such as cellulose and lignin that have a lower water-holding capacity. In addition, some water-soluble fibers such as pectin's, gums, mucilage's, and algal polysaccharides form viscous (thick) solutions within the gastrointestinal tract [7,22,36].

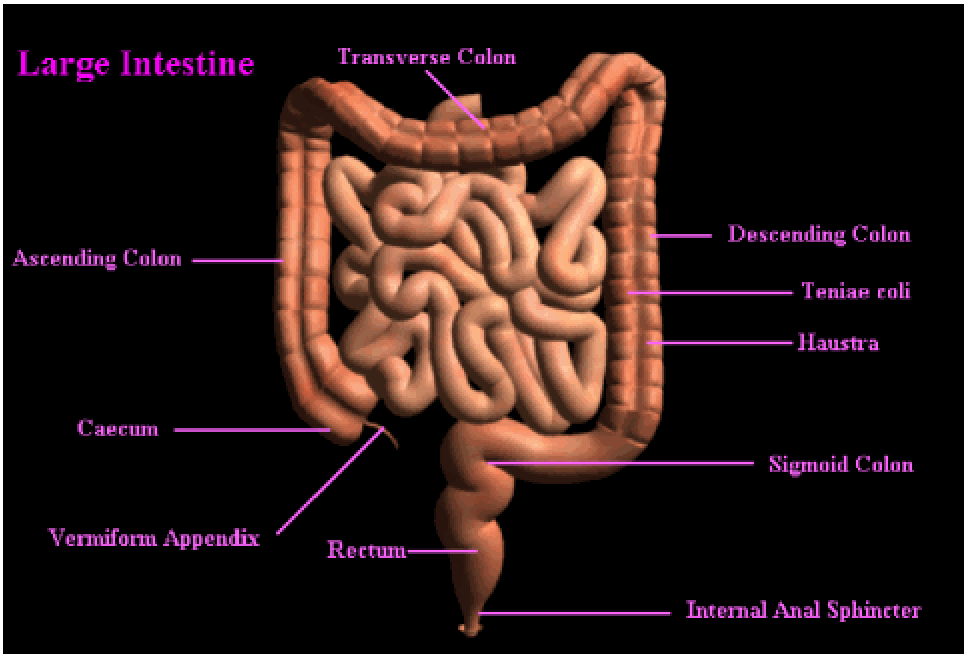
Water-holding capacity, however, is not just dependent on the fiber's solubility in water. The pH of the gastrointestinal tract, size of the fiber particles, and/or degree of processing of the foods providing fiber also influence the water-holding capacity and in turn its physiological effects. Coarsely ground bran, for example, has a higher hydration capacity than that which is finely ground. Consequently, coarse bran with large particles holds water, increases fecal volume, and speeds up rate of fecal passage through the colon. Maintaining the integrity of cells in grains and legumes rather than subjecting them to traditional milling processes also appears to affect the water-holding capacity of fibers.

The gastrointestinal effects of the ingestion of fibers such as pectin's, gums, mucilage's, algal polysaccharides, and some hemicelluloses that can hold water and create viscous solutions within the gastrointestinal tract include [22,30,36]:

- Delayed (slowed) emptying of food from the stomach.
- Reduced mixing of gastrointestinal contents with digestive enzymes.
- Reduced enzyme function.
- Decreased nutrient diffusion rate and thus delayed nutrient absorption
- Altered small intestine transit time.

Each of these effects will be discussed.

Gastric Emptying (great for dieting)



When fibers form viscous (thick) gels or hydrate (holding water) within the stomach, the release of the chyme (food that has been acted upon by the stomach juices, but has not yet been passed on into the intestines) from the stomach into the duodenum (first, or proximal portion of the small intestine) is delayed (slowed). Thus, nutrients remain in the stomach longer with these fibers than would occur in the absence of the ingested fiber. This effect creates a feeling of postprandial (after eating) satiety (fullness) as well as slows down the digestion process, because carbohydrates and lipids that remain in the stomach undergo no digestion in the stomach and must move into the small intestine for further digestion to occur. For those of you that are cutting, you can see how fiber will assist your cravings, and help you stay strict with your diet [14,24].

Scientists, J. Russell and P. Bass performed an experiment on the affect of fiber on gastric emptying rate. Here is a quote on the results [30,36]:

"Dietary fibers such as psyllium and guar gum have been shown to delay the gastric emptying of liquids and solids, presumably due to an increase in meal viscosity....Low-viscosity fiber meals emptied from the stomach rapidly (E 1/2 approximately 10 min) compared with the high-viscosity meals (E 1/2 approximately 40 min). "

Mixing with Digestive Enzymes

The presence of viscous gels or hydrated fibers in the gastrointestinal tract provides a physical barrier that can impair the ability of the nutrients in the food to interact with the digestive enzymes. This interaction is critical for digestion to occur [26].

Enzyme Function

Viscous gel-forming fibers have been shown to interfere with the enzymatic hydrolysis (discussed in the definition of fiber) of nutrients within the gastrointestinal tract. For example, hydrocolloids may inhibit intestinal peptidases (ase usually refers to enzyme; so peptide enzymes) that are necessary for the digestion of peptides to amino acids. The activity of pancreatic lipase also has been diminished because of ingestion of viscous gel-forming fibers and has thus resulted in inhibition of lipid digestion. It is unclear whether fiber directly decreases the activity of these digestive enzymes or acts by reducing the rate of enzyme penetration into the food [7].

Small Intestine Transit Time

In general, soluble fibers typically delay small intestine transit (travel) time versus insoluble fibers, which increase (speed up) transit time within the small intestine. As with decreased diffusion rates, the changes in transit time, especially if it is increased, may result in decreased nutrient absorption due to insufficient time for the nutrients to be in contact with enterocytes (cells of the intestinal epithelium) [14]

Insulin sensitivity!

