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Nutritional Health Function and Quality Safety Evaluation of Traditional Fermented Food Based on Projectization

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Abstract: Fermented food in the biological reaction can produce beneficial substances for the body, which can help the body to reduce blood lipid, improve antioxidant capacity, inhibit tumor, improve the body immunity and reduce the aging rate and prevent gastrointestinal diseases. In terms of the overall development level, the industrial production degree of traditional fermented food is not high, and the production process still needs traditional experience. Therefore, the products are still in an unstable state, causing many safety risks. Therefore, it is very important to reduce the harm of traditional fermented food and improve its safety. This paper analyzes the nutritional components of traditional fermented food, the effects on health and the factors affecting the safety of traditional fermented food, and points out that the first thing to ensure the safety of traditional fermented food is to objectively evaluate its quality and safety.
Keywords: Traditional fermented food, nutritional health function, quality and safety, evaluation research.

Introduction

Fermented food is not strange to Chinese people. It is a kind of food produced by microbial fermentation. Fermented food has a long history in China and has a very rich connotation. With the development of time, fermented food gradually spread to other countries and formed a unique fermentation culture, which further promoted the development of the world food industry. Because fermented foods contain a variety of beneficial ingredients, it plays a good role in the health promotion, so it has attracted more and more consumers and scientific researchers' attention that it is important to further improve the quality of fermented foods and dig deep fermentation principle and used them to guide production.

Understand the functional components and health care functions of traditional fermented food

Traditional fermented food is made by microorganism fermentation, which has obvious regional and national characteristics. Globally, fermented foods have a wide variety of varieties, which are widely distributed and have a long history. Many regions and ethnic groups have their own traditional fermented food. In China, there are soy sauce produced by brewing process and fermented bean curd produced by authentic process. Such as sake and natto made in Japan, kimchi made by fermentation process in Korea, and bread and cheese food favored by westerners are all fermented food. However, due to the different geological resources and living customs in different parts of the world, fermented food productions have obvious differences in terms of technology, flavor and nutrition [1].

Functional components in traditional fermented food

In the production process of fermented food, the metabolites generated by the propagation of microorganisms and the decomposing materials formed by microbial enzymes contain many nutrients beneficial to human health. Fermented food usually uses one or more agricultural products as auxiliary raw materials in the process of microbial fermentation, generating thousands of metabolites while producing the main products. All these substances produce fermented food with unique flavor according to the natural fermentation mechanism, and a large part of the functional factors formed by fermentation are beneficial to human health [2].

(1) Functional carbohydrates. The fermentation process produces many of these compounds, such as polyoligosaccharides, fungal polysaccharides, and monosaccharides. Oligosaccharides are composed of several monosaccharides in the form of glycoside bond molecules that are further combined into oligosaccharides, such as galactosaccharides, xylooligosaccharides, fructooligosaccharides and soybean oligosaccharides. These sugars are not easy to be absorbed by the human body and can be combined directly through the intestinal tract, which is beneficial to the reproduction of bifidobacteria, thus effectively improving the micro-ecological environment of the body and promoting healthy growth of the body.

(2) Peptides and amino acids. From the Angle of biology, polypeptide is a kind of amino acid polymer, its molecular weight is much smaller than the molecular weight of protein, which has a lot of benefits to the human body. But protein does not have important functions and it is the focus of the current scientific research project. For example, the production of soy peptides in the fermentation process can reduce the body fat content, enhance the ability to exercise, and further improve the body's ability to digest. Glutathione is an organic component of yeast. It contains glutamate, glycine and cysteine, which constitute a tripeptide with important physiological functions for human body.

(3) Antioxidant active substances. After scientific research confirmed that most traditional fermented foods have a way to resist the aging of antioxidants, such as soybean on microorganism fermentation. The original

polymer insoluble substances by fermentation is decomposed into low molecular soluble substances, which not only still retains the original functional ingredients, but also generate some new material, and these substances have antioxidant properties, such as some vitamins protein substance, nuclear glycosides and melanin, etc. [3].

(4) Substances that lower cholesterol and blood pressure. After microbial fermentation, some raw materials will produce substances that can resist the oxidation of serum lipids and reduce the production of lipid peroxide, so they can effectively reduce the content of triglyceride and cholesterol in the body, and have a significant role in dredging blood vessels, such as soybean saponins and monascus.

