

Research Article

Research on the Facilitation of Dietary Fiber to Body Digestive Function

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Abstract: This study explores the facilitation of dietary fiber to body intestinal canal digestive function; Make analyses to the efficacy of different dietary fibers to digestive system and study their mechanism of action. The research shows that dietary fiber can promote the proliferation of beneficial bacterium and can restrain the production of harmful bacterium. Through the research on intrinsic factor intestinal flora and extrinsic factor dietary fiber which have an influence on body metabolism, it discussed and analyzed the interaction relation between the intake of dietary fiber and the variety and quantity of intestinal flora. Dietary fiber can facilitate body digestive function.

Keywords: Dietary fiber, digestive function, intestinal microflora

INTRODUCTION

Dietary fiber is indispensable for healthy eating and it plays an important role in keeping the digestive system health. Besides, by getting enough fiber can also prevent cardiovascular disease, cancer, diabetes and other diseases. Fiber can clean digestive wall and enhance digestive functions, at the same time, fiber can dilute and accelerate the removing speed of carcinogenic substances and toxic substances in food, so as to protect the fragile digestive tract and prevent colon cancer (Peilong *et al.*, 2013). Fiber can also slow down the digestion rate and excrete the cholesterol as quickly as possible, so that it can control the blood sugar and cholesterol in the blood stream at the ideal level.

Dietary fiber or roughage is the indigestible portion of food derived from plants. The consumption of foods high in fiber has been found to reduce appetite (Rebello *et al.*, 2013). It has two main components.

Soluble fiber, which dissolves in water, is readily fermented in the colon into gases and physiologically active byproducts and can be prebiotic and viscous.

Insoluble fiber, which does not dissolve in water, is metabolically inert and provides bulking, or it can be prebiotic and metabolically ferment in the large intestine. Bulking fibers absorb water as they move through the digestive system, easing defecation.

Dietary fibers can act by changing the nature of the contents of the gastrointestinal tract and by changing how other nutrients and chemicals are absorbed (Eastwood and Kritchevsky, 2005). Some types of soluble fiber absorb water to become a gelatinous, viscous substance which is fermented by bacteria in the digestive tract. Some types of insoluble fiber have

bulking action and are not fermented (Anderson *et al.*, 2009). Lignin, a major dietary insoluble fiber source, may alter the rate and metabolism of soluble fibers. Other types of insoluble fiber, notably resistant starch, are fully fermented (Nugent, 2005).

Chemically, dietary fiber consists of non-starch polysaccharides such as arabinoxylans, cellulose and many other plant components such as resistant starch, resistant dextrins, inulin, lignin, waxes, chitins, pectins, beta-glucans and oligosaccharides. A novel position has been adopted by the US Department of Agriculture to include functional fibers as isolated fiber sources that may be included in the diet. The term "fiber" is something of a misnomer, since many types of so-called dietary fiber are not actually fibrous (Chuang *et al.*, 2012).

Food sources of dietary fiber are often divided according to whether they provide (predominantly) soluble or insoluble fiber. Plant foods contain both types of fiber in varying degrees, according to the plant's characteristics. Advantages of consuming fiber are the production of healthful compounds during the fermentation of soluble fiber and insoluble fiber's ability (via its passive hygroscopic properties) to increase bulk, soften stool and shorten transit time through the intestinal tract. A disadvantage of a diet high in fiber is the potential for significant intestinal gas production and bloating. Constipation can occur if insufficient fluid is consumed with a high-fiber diet (Beysseriat *et al.*, 2006).