Insulin sensitivity is of great value to bodybuilders. Increased sensitivity promotes a much greater anabolic response to food consumption, while insulin resistance leads to elevated fat storage. In addition, insulin resistance can lead to the most common form of a disease, which inflicts more than 8 million people in the United States known as type 2-diabetes. With this in mind, it has been proven that fiber greatly enhances our bodies' sensitivity to insulin. How this is achieved, will be shown subsequently. For more on the importance of insulin sensitivity, I refer to the following article, 13 Weeks To Hardcore Fat Burning - " The Diet "

But before we move on, let's discuss what diabetes is. Participants who became diabetic usually become non-insulin dependent diabetics (also called adult-onset or type 2 diabetes), the most common form of the disease that afflicts 8 million people in the United States. High blood sugar (glucose) levels in type 2 diabetes results from [6,9]:

1. Decreased effect of insulin on peripheral tissue (insulin resistance),
2. Inadequate insulin production to control blood sugar (relative insulin deficiency). Diabetes occurs when the pancreas cannot produce sufficient insulin to manage blood glucose regulation.
3. A combined effect of the two.

Now, let's look how exactly fiber affects insulin production in the human body. To begin, for nutrients to be absorbed, they must move from the lumen (tube) of the small intestine through a glycoprotein water layer lying on top of the enterocytes (intestinal epithelium, which provides better absorption for intestines). The fiber-associated decreased diffusion rate of nutrients through this layer is probably due to an increased thickness of the unstirred water layer. In other words, the unstirred water layer becomes more resistant to nutrient movement, and without this movement nutrients cannot be absorbed into the enterocyte [12,24,25,26,31].

Another mechanism may also be responsible for decreased nutrient diffusion. Gums appear to slow glucose absorption by decreasing the convective movement of glucose within the intestinal lumen. Convective currents induced by peristaltic (wave like movements, caused by muscular contractions) movements are responsible for bringing nutrients from the lumen to the epithelial surface for absorption. Decreasing the solute movement also may help to explain the decreased absorption of amino acids and fatty acids caused by viscous fiber. Ingestion of viscous mucilaginous fibers such as guar gum, but also pectin and psyllium, have been shown to slow transit (transportation, moving through), delay glucose absorption, lower blood glucose concentrations, and affect hormonal response (such as insulin) to the absorbed nutrients. Such results are of great significance to warriors of the iron jungle. This shows that consuming dietary fiber, will promote a slow, and efficient nutrient absorption rate. Which in turn will resists high rapid bursts of insulin, which leads to fat storage, and resistance. This is also beneficial to individuals with diabetes mellitus and reduce postprandial blood glucose concentrations and insulin needs/response [31,35].

A possible explanation for a potential carbohydrate intake-diabetes link relates to the digestion rates of different carbohydrate sources. Low-fiber processed starches (and simple sugars in soft drinks) digest quickly and enter the blood at a relatively rapid rate (high glycemic index). Dietary fiber slows carbohydrate digestion, thus minimizing surges in blood glucose (in-effect lowering glycemic rate). The rapid increase in blood glucose that accompanies refined processed starch consumption (in contrast to the slow-release forms of high fiber, unrefined complex carbohydrates) increases insulin demand, stimulates overproduction of insulin by the pancreas, and accentuates hyperinsulinaemia (high blood insulin). Consistently eating such foods may eventually reduce the body's sensitivity to insulin (more resistant), thus requiring progressively greater insulin output to control blood sugar levels. Both bodybuilders, and diabetics would greatly benefit from fiber [35,36].

Now here is a scary stat: about 25% of the population produces excessive insulin in response to rapidly absorbed carbohydrates! These insulin-resistant individuals may be at increased risk for obesity if they consistently eat carbohydrates that are absorbed rapidly. This increase in weight occurs because abnormal quantities of insulin facilitate glucose conversion to triglyceride (fat) by the liver, which then becomes stored as body fat in adipose tissue. If these observations prove correct, the obese are affected the most. This group shows the greatest insulin resistance and consequently, the greatest insulin response to a blood glucose challenge. Bodybuilders are not as prone to this disease; due to animalistic training sessions, and dedication to a strict diet. Nevertheless, consumption of fiber (especially if you have a family history for this disease) would help athletes avoid this. And as stated above, the anabolic results of muscular insulin sensitivity are invaluable [6].

Thus, To reduce the risks for type 2 diabetes and obesity, consumption of more slowly absorbed, unrefined complex carbohydrate foods (low glycemic index) provides a form of "slow-release" carbohydrate without producing rapid fluctuations in blood sugar. If rice, pasta, and bread remain the carbohydrate sources of choice, they should be consumed in unrefined form as brown rice and whole-grain pastas and breads, which contain higher contents of fiber. Such a dietary modification would greatly benefit bodybuilders in their goal for obtaining freakiness, while maintaining a lean physique.

Dietary fiber also slows the rate of carbohydrate digestion causing slower absorption by the intestine. In addition, fiber may also decrease the total number of calories consumed in subsequent meals. Eating a fiber-rich breakfast, for example, decreased the total caloric intake during breakfast and a buffet-type lunch consumed 3.5 hours later. Dietary fiber also contains anabolic micronutrients, particularly magnesium, which may help to control insulin. Magnesium possibly increases the body's sensitivity to insulin, thus reducing the required level of insulin production [28,33,44].