(5) Probiotics and enzymes. The human body contains a lot of bacteria, among which the ones that are good for you are called probiotics, which balances the bacteria in the body. In microbiology, probiotics belong to the category of bifidobacterium, which includes short bifidum, long bifidum, young bifidobacterium and baby bifidum, etc. Lactobacillus, which plays an important role in human body, is a kind of probiotics with health function. These beneficial probiotics are found in many fermented foods, but vary in function with some playing a major role and others a minor one. Lactobacillus plays an important role in the micro-ecological circulation of the body, it can not only play a certain role in the prevention of gastrointestinal diseases, but also can reduce the blood concentration, reduce the occurrence of tumor diseases, improve the immune capacity of the body and have a positive role anti-aging process.

Nutritional and health functions of traditional fermented food

Fermented food produced by traditional fermentation process has natural mellow flavor, pure taste and rich nutrition. The production of health-promoting substances by microbial fermentation may reduce the harmfulness of raw materials to some extent, make food more natural and more edible in taste, and also have many functional ingredients.

(1) Fermented dairy products. Fermented dairy products are a kind of dairy products produced by fermentation of cow's milk, goat's milk and horse's milk by lactic acid bacteria, yeast and bifidobacteria. For example, yogurt and some cheese products belong to fermented food. After fermentation, this animal milk degrades the relevant ingredients, and at the same time produces a lot of soluble calcium, phosphorus and other substances. In this process, it also produces beneficial vitamins for the body. So after a series of microbial fermentation, its nutritional value is higher than the raw material itself. And a new generation of these substances also has many functions: it can adjust intestinal bacterial flora, further strengthen the function of vitamin and protein metabolism, have certain effect to prevent constipation, produce antibiotics on lactose, protect liver, reduce the occurrence of colon disease, prevent the happening of the disease, improve body immunity and reduce lipid body contains cholesterol, etc.

(2) Fermented soybean products. Soybean contains more protein and has

higher nutritional value, but phytic acid, lectin, trypsin inhibitors and antitrophic factors such as antigen protein in soybean will have adverse effects on the absorption of nutrients by human body. Soybean can turn the original low molecular polymer insoluble substances into soluble substances after degradation microbial fermentation. Some functional materials such as oligosaccharides and soy isoflavones still plays a role, and produced some of the new substance such as protein melanin, nucleosides and aromatic substances, so as to give the product a higher nutritional value. Many fermented foods play an important role in promoting health, such as tempeh, which helps break down food in the digestive system, strengthens the brain and helps prevent high blood pressure. Sauce can help the human body to improve the antioxidant capacity, which cannot be conducive to the body's emission of substances by metabolism out of the body. Danbei contains a lot of flavonoids, which have strong antioxidant effect. Natto contains nattokinase, which dissolves clots in blood vessels to clear them. It also has antioxidant properties, which helps prevent cancer and osteoporosis.

(3) Fermented vegetables. South Koreans love kimchi, which comes in more than 190 varieties and has different nutritional values. Most pickles contain calcium, iron, phosphorus, salt and other substances. The fish sauce used in pickles is rich in protein, amino acids, fiber and VB1. Fermented kimchi contains nutrients that can reduce the risk of cardiovascular disease, gastrointestinal disease and anemia, as well as improve the immune system. Pickled and fermented sauerkraut in northern China also plays a role in preventing gastrointestinal diseases and lowering cholesterol.

(4) Fermented wine. Glucose produced by fermentation process contains polyphenols such as flavonoids, anthocyanins, flavonols and tannins, which can eliminate oxygen free radicals, prevent platelet coagulation and oxidation of lipoproteins, as well as its antioxidant function and anti-cancer effect. So people like to drink wine because of its anti-cancer effect and prevention of atherosclerosis health function. The French have more wine drinkers and have significantly lower rates of cardiovascular disease than the rest of the world.

(5) Vinegar. China is a large country producing vinegar, and has a long vinegar culture. According to research, the nutrient composition of vinegar has acetic acid, amino acid and vitamin. According to the theory of traditional Chinese medicine, vinegar has the functions of stopping bleeding and removing stasis, smoothing breath and removing pain, correcting taste and detoxification. Vinegar is also popular in Japan. Scientific researches confirm that long-term edible vinegar has the effects that makes blood pressure stable, reduce senescence degree and fatigue degree, reduce blood sugar, prevent cold and ventilated disease and prevent cancer.

