The Effects of Dietary Fiber on Intestinal Flora

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Abstract. Once, dietary fiber was considered as a "non-nutritive substance". It is a non-starch polysaccharide, which cannot be decomposed by enzymes in the digestive tract of the human body, so it cannot be absorbed by the human body. The intestinal flora is the normal microorganism in the human intestine. Several studies point to a vital role for gut microbiota (GM) in preventing disease and reducing inflammation in humans. Gut microbiota has an important relationship with the human brain-gut axis, and the biological metabolites they produce are closely linked to the function of nervous system. It has been found that dietary fiber has great influence on intestinal flora. Improper dietary fiber intake may even cause various diseases. Food contains a lot of dietary fiber, which can help us regulate the number of intestinal flora. Once, people got dietary fiber from medicine. Studies have shown that some fruits, vegetables and cereals also contain a large number of different types of fiber. People can adjust the proportion of bacteria in the body by changing their diet.

Keywords: Dietary Fiber; Intestinal Flora; Health Diet; Nutrition.

1. Introduction

People once thought that dietary fiber was a "nonnutritive substance", so dietary fiber was not valued by people. However, with the change of time, nutrition and related science have made great progress. Scientists have found that dietary fiber plays an extremely important role in physiology [1]. Therefore, with the increasingly refined dietary components, dietary fiber has become a concern of the academic community and the public, and has been identified as the seventh type of nutrients by the nutrition community, which is different from the traditional six nutrients - protein, fat, carbohydrate, vitamins, minerals and water. The intestinal flora is a bacterial group that is designated to be planted in the human gut and has long-term interdependence with the human body, including more than 40 genera, 400 to 500 species, 10 times that of human cells. Based on the impact of dietary fiber on the intestinal flora, this paper focuses on describing the diseases that this impact may bring to humans, and how to control the amount of dietary fiber in humans by diet. This article summarized what is dietary fiber and intestinal flora, what are the effects that an unbalanced flora ratio will bring, and how can people change these problems by eating high fiber level foods.

2. Dietary Fiber and Intestinal Flora

2.1. Dietary Fiber

Dietary fiber is a non-starch polysaccharide, which cannot be decomposed by enzymes in the human digestive tract, so it cannot be absorbed by the human body. People need to take enough fiber each day. Research shows that the demand for dietary fiber varies with gender and age. The study shows that men over 50 years old should consume 30 grams of fiber per day, men under 50 years old should consume 38 grams of fiber per day, while women over 50 years old should preferably consume 21 grams of fiber per day, and women under 50 years old should consume 25 grams of fiber per day [1]. Different dietary fibers are divided into two categories according to whether they can be dissolved in water. One is soluble dietary fiber, and the other is insoluble dietary fiber.

2.1.1 Soluble Fiber

Soluble fiber, as its name, it includes every kinds of fiber that can be dissolved in water. Once soluble fiber is dissolved in water, it will become a gel like substance, which can help digestion, affect

the absorption of human nutrition and regulate defecation [2]. Soluble fiber has many benefit if people englobe appropriate amount of dietary fiber. For example, soluble fibers are considered to be prebiotic. This means that they are easy to be broken down by bacteria in the colon. Soluble fiber can accelerate the growth of beneficial bacteria in human intestine, and promote the fermentation of beneficial bacteria, playing a variety of roles in promoting health. This is a very health-promoting process [3].

2.1.2 Insoluble Fiber

Insoluble fiber cannot be solved in water. Insoluble fiber can control body weight by resisting hunger, and insoluble fiber can make defecation more regular [4].