There are many experiments, which show fiber enhances insulin sensitivity. Juntunen KS et al. has this to say [25], “High-fiber rye bread appears to enhance insulin secretion, possibly indicating improvement of b cell function.” McKeown NM et al. states [31], “The association between whole-grain intake and fasting insulin was attenuated after adjustment for dietary fiber and magnesium.” Concerning diabetes, Tabatabai A, Li S. from the results of several tests stated [26]:

“Dietary fiber shows promise in the management of type 2 DM. The inclusion of sufficient dietary fiber in a meal flattens the postprandial glycemic and insulinemic excursions and favorably influences plasma lipid levels in patients with type 2 DM. Water-soluble fiber appears to have a greater potential to reduce postprandial blood glucose, insulin, and serum lipid levels than insoluble fiber. Viscosity of the dietary fiber is important; the greater the viscosity, the greater the effect. Possible mechanisms for metabolic improvements with dietary fiber include delay of glucose absorption, increase in hepatic extraction of insulin, increased insulin sensitivity at the cellular level, and binding of bile acids. Patients with type 2 DM should increase their dietary fiber intake to 20 to 35 g/d and be aware of the considerations when increasing fiber intake.”

As stated above, magnesium shows great promise for improving insulin sensitivity. Here is a quote form Rodriguez-Moran M, and Guerrero-Romero F. on the results of there experiments [35].

"RESULTS:-At the end of the study, subjects who received magnesium supplementation showed significant higher serum magnesium concentration (0.74 +/- 0.10 vs. 0.65 +/- 0.07 mmol/l, P = 0.02) and lower HOMA-IR index (3.8 +/- 1.1 vs. 5.0 +/- 1.3, P = 0.005), fasting glucose levels (8.0 +/- 2.4 vs. 10.3 +/- 2.1 mmol/l, P = 0.01), and HbA(1c) (8.0 +/- 2.4 vs. 10.1 +/- 3.3%, P = 0.04) than control subjects. CONCLUSIONS:-Oral supplementation with MgCl(2) solution restores serum magnesium levels, improving insulin sensitivity and metabolic control in type 2 diabetic patients with decreased serum magnesium levels."

Therefore, consuming fiber with starchy carbs such as bread, and having more fibrous sources of carbohydrates for instance oatmeal, will greatly reduce high insulin bursts, and promote more efficient use of this anabolic hormone [25,31,33,44].

Adsorption

It's important to understand, "a**b**sorption", and "a**d**sorption" have two different meanings. Webster's dictionary says adsorption is:

"Adsorption- the adhesion in an extremely thin layer of molecules (as of gases, solutes, or liquids) to the surfaces of solid bodies or liquids with which they are in contact. "

Basically, adsorption has to do with a substances ability to bind. Absorption is defined as:

"The process of absorbing or of being absorbed. "

Simply put, a**b**sorption is to take it in, a**d**sorption is to bind.

Some fiber components, especially lignin, gums, pectin's, and some hemicelluloses, but also some Maillard products, have the ability to bind (adsorb) substances such as enzymes and nutrients in the gastrointestinal tract. The ability of these fibers to adsorb substances depends in part on gastrointestinal pH as well as particle size, food processing, and fermentability [13].

The physiological effects of the ingestion of fibers with adsorption properties within the gastrointestinal tract may include

- Diminished absorption of lipids.
- Increased fecal bile acid excretion.
- Lowered serum cholesterol concentrations (Hypocholesterolemic properties).
- And altered mineral balance.

The mechanisms by which these effects occur vary considerably and will be reviewed next.

Lipid digestion

Soluble fibers (e.g., pectin, guar gum, and oat bran), and also the insoluble fiber lignin may affect lipid absorption by adsorbing fatty acids, cholesterol, and/or bile acids within the digestive tract. Fatty acids and cholesterol that are bound to fiber cannot form micelles and cannot be absorbed in this bound form; only free fatty acids, monoacylglycerol, and cholesterol can be incorporated into micelles. Micelles are needed for these end products of fat digestion to be transported through the unstirred water layers and into the enterocyte (discussed earlier). Micelles are formed by bile acids, salts, and lipids. They also play a key role in the absorption of lipids. Thus, fiber-bound lipids are typically not absorbed in the small intestine and pass into the large intestine where they will be excreted in the feces or degraded by intestinal bacteria [27].

Increased Fecal Bile Acid emission

Adsorption of bile acids to fibers prevents the use of the bile acids for micelle formation. And, like fiber bound fatty acids, bile acids bound to fiber cannot be reabsorbed and re-circulated. Fiber-bound bile acids are typically sent into the large intestine for either fecal excretion or colonic microflora degradation.

Serum Cholesterol

Cholesterol is a soft waxy substance that is a natural component of the fats in the bloodstream and in all the cells of the body. While cholesterol is an essential part of a healthy body, high levels of cholesterol in the blood (known as hypercholesterolemia) increases a person's risk for cardiovascular disease, which can lead to stroke or heart attack. High levels of both total serum cholesterol and the cholesterol-rich LDL molecules induce heart ailments. Particularly with other risk factors (e.g., smoking, physical inactivity, obesity, and untreated hypertension, that is, high blood pressure). A continuous and graded relationship exists between high levels of serum cholesterol and death from coronary artery disease; thus, lowering cholesterol confers protection from heart disease. For patients with existing heart disease, coronary blood flow improves significantly in 6 months or less when drug and diet therapy are used aggressively to lower both total blood cholesterol and LDL-cholesterol, thus reducing myocardial ischemia, which is a disorder of cardiac function caused by insufficient blood flow to the muscle tissue of the heart [4,5,31].

A controlled 7- to 10-year investigation of nearly 4000 healthy middle-aged men with elevated serum cholesterol showed a cause-and-effect relationship between serum cholesterol and heart disease. Lowering cholesterol by 25% significantly reduced heart attack risk and improved survival when a heart attack occurred. Diet and a cholesterol-lowering drug produced a 50% reduction in the rate of heart disease. Improvement in coronary heart disease risk became closely linked to the cholesterol decrease by the factor of 1:2. A 1% reduction in cholesterol caused a 2% reduction in risk! These findings, corroborated in other clinical trials, show the wisdom of reducing serum lipids through diet modification, and exercise.