Grasp the safety risks of traditional fermented food

Fermentation technology has a very ancient history, and the degree of industrialized production of fermented food is still relatively low from the world scale. Especially in some underdeveloped areas achieving industrial

production is still difficult. At present, many fermented foods are still produced by using traditional techniques, and the mechanization degree is not high. The control of the production process requires the experience of technical staff to supervise, and the product quality is greatly affected by subjective factors, so it is difficult to stabilize the product quality. Due to the uncertainty of natural fermentation process, many different microbial communities will be generated, which will increase the safety risk of the products produced [4]. In general, factors influencing the safety of fermented food include physical and chemical factors, production process factors, biological factors and safety risk factors caused by transgene [5].

Biological contamination risk of traditional fermented food

Biological contamination is a major risk factor for the fermented food safety, including contamination by bacteria, mold and parasites. During the fermentation process, soybean products are mainly contaminated by fungi, among which penicillium and trichoderma are the majority. During the fermentation process, they produce toxins, which may increase the risk of cancer if consumed for a long time [6]. Aflatoxin is a well-known toxic substance that can be produced in poor fermentation environments. Aflatoxin is highly toxic and can cause cancer by accumulating in the body over a long period of time. In addition, in the process of producing fermented food, a large number of microorganisms are produced, which is also an important factor affecting the safety of fermented food.

Risks of chemical and process control factors in traditional fermented food

Chemical contamination is also an important factor affecting the safety of fermented food, including fertilizers, pesticides and other chemical contaminants. Some chemicals contaminate food ingredients directly from the surface, for example by attaching chemicals to some beans and grains. There are also some heavy metal pollutants which are very harmful to the body. Because these substances exist in the soil where plants grow, they are absorbed by plants, and then people eat, which will accumulate in the body into a relatively large dose of toxic substances and cause damage to human organs over time. In addition, due to the unstable process, the chemical substances produced in the process of fermentation will also cause harm to human body. For example, it is difficult to control the temperature, humidity and time of fermentation during the production of vegetable fermentation, resulting in the production of nitrite and other harmful substances, which will lay hidden dangers for food safety. Meat fermentation food in the production of biological amines are easy to produce, and this material will directly cause human poisoning. Therefore, special attention should be paid to meat storage temperature, humidity and process parameters in the production process to.

Physical risks of traditional fermented food

Physical contamination, which is usually made up of radioactive materials and other foreign matters, is a hidden danger to the safety of fermented food. In general, different ingredients of soil can produce different levels of

radioactive contamination, and raw materials in food production can cause foreign body contamination. Because the production of fermented food still uses the traditional workshop, the temperature and humidity in the production process are difficult to get effective control. If hygiene is not under good control, these factors will directly lead to physical pollution.

Trans enosis safety problems existing in traditional fermented food

It should be said that the emergence of transgenic technology has solved the food problem that has been troubling mankind to a large extent, but whether there are safety risks of genetically modified food has been a great dispute. Transgenic technology can help crops improve their ability to prevent pests and can greatly increase crop yields. Since transgenic raw materials are used in the fermentation process, the safety of fermented food caused by the application of transgenic raw materials must be taken seriously.

Quality and safety evaluation of traditional fermented food

Bacteria, fungi, yeast and actinomyces are the four main strains of food fermentation. It is an important factor to control and evaluate the safety of fermented food. Some strains produce toxins directly into the body that can lead to disease. Some bacteria produce metabolites that can remain dormant in the body for a long time during fermentation, thus posing a potential hazard to the human body. The effects of transgenic crops on fermented food and microbial metabolic pollution during fermentation should be paid enough attention. The safety of the above four flora directly affects the safety of microbial fermented food. The safety hidden danger caused by these four bacteria mainly involves four aspects: (1) the pathogenic problem caused by microbial flora to human body. (2) Fermentation food in the process of fermentation by microbial metabolism produced by toxic substances, hormones and antibiotics and other harm to the human body. (3) Safety problems arising from the use of genetically modified crops in the production of fermented food. (4) A large number of microbial pollution caused by the production process.