2.2. Intestinal Flora

Those kinds of fiber all relate to intestinal flora. Intestinal flora is a normal microorganism in human intestines, such as bifid bacterium, Lactobacillus, etc. The gut microbiota has multiple functions, including developing the immune system, producing vitamins, maintaining intestinal cells, and neutralizing toxins, drugs, and pathogens [5]. The intestinal flora of human body can be divided into two categories: predominant microflora and sub—dominant microflora. The predominant microflora generally refers to the flora with large quantity or density, it is usually above 10cfu/g, like Bacteroides, Eubacterium, Bifid bacterium. The sub—dominant microflora's quantity is less than 10cfu/g, mainly aerobic bacteria or facultative anaerobic bacteria, such as Escherichia coli and Streptococcus. Up to 99% of the microorganisms in the intestinal flora are bacteria, which can be divided into three categories: the Commensal microflora, the Mutualistic microflora, and the Opportunistic microflora [6]. Microorganisms on the body surface covered by epithelial cells and in contact with the external environment constitute the symbiotic microbial zone [7]. The commensal microflora benefits from the host as well as the host. Opportunistic microflora generally live as symbionts in the host, but once they get the chance, they can cause disease. The normal flora of the gastrointestinal tract if their habitat changes. For example, E. coli can cause urinary tract infection (UTI).

3. Effects of Dietary Fiber

Dietary fiber is known as "the seventh largest nutrient in the human body". Long-term high dietary fiber diet can increase the proportion of beneficial intestinal microorganisms, increase the richness and biodiversity of intestinal microorganisms, and thus prevent obesity. Dietary fiber can delay digestion and reduce intestinal absorption, improve blood glucose, And play an important role in preventing obesity (Fig 1). Dietary fiber can also bring some negative effects. Dietary fiber can lead to serious imbalance of intestinal flora and lead to chronic liver disease. Dietary fiber can reduce the content of proinflammatory factors in serum and increase interferon γ And interleukin-10 levels [8].

Improper intake of insoluble fiber can also lead to constipation. Research shows that high fiber load and dietary fiber deficiency are associated with fecal weight and defecation frequency. A study investigated the incidence of constipation among elderly people in nursing homes. The results show that 70% of the elderly suffer from severe constipation. About 7% of the elderly will have fecal impaction during the examination [8]. In order to solve the constipation problem of elderly residents in Essex County, New Jersey, the elderly center began to add bran to their hot breakfast cereal. The agency found that laxatives were no longer needed, and the agency's pharmacy reported that the county had saved $44000 on laxatives. The formula includes fiber rich liquid for tube feeding, hot cereal with added bran and special fiber plum juice supplement [9]. Constipation is a very serious problem. If not strictly prevented, it may bring other more serious diseases to humans, such as intestinal perforation, intestinal obstruction, rectal exfoliation or rectal ulcer. Therefore, people must pay attention to the intake of dietary fiber. There are differences in the ability of different bifid bacterium species to utilize dietary fiber. At the same time, the proliferation of bifid bacteria will have different changes due to different properties and structures of dietary fiber. The benefits of Bifid

bacterium and dietary fiber used together will be affected by the antagonism or synergy between them in promoting intestinal health [10].

Dietary fiber can not only prevent disease, but also help people control their weight. Dietary fiber can absorb water and expand well, and they can increase the sense of satiety. It plays a very strong role in reducing the intake of other excessive food, so it has a good weight loss effect.