Consequently, fiber has been shown to greatly reduce cholesterol. The ability of fibers to lower serum cholesterol concentrations is based on a series of events. First, with the excretion of bile acids in the feces, less bile undergoes enterohepatic (intestine or liver involvement) re-entry [4]. A decrease in the bile acids returned to the liver necessitates the use of cholesterol for synthesis of new bile acids. The net effect of the process is lower serum cholesterol.

A second proposed mechanism for the hypocholesterolemic (lower blood cholesterol) effect of fiber is the shift of bile acid pools away from cholic acid (type of acid derived from cholesterol) and toward chenodeoxycholic acid (a bile acid joined with glycin or taurine. Cleans fat and helps absorption) Chenodeoxycholic acid appears to inhibit 3-hydroxy 3-methylglutaryl (HMG) CoA reductase. Which are enzymes that help fat and steroid biosynthesis (build up of living compound, or chemical). Decreased HMG CoA reductase activity results in reduced hepatic (pertaining to liver) cholesterol synthesis and theoretically lower blood cholesterol concentrations [4,5].

A third mechanism, shown in animal studies, suggested that production of propionate from bacterial degradation of fiber (discussed shortly) lowers serum cholesterol concentrations. However, propionate fed to humans has had varying effects on serum cholesterol concentrations. This will be discussed more further on. Anderson JW. States this from his experiment on fiber [4]:

> "Diets rich in wholegrain foods tend to decrease serum LDL-cholesterol and triacylglycerol levels as well as blood pressure while increasing serum HDL-cholesterol levels. Whole-grain intake may also favourably alter antioxidant status, serum homocysteine levels, vascular reactivity and the inflammatory state. Whole-grain components that appear to make major contributions to these protective effects are: dietary fiber; vitamins; minerals; antioxidants; phytosterols; other phytochemicals. Three servings of whole grains daily are recommended to provide these health benefits."

Studies suggest that psyllium, guar, and oat gum as well as pectin have the greatest potential to lower serum cholesterol. Oat bran and soybean fibers have intermediate effects, while corn, wheat, and rice bran appear to be ineffective. Ingestion of fruits and vegetables that have a mixture of soluble and insoluble fibers has been shown to decrease serum cholesterol concentrations.

Minerals

Some fibers-especially those with uronic acid (breakdown of a type of alcohol) such as hemicellulose, pectins, and gums-can form cationic (positively charged) bridges with minerals within the gastrointestinal tract. Lignin, which has both carboxyl and hydroxyl groups, is also thought to play a role in mineral absorption. The overall effect (positive or negative) that fiber has on mineral balance depends to some extent on its degree of fermentability or its accessibility to bacterial enzymes in the colon.

Microorganism production from slowly fermentable fibers may result in increased binding of minerals within the new microbial (micro) cells and result in the loss of minerals from the body, assuming colonic mineral absorption. In contrast, the more rapidly fermentable fibers (such as pectin's) appear to have a favorable effect on mineral balance. Calcium, zinc, and iron bound to these fiber components are released as fermentation occurs and may possibly be absorbed in the colon [37].

Fermentability

Both the small and large intestines contain numerous microflora (bacteria), although most are found in the large intestine. Many of these microflora are capable of degrading (fermenting) fiber, especially pectin's, gums, mucilage's, and algal polysaccharides. In addition to these fibers, some cellulose and some hemicelluloses are also fermentable, but their fermentation is much slower than that of the other fibers. In this section, first fermentable fibers and their effects on the body will be discussed. A discussion of the effects of fiber that are not fermentable will follow [27].

Fermentable Fibers

The principal metabolites (any substance produced by the metabolism) of fermentable fibers (including any starch that has passed into the caecum, which is a pouch at the end of the small intestine, and been degraded by bacteria) are lactate and short-chain fatty acids (SCFAs), formerly called volatile fatty acids (VFAs) because of their volatility in acidic aqueous solutions. Many different fibers including pectin, gums, oat and wheat bran, and psyllium, which are mostly mucilage's and non-polysaccharides, are degraded to short-chain fatty acids. The short-chain fatty acids include primarily acetic, butyric, and propionic acids. In addition to these acids, other products of fiber fermentation are hydrogen, carbon dioxide, and methane gases that are excreted as flatus (puff of wind) or are expired by the lungs [13].

Different fibers are fermented to different short chain fatty acids in different amounts by different bacteria. For example, ingestion of pectin resulted in higher propionate (organic acid derived from fermentation) concentrations in the colon of rats versus wheat bran, which resulted in higher butyrate (an acid, also found in butter) concentrations. Bacteria's, which act on pectin's include [7]:

- Bacteroides a rod shaped bacteria that generates acetate, propionate, and succinate.
- Eubacteria that yield acetate, butyrate, and lactate.
- Bifidobacteria that produce acetate and lactate.

Some general effects of short-chain fatty acids generated from fiber fermentation by intestinal microbes include [27]:

- Increased water and sodium absorption in the colon.
- Mucosal cell proliferation. Mucosal cells are any membrane or lining which contain mucus-secreting glands for lubrication.
- Provided energy.
- Acidification of tubed (or luminal) environment.

Each of these effects will be discussed subsequently.

Acidification of Luminal atmosphere

The generation of short-chain fatty acids in the colon from bacterial fermentation of carbohydrates, results in a decrease in the pH of the colon's luminal environment. pH is a measure of acidity--the lower the pH the more acidic, the higher the pH the more basic. With the more acidic pH, free bile acids become less soluble. Furthermore, the activity of 7 & dehydroxylase diminishes (optimal pH -6-6.5) and thus decreases the conversion of primary bile acids to secondary bile acids. With the lower pH, calcium also becomes more available (soluble) to bind bile and fatty acids. These latter two changes may be protective against colon cancer [16,27,43].

