Study on Functional Components of Functional Food Based on Food Vitamins

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Abstract. The research and development of functional food ingredients of food vitamins are gradually moving towards serialization, nutrition, functionalization and standardization, and more and more high-tech applications in this area. In addition to rich basic nutrients (i.e. proteins, fats, sugars, vitamins and minerals), food also contains a wide range of bioactive substances, such as polyphenol compounds, organic sulfur compounds, phytoestrogen terpenoids, etc. At present, the research on functional ingredients of these food sources has become a hot research field in the international academic circle. This paper discusses the meaning of functional foods and their functional ingredients, and expounds the synthesis and extraction of vitamin E. At the same time, the function of compound food fiber in functional food was introduced.

1. Introduction
With the improvement of people's health awareness, the need to obtain health care functions from food has become more urgent. The research on functional ingredients in food is not only limited to phytochemicals, but also the revelation of new effects of traditional nutritional ingredients is continuously carried out. With the gradual deepening of research [1]. In addition, in order to bring nutrition, safety and convenience to consumers, many functional foods have been introduced in the market at present, which are divided into three categories: low-functional foods, i.e. people do not need too much intake of the ingredients contained in them, such as low calorie, low fat, low sodium, low carbohydrate, low sugar, etc.; Vitamin C is a kind of water-soluble vitamin most needed by human body. Due to its complex and important physiological functions, in recent years, various countries attach great importance to the nutrition and health care of Vitamin C. In our country, Vitamin C food and vitamin functional foods emerge in endlessly [2]. Therefore, functional foods with the functions of regulating human body, preventing diseases and promoting rehabilitation have attracted much attention, and the understanding of the efficacy of functional food compounds has become a hot spot in the research and development of functional foods.

2. Definition of Functional Foods and Functional Ingredients of Functional Foods

2.1. Functional food
One is a functional food that contains nutritional elements beyond ordinary food and can provide health effects, or a processed food that can be labeled with health function. Maintaining the effective
and stable situation of the physiologically active ingredients in food, or directly treating the physiologically active ingredients into functional food, is called the third generation functional food [3]. Another important criterion is that functional food is not different from ordinary food in appearance and taste, and the sales channel is not a pharmacy but a supermarket, which is a product that can be purchased just like ordinary food. Can provide additional energy, and can delay fatigue or accelerate the elimination of fatigue; Shorten brain response time and improve decision-making ability.

2.2. Functional ingredients of functional foods
For the functional ingredients of functional foods, it is simply "refers to the functional ingredients in functional foods", refers to the "substances capable of regulating human body function through activating enzyme activity or other means" in food vitamin functional foods. Food vitamin functional foods shall generally contain functional ingredients corresponding to functions, and ensure the minimum effective content of functional ingredients, and control the maximum limit of effective ingredients when necessary. Its characteristics have the legal characteristics of food, including sensory characteristics, nutritional characteristics and safety characteristics, and have undergone necessary animal or human functional experiments. In addition, the effective components and contents and applicable objects should be very clear, with strict definition procedures, etc. Consumers have begun to get used to choosing specific functional foods according to their own health conditions. Therefore, it is very important to understand the main functional ingredients contained in functional foods and their functions.

3. Compounds in Functional Foods

3.1. Food fiber
Dietary fiber is also called edible fiber, which refers to the general name of polysaccharides and carbohydrates that cannot be digested by human body, including cellulose, hemicellulose, pectin, lignin, etc. Dietary fiber has a strong water absorption capacity, which can significantly increase the volume of feces in intestinal tract, soften feces, and promote its elimination. Whether stool is unobstructed is one of the important signs of human health [4]. For example, the accumulation of some metabolic lactic acid and proteolytic substances in the activity process cannot be eliminated in time, which affects the normal metabolism in the body and causes the decline of exercise ability. Internal environment disorder, such as imbalance of acid-base balance, ion distribution, osmotic pressure balance, water balance, etc. The packaged food containing Vitamin C will also lose and decrease Vitamin C during the shelf life of 6 months to 1 year. Therefore, as a processed food containing natural Vitamin C, Vitamin C must be supplemented to maintain its original Vitamin C content. Dietary fiber can promote the normal metabolism of blood lipid and lipoprotein. It can also be combined with bile acid and cholesterol to reduce the absorption level of lipid, thus reducing the concentration of blood lipid and blood fullness, keeping blood vessels unblocked, preventing or slowing down arteriosclerosis and the incidence of cardiovascular and cerebrovascular diseases [5].