Dietary fiber mainly contains polysaccharide which is incapable of being utilized by body, namely the polysaccharide that both cannot be digested by enzymes in the gastrointestinal tract of body and absorbed by

Table 1: The classification and function of plants dietary fiber

Classification		Food within dietary fiber	Function
Water-soluble dietary fiber	Adhesive substance of plants	Mannan, FOS, SBOS	Provide energy, with low calorific value, proliferate beneficial bacteria in intestinal canal
	Algae	Undaria pinnatifida, laminaria japonica, porphyra, agar, etc.	Provide minerals and vitamins, etc.
	Pectin	Apple, orange, sweet persimmon, the root vegetables	Inorganic substances of Vc and Ca, etc.
	Synthesized polysaccharide	Polysaccharide, hydroxymethyl fiber	Carbon source substances
Non-water-soluble dietary fiber	Lignin	Cereal, grains	Vegetable protein, starch, Vc, mineral substance ion, etc.
	Hemicellulose	Beans	Vegetable fat, vitamin A, Vc, etc.
	Cellulose	Vegetables with more leaf veins (Chinese cabbage, spinach, etc.)	Mineral substance ion, B vitamins, Vc, etc.

Table 2: The classification and function of animal dietary fiber

Classification	Functional components	Function
Crustacea	Chitosan	Reduce the cholesterol in the blood; make cell activation and enhance the generation of antibody; promote metabolism and digestive absorption; promote the proliferation of bifidobacterium.
Mollusc	Deacetylation chitosan	Increase calcium by forming chelate; anticancer: the main ingredient of chitosan and deacetylation chitosan is N-acetyl chitosan, which has immune activation function and can restrain the proliferation of cancer cell; eliminate the specificity of food.

body. This kind of polysaccharide is mainly from the complex carbohydrates on plant cell walls, which can also be called non-starch polysaccharides, namely the polysaccharide of non-alpha-glucan.

This study makes a further study and elaboration on the facilitation of dietary fiber to intestinal digestive function.

MATERIALS AND METHODS

Classification of dietary fiber: Dietary fiber refers to animal polysaccharide substance and adhesive substance within lignin, cellulose and plants among the intake food of body, which can be absorbed and decomposed by digestive enzymes. Dietary fiber can be divided into plants dietary fiber and animal dietary fiber in accordance with their sources. The dietary fiber people take in daily life is mainly from plants, including algae, beans, various vegetables and fruits, etc. It can be divided into coarse fiber and pectin fiber according to structure. Among them, crude fiber refers to dietary fiber that does not dissolve in water, including cellulose, hemicelluloses and lignin, etc.; the other kind is pectin fiber which is soluble in water, such as the pectin of fruits, vegetables, etc., as shown in Table 1.

Dietary fiber not only includes plants fiber, but also includes animal fiber, such as chitin in the exoskeleton ingredient of crustaceans shrimp and crab, chitosan and deacetylation chitosan among skeleton ingredients of cartilage animals crustaceans and cuttlefish. They play an important role in human metabolism (Table 2).

The effects of dietary fiber on intestinal function: Dietary fiber plays an important role in maintaining the

normal function of intestinal canal. By adding fiber in liquid can make the intestinal function of patients receiving enteral nutrition maintain normal and increase the tolerance to enteral nutrition. Many effects of fiber on intestinal canal are related with the degree it is degraded by bacteria in colon. Compared with insoluble fiber, soluble fiber is easier to the glycolysis of colonic flora, but the latter has high viscosity, so it is seldom applied in enteral nutrition. Soybean fiber is easy to be made as finished product, so it is the fiber source that is most commonly used in enteral nutrition. The water solubility of pectin and guar gum is extremely strong, but it is easy to form gel, so it is not suitable for tube feed nutrition. The effect of fiber in increasing the volume of faeces in colon is related with the water solubility of dietary fiber and the amount of bacteria it increases after fermentation. Fiber with excellent water-solubility can lose ability of maintaining water as the result of the rapid glycolysis, so it makes less influence on the passage time and faeces weight in colon. The increase of flow velocity of feeding can accelerate the transfer in intestinal canal, while, the speed of transfer in intestinal canal can slow down when it is influenced by the inhibitory feedback triggered by nutrient, therefore, during enteral nutrition, the transfer speed in intestinal canal is likely to rely on the balance between the acceleration effect of the flow velocity of feeding and the inhibiting effect borne by nutrition (Zebeli *et al.*, 2012), but by adding fiber in diet can change such balance. Research has shown that the intestinal transfer of patients with low-residue diet can be accelerated by improving the flow velocity of feeding, on the contrary, the intestinal transfer of patients with fiber supplement is inhibited obviously.