Increased Absorption in the Colon

Short-chain fatty acids produced by fermentation are rapidly absorbed, and their absorption in turn stimulates water and sodium absorption in the colon [30].

Mucosal Cell Proliferation

Substrates generated from the degradation of dietary fiber in the colon stimulate the production of mucosal cells in the gastrointestinal tract. Provision of Energy Short-chain fatty acids provide body cells with substrate (substance on which an enzyme acts) for energy production. Butyric acid provides an energy source for colonic epithelial cells. The fatty acids not used by the colonic cells, primarily the propionic and acetic acids, are carried by the portal vein to the liver, where the propionate and some of the acetate are taken up and metabolized. Most of the acetate, however, passes to the peripheral tissues, where it is metabolized by skeletal and cardiac muscle. Remember from the section on lowered serum cholesterol? It is the propionic acid generated from fiber fermentation that in rats inhibited hepatic cholesterol biosynthesis [21]!

Detoxification

The detoxification role is based on the theory that the synthesis of increased microbial cells could result in the increased microbial scavenging of substances or toxins, which eventually are excreted. Alternately, certain colonic bacteria appear to inhibit proliferation of tumor cells and/or delay tumor formation.

In addition, bacteria such as L. acidophilus reduced the activity of enzymes that catalyze the conversion of procarcinogens to carcinogens [16].

Provision of Energy

Fermentation of carbohydrates by colonic anaerobic bacteria makes available to the body some of the energy contained in undigested food reaching the cecum. The exact amount of that energy realized depends mostly on the amount and type of dietary fiber that is ingested. It is estimated that in developed countries as much as 10% to 15% of ingested carbohydrate may be fermented in the colon; in the third world (developing) countries, this percentage may be considerably higher do to more bacteria accumulation [32].

Increased Fecal Volume

In addition to its detoxifying role, microbial proliferation may promote increased fecal volume or bulk by 40 to 100%. Bulking action may aid gastrointestinal functioning by exerting a scraping action on the cells of the gut wall, binding or diluting harmful chemicals or inhibiting their activity, shortening the transit time for food residues (and possibly carcinogenic materials) to pass through the digestive tract. These actions may reduce the chances of colon cancer and various other gastrointestinal diseases.

Fecal bulk consists of unfermented fiber, salts, and water as well as bacterial mass. In general, fecal bulk increases with increased bacterial proliferation. This occurs not only because of the mass of the bacteria but also because bacteria's are about 80% water. Thus, with increased fecal bacteria present, there is an increase in mass and in the water holding capacity of the feces.

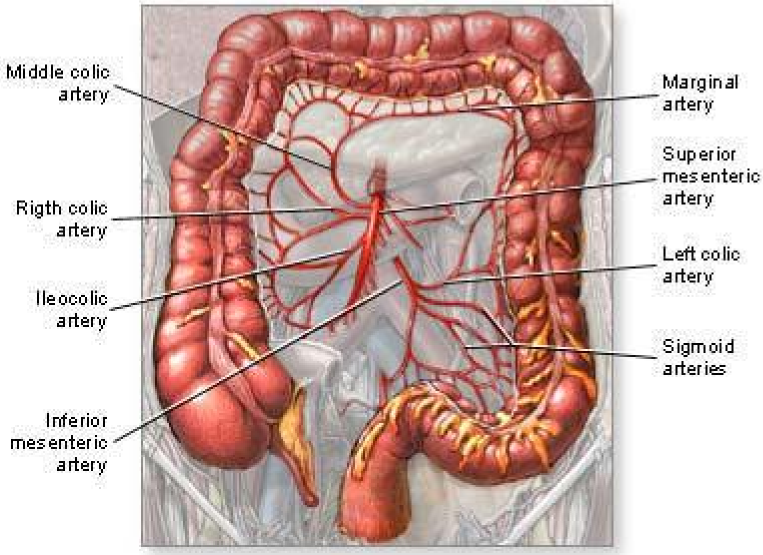
In general, fecal bulk increases as fiber fermentability decreases. The rapidly fermentable fiber appears to have little or no effect on fecal bulk. Therefore, choosing the appropriate food source(s) of fiber depends on the specific fiber effect(s) being sought and whether the food contains the fiber components producing this effect(s). Wheat bran is one of the most effective fiber laxatives because it can absorb three times its weight of water, thereby producing a bulky stool. Gastrointestinal responses to wheat bran include.

- Increased fecal bulk.
- Greater frequency of defecation (to expel feces).
- Reduced intestinal transit time.
- Decreased intraluminal pressure.

Rice bran has been found to be even more effective than wheat bran in eliciting an increased fecal bulk and reduced intestinal transit time; both rice and wheat bran are helpful in treating constipation [39].

Non-fermentable Fibers

The fiber components that are non-fermentable, principally cellulose and lignin, or that are more slowly fermentable, such as some hemicelluloses, are particularly valuable in promoting the proliferation of microbes in the colon. Microbial proliferation may be important for both detoxification as well as a means of increasing fecal volume (bulk) [13,16].



Colon Cancer

Colorectal (relating to colon) cancer includes cancers of the colon, rectum, appendix and anus. When abnormal cell growth occurs, a tumor develops. If the cells of a tumor acquire the ability to invade and thus spread into the intestinal wall and to other sites, a malignant or cancerous tumor develops. Most colorectal cancers develop first as colorectal polyps, which are growths inside the colon or rectum that may later become cancerous. This is a terrible disease, which can inflict innumerable stomach disorders such as diarrhea, constipation, stomachaches, vomiting, lack of energy, and most devastating of all, death. Colorectal cancer is one of the deadliest forms of cancer among men and women combined, second only to lung cancer. Today I hope to equip you with a powerful weapon in the battle against this disease.