3.2. Carotenoid
Carotenoids are the general name of two kinds of pigments, namely, hydrocarbon carotene and lutein, derivatives of other classes. They belong to four kinds of mushroom compounds. They are red, orange and yellow pigments found in plants and seaweeds. They are also secondary metabolites of most plants and some microorganisms. Vitamin C not only has the function of treating scurvy, but also can help hematopoiesis, promote wound healing, enhance body immunity, detoxify, etc. The content of Vitamin C is about half higher than that of Chinese cabbage. Cabbage is rich in folic acid, which is an advantage of cabbage vegetables. Therefore, pregnant women and anemic patients should eat more cabbage. It is also an important beauty product. Recent studies have shown that carotenoids can not only be widely used as important natural pigments in food, medicine, cosmetics and feed, but also play an anti-oxidation role and scavenge free radicals in the body. Most carotenoids, mono-carotene and
lycopene are effective antioxidants, which can quench O2 and capture peroxy radicals to play an antioxidative role.

3.3. Fructooligosaccharide
Fructooligosaccharides, also known as fructooligosaccharides or sucralose oligosaccharides, are sucrose and 1-3 fructosyl groups combined with fructose in sucrose via β-2-1 bond to form sucralose, sucralose tetraose and sucralose pentose. Wheat, barley, rye, garlic, onion, leek, artichoke and banana are all excellent sources of fructooligosaccharides. The higher the content of lycopene in human plasma, the lower the incidence of various cancers and coronary heart disease. Tomato can greatly reduce the incidence of pancreatic cancer and other cancers, and it is also the best source of Vitamin C. For example, Lycium barbarum polysaccharide can improve the immune function of patients with malignant tumor undergoing radiotherapy, and is a protective agent for preventing ionizing radiation from damaging the immune function of the body [6]; it can regulate immune function, affect endocrine system, improve taste and stimulate appetite. Promoting normal metabolism and visual function of vitamin A is helpful to improve night vision function. For the improvement of intestinal bacteria system, fructo-oligosaccharide is the proliferation factor of bifid bacterium, a useful intestinal bacterium. The existence of bifid bacterium can enhance the immunity of human body, and has the functions of preventing diseases, resisting diseases, preventing aging, improving constipation, etc. It can improve lipid and applicability to diabetic patients. It is better for children to eat one or two fresh tomatoes or supplement tomato products such as tomato juice every day. For patients with cardiovascular diseases such as hypertension or heart disease, it is better to eat tomato juice or tomato products without salt or salt.

3.4. Flavonoid
Bioflavonoids, also known as vitamin P, are commonly associated with Vitamin C and widely distributed in nature. They belong to secondary metabolites of plants and widely exist in yellow-green vegetables, fruits, flowers, beans and other plants. Dust and impurities remaining in the human digestive system can be absorbed centrally and then discharged out of the body, thus playing the role of expelling toxin and clearing stomach. Vitamin C is the main substance of collagen and an important component of connective tissue of cell protective layer, but calcium is also indispensable. Like pectin, calcium can make the connective tissue of Vitamin C strong and elastic. It has anti-cancer and anticancer effects by resisting oxidation and scavenging oxygen free radicals, can treat hypertension, diabetes and its complications by reducing blood sugar, blood fat and urine sugar, can also enhance the body's immune system function to play a role in liver protection, and can also treat abscess ulcer by its anti-inflammatory, anti-allergy and anti-virus effects. In terms of cellular immunity, selenium deficiency can lead to a decrease in the number of macrophages, selenium can activate macrophages in cooperation with macrophage activating factor, and simultaneously reduce the inhibition on lymphocyte proliferation reaction. In addition, it can also be used as a natural antidote for some heavy metals. If the average daily food contains flavonoids, it is sufficient to maintain the required pharmacological activity concentration of body tissues.