There are many ways to detect the safety of bacteria species. Currently, the risk assessment mechanism of microbial flora is usually used in China to evaluate whether there are potential safety risks in the quality of fermented food. The process is generally described as objective, identification of microbial hazards, assessment of hazardous substances, characteristic analysis and description of food risks.

Objective statement method

In the process of fermentation, microbial activities can affect the color, taste and aroma of food. Therefore, it can be said that the safety of fermented food can be effectively evaluated by the activity of microorganisms in the fermentation process.

Hazard identification method

Identifying pathogens that infect people with disease through fermented food could improve risk assessments. Relevant microbial expertise and fermentation knowledge as well as relevant reference data must be provided in this evaluation process. Such as quantitative and qualitative analysis of the fermented food consumption caused by microbial changes and physical and chemical changes. In the detection process, not all pathogenic bacteria can be detected, so we should adopt scientific methods for hazard identification.

Exposure assessment method

An exposure assessment is an assessment of the extent to which certain pathogenic bacteria may accumulate in the body as a result of eating a particular type of food. This method takes time to evaluate and takes into account the degree of harm caused by the food nature and the way body reacts.

Hazard characteristic description method

Exposure assessment mainly tends to analyze the degree of harm that pathogenic bacteria may cause in human body through fermented food, and the description of harm characteristics mainly focuses on the harm effect caused by specific harm in human body, mainly involving the nature, frequency, duration and condition of disease caused by this bacteria community. Hazard characterization focuses on the dose-effect relationship between the degrees of disease caused by the number of pathogenic bacteria.

Risk characteristics description method

Risk characterization is the final stage of the assessment process. It's a synthesis of all the processes that happened before. It provides an overall estimate of the disease nature caused by pathogenic bacteria, the number of infections and severity of the disease, as well as quantitative and qualitative analysis to identify risk factors.

Conclusion

To sum up, from a global perspective, the industrial production of fermented food is still in a relatively low stage of development. The production conditions of many fermented food, such as fermented bean sauce and fermented bean curd, are still in the stage of small workshops, and both production equipment and production technology are relatively backward. Therefore, scientific research should be carried out to improve the modern production level of fermented food, so as to meet the social demand. What is commendable is that many countries have begun to pay attention to and invest manpower and material resources in scientific research to promote the technological content of fermented food production. For example, Japan has realized the large-scale production of natto. South Korea has also increased input to modernize kimchi production. In addition, people generally lack the knowledge of relevant microbial reactions and chemical reactions in the

production process of fermented food, resulting in frequent safety problems of fermented food. Therefore, efforts should be made to learn the principle of fermentation to improve the safety of fermented food. And scientific measures should be taken to ensure the taste, aroma and nutrition of fermented food, so that people can eat nutritious and safe fermented food. With the gradual improvement of people's food safety awareness and the continuous progress of science and technology, fermented food will become more and more popular, and the nutritional function of fermented food is the main direction of its future development.

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References

[1] Samuel, S.M.S. 2008. Application of agricultural biotechnology to improve food nutrition and healthcare products. Asia Pacific Journal of Clinical Nutrition, 17 (S1): 87-90.

[2] Rolf, M., Florence, C., Philipp, H. 1996. Zeitschrift Fur Le0bensmittel-Untersuchung Und-Forschung, 203 (4): 339-344.

[3] Pennington, T.H. 2000. The microbiological safety of food. Journal of Medical Microbiology, 49 (8): 677-679.

[4] Xie, M.X., Fei, Y., and Wu, J.R. 2019. The meta omics pass reveal microbial assortments and the key enzymes in bean sauce asurgeon, a traditional fermented soybean product. Journal of the Science of Food and Agriculture, 13 (14): 6522-6534.

[5] Tsvetanka, T.A., Tatyana, B., Petya, B. 2018. The traditional balkan fermented milk products. Journal of Engineering in Life Sciences, 17 (11): 807-819.

[6] Mao, Y., Deng, M.C. 2018. Cloning, expression and characterization of the esterase gene in a metagenomic library of traditional fermented food. acta universitatis cibiniensis. The Series E: The Food Technology, 22 (2): 33-41.