Several of the aforementioned characteristics of fiber illustrate the proposed mechanisms by which fiber can prevent colon cancer. These characteristics and mechanisms are listed and discussed here [8,17,20,30]:

- High bile acid concentrations are associated with a high risk of colon cancer. Thus, fibers that adsorb bile acids to promote fecal excretion serve a protective effect by decreasing free concentration and the availability of bile acids for conversion to secondary bile acids, which are thought to promote colon carcinogenesis (production of cancer from cells).
- Fibers that increase fecal bulk decrease the intraluminal concentrations of carcinogens and thereby reduce the likelihood of interactions with colonic mucosal cells.
- Allowance of a fermentable substrate to colonic bacteria alters kinds and numbers of bacteria and/or their metabolism, which may inhibit proliferation or development of tumor cells or conversion of procarinogens to carcinogens.
- A shortened fecal transit time decreases the time during which toxins can be synthesized and in which they are in contact with the colon.
- Fiber fermentation to short-chain fatty acids decreases the interluminal pH, thereby decreasing synthesis of secondary bile acids, which have been shown to promote the generation of tumors.

- Degradation of fiber by fermentation may release fiber-bound calcium. The increased calcium in the colon may help eliminate the mitogenic advantage that cancer cells have over normal cells in a low-calcium environment.
- Butyric acid appears to slow the proliferation and differentiation of colon cancer cells.
- Insoluble fibers such as lignin that resist degradation bind carcinogens, thereby minimizing the chances of interactions with colonic mucosal cells.

But, not all studies show anticarcinogenic effects with fiber. In some studies show soluble fibers enhance the development of colorectal cancers. Proposed mechanisms for this action include soluble fibers reduce the ability of insoluble fibers to adsorb hydrophobic carcinogens, thus more carcinogens may enter the colon maintained in solution than adsorbed onto insoluble fibers; on degradation of soluble fibers, carcinogens are released and deposited on the colonic mucosal surface; soluble fibers may cross the intestinal epithelium and transport with them carcinogens maintained in solution; soluble fibers may reduce absorption of bile salts and thereby increase the chance for conversion to secondary bile acids [17,19,23,40].

There is little agreement among the numerous studies designed to determine the effect of fiber in the development of colon cancer. Most of the evidence for the positive role of fiber in colon cancer prevention hall comes from epidemiological observations. Unfortunately, in these epidemiological studies, variation in many dietary factors other than fiber intake has been noted. The dietary factors most often identified as being involved in variations in the incidence of colorectal cancer between different population groups are too many total calories, high fat, fat greasy couch potatoes that do not train, low fiber, low intake of vitamin D and calcium, and a low intake of antioxidants. Medical-analyses, however, of both epidemiological (study of controlling health problems) and case-controlled studies that investigated dietary fiber and colon cancer found that fiber-rich diets were associated with a protective effect against colon cancer in the majority of studies. Furthermore, risk of colorectal cancer in the United States is thought to be reducible by up to 31% with a 13-g daily increase in dietary fiber intake [1,19,21,23,30,34,38,39,40].

More, is not always better

Excessive fiber intake (particularly high-fiber foods that contain seed coats and thus large amounts of phytates) may be ill advised. Higher than recommended fiber ingestion generally blunts the intestinal absorption of the major minerals calcium and phosphorous, and some trace minerals including iron and zinc. This is of particular affect among infants, children, adolescents, and pregnant women whose mineral needs are greater than those for adult men and non-pregnant women. Fluid imbalance may also occur from excess fiber, especially those with high water-binding capacity. Over consumption can also lead to volvulus, an enlargement and twisting of the sigmoid colon, which then impedes digestive residue passage through the alimentary system [1,2, 3,37].

Sounds bleak ah? Fear not, next we will discuss how to avoid these ailments, and exactly how much fiber to consume, for maximal results.

Optimal consumption/Overview

Recommendations for increasing the amount of dietary fiber in the U.S. diet have come from several governmental and private organizations, each with a concern for improving the health of the U.S. public. The importance of an adequate intake of fiber to the improvement of health is demonstrated by some of the physiological effects exerted by its various components. Particularly noteworthy are the glucose and lipid effects of soluble fiber. Slowing the absorption rate of carbohydrates can be very anabolic for bodybuilders, helping to maintain muscular insulin-sensitivity. And is also of great benefit to the individual with diabetes mellitus in regulating blood glucose levels. Lowering serum cholesterol levels has significant benefits in the prevention of atherosclerosis (hardening/narrowing arteries). Adequate fiber intake also has been implicated in control of various gastrointestinal disorders, including colon disease, irritable bowel syndrome (bowel disorder, i.e. cramping abdominals, diarrhea, ect.), and constipation [7,10,41,42].

The non-fermentable fibers, especially cellulose and lignin, and fibers that are more slowly fermentable, such as some hemicelluloses, have been shown to be helpful in overcoming constipation, particularly constipation associated with or irritable bowel syndrome. Data shows populations with high fiber intakes have a lower incidence of these gastrointestinal disorders as well as colon cancer. The bulk provided by fiber gives some satiety (satisfaction) value. High-fiber foods may reduce the hunger associated with caloric restriction while simultaneously delaying gastric emptying and somewhat reducing nutrient utilization, all of which are beneficial for cutting [2,3,41,42].

The recommended intake of fiber for the general population ranges from 20 to 40 g/day but may reach as much as 50 g/day for some individuals with specific conditions. A minimum fiber intake of about 20 g/day is recommended by the American Dietetic Association the National Cancer Institute [11], and the Federation of American Societies for Experimental Biology (FASEB) [1]. Alternately, 10- to 13-g dietary fiber intake/1,000 kcal also has been suggested. FASEB, the National Cancer Institute and the American Dietetic Association [3] suggest an upper limit of 35 g/day.