4. Physiological Function of Vitamin C
Lack of Vitamin C in childhood can damage tooth development. Teeth are easy to be eroded and gums are easy to bleed. The basic structure of bones is destroyed, which makes bones loose and easy to fracture. Even if there is sufficient calcium and phosphorus, calcium cannot be stored in bones and sufficient Vitamin C can be added. No matter children or adults, it has obvious effect of improving teeth and bone growth. It can be placed in Vitamin C aqueous solution to prevent browning. Only when Vitamin C is added to the juice can the color be kept bright. Citrus dried fruits are not easy to brown due to their rich Vitamin C, but their canned products still contain Vitamin C. In order to stabilize the quality and prolong the shelf life. The detoxifying effect of Vitamin C is to combine with toxic substances invading human body and excrete with urine.
At least 33 cases found in 46 cases of epidemiological investigation can show that Vitamin C has the effect of preventing canceration, especially closely related to non-hormone dependent canceration such as lung cancer and gastric cancer. After decades of follow-up investigations, 16 research teams from 7 countries found that the occurrence of gastric cancer was negatively correlated with Vitamin C intake (Table 1) [7].

| Vitamin C intake (mg/d) | 10  | 40  | 60  | 80  | 100 |
|-------------------------|-----|-----|-----|-----|-----|
| Incidence of gastric cancer (%) | 4.3 | 3.2 | 2.5 | 2.2 | 1.6 |

When people are infected with diseases, the content of Vitamin C in blood will decrease and disappear. Taking enough Vitamin C can help the body to resist diseases. Carnitine can increase the oxidation rate of fat, reduce the consumption of glycogen, delay fatigue and improve the tolerance of the body during long-term intensive exercise. In the treatment of hepatobiliary diseases, it can promote the regeneration of liver cells and the synthesis of liver glycogen, and enhance the detoxification ability of the liver. Vitamin C has the effect of blocking nitrosamine formation in the body, so it has anti-cancer effect.

5. The Special Function of Vitamin C in Food Industry

As Vitamin C is a nutritional drug, it was mainly used for patients in our country in the past, so the hospital should supply some when prescribing. With the development of economy and improvement of life, Vitamin C has begun to enter the food industry and family. In aquatic product processing products, Vitamin C can inhibit puFA (highly unsaturated fatty acid) deterioration, odor and shrimp blackening caused by oxidation. Turbidity and flavor deterioration are two major problems in potential fruit production. If appropriate amount of Vitamin C is added during fermentation and canning, not only the fermentation effect and yield can be improved, but also the flavor, color and stability of the product can be enhanced. It can prevent food oxidation in the food industry. This effect of Vitamin C will be used more and more widely in the food industry. The development policy of food additives is "natural nutrition and multifunction". Animal oil is rich in saturated fatty acids, but due to its lack of natural antioxidant components, it is more prone to oxidative rancidity than vegetable oil containing antioxidant components. Antioxidants must be added when it needs to be stored for a long time. Among them, fatty acid salts of Vitamin C have good effects. Practice has shown that, even in some vegetable oils, adding Vitamin C salts can prolong the shelf life by 3-4 times [8].

6. Synthesis and Extraction of Vitamin E

Vitamin E, DL-α tocopherol, or tocopherol for short, is widely found in green parts of plant tissues and germ of gramineous seeds. However, a large number of industrial products on the market are synthetic vitamin E, which is a well-known fat-soluble vitamin E. It is widely used in medicine, cosmetics, food and feed industries as nutritional supplements and antioxidants. The hydroxyl group on its benzene ring is easy to lose electrons or H+ and be oxidized. This structural feature can eliminate oxygen free radicals. At the same time, as a hydrogen donor, it competitively combines with polyunsaturated fatty acid (ROO-) in the free radical reaction process to convert it into hydroxyl grease. Acid, alkali, ammoniation process and high temperature will not destroy vitamin E, but it can be oxidized slowly in the air and decomposed by ultraviolet radiation. At present, the extraction method is mainly used, which has the advantages of simple process, mild conditions and low energy consumption, and has the disadvantages of difficult solvent recovery and a little impurity. The CO2 supercritical fluid extraction method has the advantages of short process flow, no solvent residue, and retains the pure natural activity of vitamin E. Generally known as vitamin E, d-α tocopherol is actually a mixture of eight tocopherols of α, β, γ, δ tocopherol and α, β, γ, and δ triene tocopherols, which have
the highest biological activity. It is \( \alpha > \beta > \gamma > \delta \). \( \delta \)-\( \delta \) has the strongest anti-oxidation performance, in the order of \( \delta \geq \gamma \geq \beta > \alpha \), which is mainly contained in vegetable oil.