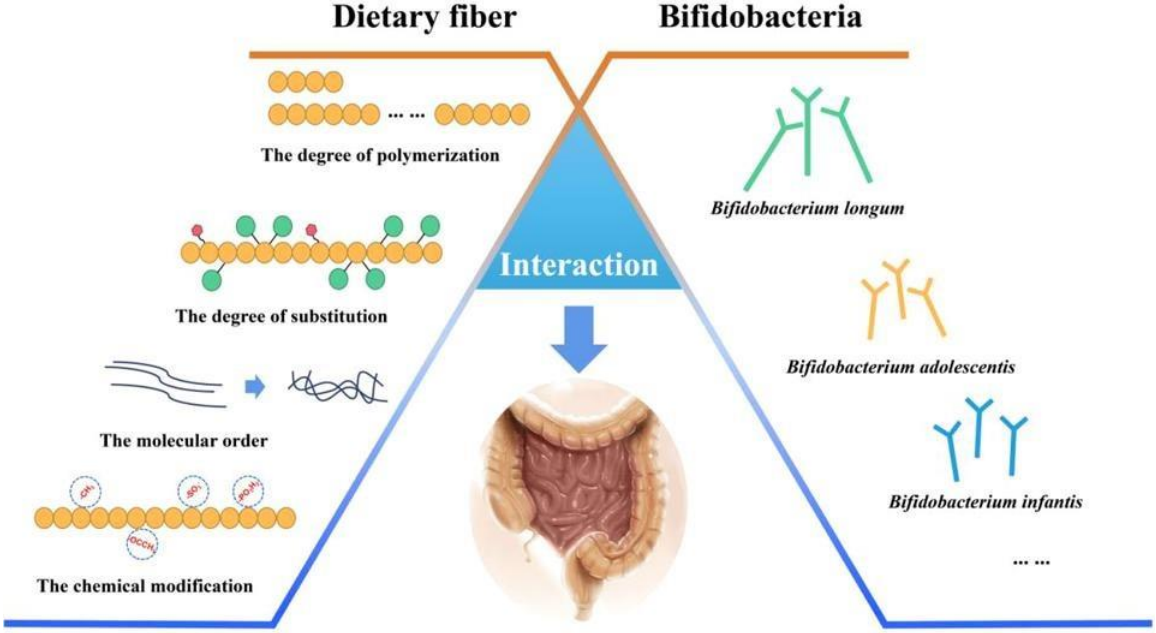


Fig.1 Interactions between dietary fiber and gut microbes [10]

4. Foods and Dietary Fiber

People can use daily diet to control the amount of dietary fiber, thus affecting the intestinal. The fiber moves easily and quickly in the digestive tract, which is helpful for the normal operation of the digestive tract. A high fiber level diet can help reduce the danger of diabetes, obesity and heart disease. People get fiber from plant foods – whole grains, nuts, vegetables, beans, fruits, and legumes. These are flora fiber-rich diet including foods [1]. However, if people cannot get enough fiber from their diet, they can take fiber supplements as a substitute, like calcium polycarbophil, methylcellulose, psyllium, and wheat dextrin. If people slowly increase their fiber intake, they can effectively prevent gas and cramps.

Here are some kinds of foods that are very familiar in people's daily life.

First, coarse grains —— sweet potato, potato, corn, oats, quinoa, etc., are riche in dietary fiber. Take rice as an example: There is a substance called DFs in rice bran and wheat bran. This substance stimulates the production of mucus associated bacteria through metabolites to enhance the intestinal barrier and regulate the immune system. In addition, they can promote the production of a bacterium called sacs and regulate the number of specific bacteria to maintain host health. Therefore, people began to eat a diet rich in whole grains, which is considered as a biological therapeutic strategy capable of maintaining human health [11].

Secondly, fruits like apples, pears, bananas, peaches, are also rich in dietary fiber. The contents of vitamins and trace elements are also high, and the sugar content is high. This kind of food tastes sweet and can provide a variety of nutritional elements for the human body. People with high blood sugar are not recommended to eat more.

Finally, vegetables are also very rich in dietary fiber. For example, celery, Chinese cabbage, rape and Chinese cabbage, and a variety of nutrients, which can promote health.

5. Conclusion

In short, the intestinal flora is an indispensable part of the human body and an important part of maintaining the normal operation of the human intestinal tract. When it comes to intestinal flora, we have to mention dietary fiber. As a dietary modification therapy, dietary fiber can affect the abundance of gut microbiota and increase some beneficial microorganisms that can produce SCFAs. Maintaining gut microbial homeostasis and controlling the concentration of positive metabolites such as short-chain fatty acids in the gut is the direction of future research on the prevention and treatment of specific diseases. Dietary fiber has attracted much attention as an effective means to control the proportion of intestinal flora. Today, healthy eating is promoted for various purposes. By consuming fiber-rich foods such as wheat, potatoes and peaches, one can effectively control the ratio of bacteria in the body, thereby reducing disease and the need for medicinal fiber supplements.

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