Recommendations for fiber intake for those with specific diseases or conditions are similar to guidelines for healthy individuals. For those with non-insulin-dependent diabetes mellitus, the upper level of recommended fiber consumption should be about 40 g/day, and for obese individuals with non-insulin-dependent diabetes mellitus, about 25 g dietary fiber/1,000 kcal is recommended [9]. For clients with a family history of diet-implicated cancers, daily fiber consumption should regularly be about 35 to 40 g/day [15]. Intakes of up to 50 g/day are recommended for people with hypercholesterolemia (high cholesterol) [11,15].

Intakes of fiber beyond the upper range of 40 to 50 g/day as stated above, can create problems. Intestinal obstruction in susceptible individuals as well as fluid imbalance have occurred with high intakes of fiber, especially those with high water-binding capacity [37,41-44].

Excessive insoluble fiber intake may pose the hazard of negative mineral balance. In particular, excessive fiber intake could be detrimental for calcium, zinc, and iron balance. However, a fiber intake of 30 to 40 g/day when accompanied by an adequate intake of minerals, and water, appears to have no detrimental effects--only possible benefits! [11,18,37,42].

Here is a sample daily diet plan for dietary fiber intake. This should be spread out throughout the day. I.e. 6 meals [42]:

- 1-2 servings of Fiber-rich legumes.
- 5 servings of fruits and or vegetables (total) per day.
- 2 to 3 of whole grains per day.

Fiber supplements most likely would not hold the same benefits as from natural sources. Due to the fact that they lack much nutritional value. As such, it would behoove you to consume natural sources of fiber in great varieties of cereals, legumes, fruits, and vegetables so that the benefits of dietary fibers are maximized [3,10,11].

Quick Fiber calculation method

There are many charts available, which will give you accurate calculations for fiber content. But today, I would like to present a fascinating experiment that will permit you immediate addition of dietary fiber, with high accuracy. With this knowledge, no matter where you are, or what technology may be at hand, you will be able to add up fiber ratios fairly accurately. Proceed for the answer how.

Marlet JA, et al, proposed this very quick method of obtaining fiber amounts. In an experiment, the data for 342 foods were condensed to 228 foods by combining similar foods. The comprehensive database developed includes pectin, hemicelluloses, and beta-glucan contents of the soluble and insoluble fractions of fiber and the cellulose and Klason lignin contents of the insoluble fiber. Three fourths of the 228 foods contained 2.0 g fiber per serving or less; only 10% contained more than 3.0 g per serving. The quick method consists of multiplying the number of servings in each food group by the mean total dietary fiber content of foods in that group: 1.5 g for fruits (n = 43), 1.5 g for vegetables (n = 68), 1.0 g for refined grains (n = 80), and 2.5 g for whole grains (n = 13). Actual fiber values from the database should be used in the quick method if foodstuffs concentrated from grains, legumes, and nuts and seeds are consumed. The values calculated from this quick method were within 10% of the results obtained by looking up each individual fiber components in foods [29].

Conclusion

This article is only a fraction of the sure design, and ingenuity you will encounter as you venture further into your studies of the sciences. Sir Fred Hoyle, a well respected scientists in the field of human origins states [45].

> “It is therefore almost inevitable that our own measure of intelligence must reflect ... higher intelligences ... even to the limit of God ... such a theory is so obvious that one wonders why it is not widely accepted as being self-evident.”

I wholly agree my friend. I believe the psalmist summed this up best [46]; 14 *I will praise thee; for I am fearfully and wonderfully made: marvellous are thy works; and that my soul knoweth right well. Psalms 139:14*

Keep it Hardcore

Venom

Venom@abcbodybuilding.com

References:

1. Ad Hoc Expert Panel on Dietary Fiber, Federation of American Societies for Experimental Biology. Physiologic and health consequences of dietary fiber. Rockville,MD:FASEB,1987.
2. Aldoori W; Giovannucci E, Rockett H, Sampson L, Rimm E, Willett w: A prospective study of dietary fiber types and symptomatic diverticular disease in men. J Nutr 1998;128:714-9.
3. American Dietetic Association. Position of the American Dietetic Association: health implications of dietary fiber. J Am Diet Assoc. 1997;97:1157-9.
4. Anderson JW; Jones AE, Riddell-Mason S. Ten different dietary fibers have significantly different effects on serum and liver lipids of cholesterol-fed rats. J Nutr 1994;124:78-83.
5. Anderson JW. Whole grains protect against atherosclerotic cardiovascular disease. Proc Nutr Soc. 2003 Feb;62
6. Anderson. W; Bryant CA. Dietary fiber: diabetes and obesity. Am J GastroenteroI1986;81:898-906.
7. Asp NG, Johansson CG. Dietary fiber analysis. Nutr Abstr Rev 1984;54:736-52.
8. Ausman LM. Fiber and colon cancer: does the current evidence justify a preventive policy? Nutr Rev 1993; 51:57-63.
9. Beeebe CA, Pastors JG, Powers MA, Wylie-Rosett J. Nutrition management for individuals with noninsu1independent diabetes mellitus in the 1990s: a review by the Diabetes Care and Education dietetic practice group. J Am Diet Assoc 1991;91:196-202,205- 7.
10. Bingham S. Definitions and intakes of dietary fiber. Am J Clin Nutr 1987;45:1226-31.
11. Butrum RR, Clifford CK, Lanza E. NCI dietary guidelines: rationale. Am J Clin Nutr 1988; 48:888-95.
12. Diabetes Care and Education Practice Group, the American Diabetes Association. Nutritional recommendations and principles for individuals with diabetes mellitus. J Am Diet Assoc1994; 4:504-6.
13. Eastwood MA, Passmore R. A new look at dietary fiber. Nutr Today 1984;19:6-11.
14. E. Raybould and Y. Tache Cholecystokinin inhibits gastric motility and emptying via a capsaicin-sensitive vagal pathway in rats
15. Floch MH, Maryniuk MD, Bryant C, Franz MJ, Tietyen-Clark J, Marrota RB, Wolever T, Maillet J0, Jenkins At. Practical aspects of implementing increased dietary fiber intake. Nutr Today 1986;21:27-30.
16. Gorbach SL. Lactic acid bacteria and human health. Ann Med 1990;22:37-41.