In nature, natural vitamin E is fat soluble in oil and grease of plants in the form of various isomers. Because tocotrienols contained in corn germ oil, soybean oil and wheat germ oil is not contained in synthetic vitamin E, it is more popular among edible oil consumers at home and abroad. The composition and content of vitamin E in vegetable oil are shown in Table 2.

| Oil type      | Crude oil | Refined oil |
|---------------|-----------|-------------|
|               | Total content | \( \alpha \) | \( \beta + \gamma \) | \( \delta \) | Total content | \( \alpha \) |
| Soybean oil   | 87-113    | 5-15        | 58-75      | 22.3-33.1 | 72-116 | 5-11         |
| Corn oil      | 84-147    | 7-30        | 74-112     | 2.0-6.1   | 68-77  | 14-20        |
| Rapeseed oil  | 84-95     | 40-48       | 35-50      | 0.3-0.9   | 24-70  | 28-36        |
| Sunflower seed oil | 50-75     | 47-71       | 2-6        | 0-1.2     | 3052   | 28-50        |

After degumming with water and deacidifying with alkali in refining process, crude germ oil prepared by germ leaching produces certain stripped substances (soapstock), and a large amount of unsaponifiable substances are adsorbed in the soapstock. Therefore, in the process of extracting vitamin E from soapstock, 0.5 N sodium hydroxide-ethanol solution should be added for supplementary saponification, followed by extraction with polar solutions such as methanol, ethanol or acetone. Figure 1.

![Figure 1. Preparation of vitamin e from soapstock](image)

The production of vitamin E mainly includes the synthesis of main ring trimethylhydroquinone and the synthesis of side chain isophytol. At present, trimethylhydroquinone is synthesized from trimethylbenzene by suffocation, nitration, reduction, oxidation and reduction reactions. At present, it has been widely used as a nutritional supplement and antioxidant in medicine, cosmetics and food industries. Compared with synthetic vitamin E, natural vitamin E has obvious difference in bio absorption and biological activity. Taking the same dose, the blood concentration of VE in human body is different, natural vitamin E is more than 2 times higher than synthetic vitamin E, and the biological activity of natural vitamin E is 50% higher than synthetic vitamin E. In terms of catalyst improvement, hydroquinone and sophistic alcohol are mostly used as basic raw materials, Lewis acids such as zinc bromide, zinc chloride or aluminum dichloride are used as catalysts, and condensation is carried out to form a ring through the carbocation mechanism of the Vocker alkylation reaction. Vitamin E is extracted from the distillate by solvent extraction, esterification, molecular distillation and adsorption separation. After extraction, fatty acid is esterified with methanol or ethanol, and fatty acid ester is removed by distillation to obtain 50% crude vitamin E, and then more than 70% vitamin E is obtained by molecular distillation. Vitamin E extracted from soybean oil contains 10% of \( \alpha \) type, 67% of \( \gamma \) type and 23% of \( \delta \) type. In recent years, foreign consumers have attached great importance to
the health care function of vitamin E, and both the UN Food and Agriculture Organization and the World Health Organization have suggested that the human body should supplement an appropriate amount of vitamin E every day to meet the demand.

7. Summary
In recent years, the development of functional foods has fully demonstrated the hot spots of functional foods and has immeasurable prospects in many aspects. However, quantitative and qualitative research on functional ingredients of functional foods is still limited. Therefore, for food industry, Vitamin C is a nutritional enhancer that everyone needs, and if it is used as a functional antioxidant, it has more extensive development potential. The research and understanding of functional compounds are more conducive to the development of higher-level functional foods. At the same time, the development of biotechnology has enhanced our ability to obtain these substance components, which will surely make the functional component family grow rapidly. Extraction of natural vitamin E, methylation of non-α natural tocopherols and research and development of downstream products will all be promising development directions of natural vitamin E industry.

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