In addition, the intake of high dietary fiber can obviously improve the dysfunction of intestinal canal. Research has shown that high fiber diet group can decrease the occurrence of spastic pain, constipation and hemorrhoids when compared with the matched group, which is related with that the dietary fiber accelerates the intestinal canal transfer, the pressure in enteric cavity is reduced, the number of intestinal peristalsis increases and the softening of feces. But, flatulence is a common problem; the application of some enzymes can help to solve this problem.

RESULTS AND DISCUSSION

Experimental research shows that excessive intake of animal protein can increase the loss of body calcium, while, excessive intake of carbohydrate source substance can cause obesity, hyperlipidemia, atherosclerosis, constipation, diabetes and other diseases as the result of excess nutrition. The intake of dietary fiber not only can replenish the nutrient substance of body, but also can prevent the occurrence of the above diseases. Thus, the function of dietary fiber for the regulation of body metabolic is diversity; the specific functions are as follows.

Nutrition: Proteins, carbohydrates and fats are all high-calorie substances, so it will increase the burden of human organs in different degrees and even lead to disease if taken for a long time. Dietary fiber not only can supplement the energy needed by human body, but also can avoid the negative effects caused by having substances with high protein and high sugar. The quantity of heat of 500 g vegetables is about 376.81 kJ, which is equivalent to that of 50 g protein or 9.67 g fat. According to the survey, the dietary fiber content of pastry and grain processed products people have in daily life is as high as about 18.1%, but the dietary fiber content in food marked with dietary fiber addition can be as much as 60%. Furthermore, the vitamins and mineral ions in dietary fiber also can adjust intestinal flora, ameliorate the gastrointestinal micro-ecological environment and promote the normal running of metabolism.

Disease prevention and health care: As the essential nutrients needed by body, seaweed, fibrous vegetables, soy products, etc. contain vitamins and calcium, iron, zinc, potassium, manganese, copper and other mineral ions. The intake of them can add body's absorption of vitamin A, vitamin B1 and vitamin C, supplement the nutrition needed by human body for metabolism, regulate the function of human body and activate

immunologic function, prevent the occurrence of colon cancer and other diseases. The intake of all kinds of food fiber can increase the body's absorption to vitamin E, reduce the content of sugar blood fat and cholesterol and regulate the vitality of body metabolism. It not only can lower blood pressure, reduce the occurrence of atherosclerosis and coronary heart disease, but also can exert the function of losing weight. As for animal dietary fiber, such as crustaceans (shrimp, crab shell, exoskeleton of insect, etc.) and the endoskeleton of mollusc (cuttlefish, etc.), the main composition of them is chitosan and they having various functions.

CONCLUSION

Dietary fiber is generally the nutrients of food that is not easy to be digested and it is mainly from the cell walls of plants, including cellulose, hemicellulose, resin, pectin and lignin, etc. Dietary fiber plays an important role in aspect of maintaining the health of digestive system. Fiber can clean digestion wall and enhance digestion function, as well as dilute and accelerate the elimination of carcinogenic substances and toxic substance in food, so as to protect the fragile digestive tract and prevent colon cancer. In addition, the fiber can slow down the digestive rate and accelerate the excretion of cholesterol, so as to control the blood sugar and cholesterol in the blood stream at the ideal level.

Water soluble fiber slow down the digestive rate and accelerate the excretion of cholesterol, so it can control the blood sugar and cholesterol in the blood stream at the ideal level. Besides, it can also help diabetics reduce insulin and triglyceride.

Water-insoluble fibers include cellulose, lignin and some hemicelluloses, as well as wheat bran corn bran, celery, pericarp and root vegetables from food. Water-insoluble fibers can reduce the risk of suffering from intestinal cancer, at the same time; it can prevent constipation and diverticulitis by absorbing toxic substances in food and reduce toxins exhausted by bacteria in the digestive tract.

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