17. Harris PJ, Ferguson LR. Dietary fibre: its composition and role in protection against colorectal cancer. Mut Res 1993;290:97-110.
18. Heaton Kw: Dietary fibre in perspective. Hum Nutr Clin Nutr 1983:37C:151-70.
19. Harris PJ, Roberton AM, Watson ME, Triggs CM, Ferguson LR. The effects of soluble fiber polysaccharides on the adsorption of a hydrophobic carcinogen to an insoluble dietary fiber. Nutr Cancer 1993; 19:43-54.
20. Hill MJ. Bile acids and colorectal cancer. Eur J Canc Prevent 1991;1:69- 72.
21. Howe GR, Benito E, Castelleto R, Cornee J, Esteve J, Gallagher RP, Iscovich JM, Deng-ao J, Kaaks R, Kune GA et al. Dietary intake of fiber and decreased risk of cancers of the colon and rectum: evidence from the combined analysis of 13 case-controlled studies.J Natl cancer Inst 1992;84:1887-96.
22. Ink SL, Hurt HO. Nutritional implications of gums. Food Tech 1987;41:77-82.
23. Jenkins DJA, Jenkins At, Rao AV; et al. Cancer risk: possible role of high carbohydrate, high fiber diets. Am J Gastroenterol1986;81 :931-5.
24. Jenkins D, Jenkins At, Wolever TMS, Rao AV; Thompson ill. Fiber and starchy foods: gut function and implications in disease. Am J Gastroenterol 1986;81 :920-30.
25. Juntunen KS et al High-fiber rye bread and insulin secretion and sensitivity in healthy postmenopausal women. Am J Clin Nutr. 2003 Feb;77(2):385-91.
26. Kritchevsky D. Dietary fiber. Ann Rev Nutr 1988;8:301-28.
27. Lupton JR, Kurtz PP. Relationship of colonic luminal short chain fatty acids and pH to in vivo cell proliferation in rats. J Nutr 1993;123:1522-30.
28. Malara A et al. Effects of alpha- and beta-adrenergic stimulation on free magnesium concentrations in platelets from healthy and obese individuals.
29. Marlett JA, Cheung Tl': Database and quick methods of assessing typical dietary fiber intakes using 228 commonly consumed foods. J Am Diet Assoc 1997;97:1139-48,1151.
30. M. Camilleri, L. J. Colemont, S. F. Phillips, M. L. Brown, G. M. Thomforde, N. Chapman, and A. R. Zinsmeister Human gastric emptying and colonic filling of solids characterized by a new method Am J Physiol Gastrointest Liver Physiol 257: G284-G290, 1989.
31. McKeown NM et al. Whole-grain intake is favorably associated with metabolic risk factors for type 2 diabetes and cardiovascular disease in the Framingham Offspring Study. Am J Clin Nutr. 2002 Aug;76(2):390-8.
32. McNeil N1. The contribution of the large intestine to energy supplies in man. Am J Clin Nutr 1984;39: 338-42.
33. Oral Magnesium Supplementation Improves Insulin Sensitivity and Metabolic Control in Type 2 Diabetic Subjects: A randomized double-blind controlled trial. Diabetes Care. 2003 Apr;26(4):1147-52.
34. Potter JD. Colon cancer-do the nutritional epidemiology, the gut physiology and the molecular biology tell the same story? Nutr 1993;123:418-23.
35. Rodriguez-Moran M, Guerrero-Romero F. Dietary fiber and type 2 diabetes. Clin Excell Nurse Pract. 2000 Sep;4(5):272-6. Review.
36. Russell and P. Bass Canine gastric emptying of fiber meals: influence of meal viscosity and antroduodenal motility Am J Physiol Gastrointest Liver Physiol 249: G662-G667, 1985.
37. Southgate DAT. Minerals, trace elements, and potential hazards. Am J Clin Nutr 1987;45:1256-66.

38. Trock B, Lanza E, Greenwald Po Dietary fiber, vegetables, and colon cancer: critical review and meta-analyses of the epidemiologic evidence. J Natl Cancer Inst 1990;82:650-61.
39. Tomlin T, Read NW Comparison of effects on colonic function caused by feeding rice bran and wheat bran. Eur J Clin Nutr 1988;42:857-61.
40. Klurfeld DM, Dietary fiber-mediated mechanisms in carcinogenesis. Cancer Res (suppl) 1992;52:2055s-9s.
41. Trowell HC, Southgate DAT, Wolever TMS, et al. Dietary fiber redefined. Lancet 1976; 1 :967.
42. U.S. Dept. of Agriculture. The Food Guide pyramid. Washington, DC: Home and Garden Bulletin Number 252,1992.
43. Van Munster IF, Nagengast FM. The influence of dietary fiber on bile acid metabolism. Eur J Cancer Prevent 1991;1:35-44.
44. Zargar AH, Bashir MI. Copper, zinc and magnesium levels in type-1 diabetes mellitus. Saudi Med J. 2002 May;23(5):539-42
45. *St. Louis MetroVoice.* AinswersinGenesis.com: The Origin of Life
46. God, The Holy Bible