Traditional Chinese food technology and cuisine

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From ancient wisdom to modern science and technology, Chinese cuisine has been established from a long history of the country and gained a global reputation of its sophistication. Traditional Chinese foods and cuisine that exhibit Chinese culture, art and reality play an essential role in Chinese people's everyday lives. Recently, traditional Chinese foods have drawn a great degree of attention from food scientists and technologists, the food industry, and health promotion institutions worldwide due to the extensive values they offer beyond being merely another ethnic food. These traditional foods comprise a wide variety of products, such as pickled vegetables, salted fish and jellyfish, tofu and tofu derived products, rice and rice snack foods, fermented sauces, fish balls and thousand-year-old eggs. An overview of selected popular traditional Chinese foods and their processing techniques are included in this paper. Further development of the traditional techniques for formulation and production of these foods is expected to produce economic, social and health benefits.

Key words: Chinese food, cuisine, traditional food, processing, health

Introduction

Food in China is not consumed merely to satisfy hunger, but for health promotion, treating diseases and, most importantly, building relationships among people and enhancing family values. Chinese cuisine has long been a creative and individualized art. The variety and combinations of food served at each meal should never be the same. Meal styles also differ regionally, so that a specific food pattern has been established in each province. Chinese traditional foods, thus, play a unique role in Chinese culture and are important to people's everyday lives. Chinese people have a keen taste for food. Sophisticated flavor and unique texture are most emphasized for food processing and preparation. Unlike Western food, creaminess is not a preferred texture; traditional foods generally are less greasy, relatively low in caloric value, and require longer preparation times to achieve the desired sensory characteristics. Many traditional Chinese foods, such as sesame oil chicken and clam soup, are associated with a therapeutic or health promoting effect besides their pleasing taste and basic nutritional values, while others are linked to a historical or folkloric story, with *zong zi* and Beggar's chicken as examples.

Drying, salting and pickling are mankind's oldest and most widely used methods of food preservation. Traditional Chinese foods rely greatly on these basic processing and preservation methods. These foods encompass a wide range of products, such as pickled vegetables, salted fish and jellyfish, winterized (semidry) meats, and salt-cured eggs. Fermentation has also been used in the preservation of foods for centuries. Almost all food from both animal and plant sources can be fermented. There are numerous kinds of traditional fermentation products including, to just name a few, sauces, vinegar, rice spirits, fermented vegetables, stinky tofu, etc., and the processes used to make them vary extensively based on the product to be fermented. Traditional Chinese foods can be characterized by their materials, ingredients, processing methods, functions or styles. A brief description of selected traditional Chinese foods based on the food categories is given in this paper. Their processing methods used to prepare them are also described herein and summarized in Table 1.

Salted vegetables

Salt has long been known to be a preservative that keeps foodstuffs from spoiling.[1,2] Salting of fresh or semidried vegetables was originally used to preserve surplus vegetables. The salted vegetables impart a distinctive flavor, are low in caloric values, and are easier to store due to their reduced bulk. Salted vegetables are frequently used as a main dish cooked with meat or other vegetables or as a side dish in China, especially in rural areas where a variety of

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salted vegetables are kept year round and appear on the table at almost every meal. The processing methods used for salting vegetables include dry salting and brine salting, depending on the raw materials and end use. Washing, desalting or cutting usually is necessary before further flavoring the products for different use.

Dry salting

Leafy vegetables are graded, sorted, and usually air-dried for a couple of days before salting. Dry salt is sprinkled onto the surface of the vegetables at a ratio of one part of salt to ten parts of vegetable. Kneading, mixing and squeezing (with stone slabs or a screw press) are performed to facilitate the exudation of juice. When bulk quantities of vegetables are salted, salt is placed between layers of vegetables. Root vegetables require cleaning, trimming and cutting into smaller pieces prior to air-drying. Dry salting of root crops, because of their bulky and dense texture, must be carried out in successive steps using a fraction of the required salt each time. Exudation juice, which helps keep the vegetables clean, is discarded each time after salting. Once salted and covered tightly in a barrel or an underground cement storage vat, the vegetables can be kept for 3-9 months, depending on temperature conditions.

Brine salting

Concentrated brine with as high as 20% salt is used to preserve minimally processed vegetables. Partially processed fresh vegetables, including bamboo shoots, lotus roots, ginger, eggplants, scallions and cucumbers, are often packed in salt brine and exported to Japan and North America for further processing. Heavily salt-cured vegetables are desalted and flavored to make a variety of pickled products.

Soy products

Soy sauce is a dark brown liquid obtained from a fermented mixture of soybeans and wheat that is very familiar to consumers both inside and outside China. With a salty taste and sharp savory flavor, it has served as an all-purpose seasoning for thousands of years. Although the traditional method is still used at a domestic level, many commercial soy sauce producers in China have now adopted a new technique.[3] Briefly, defatted soymeal and wheat bran are used in a ratio of 60:40. After treatment, the mixture is inoculated with an improved strain of *Aspergillus*. As a result, the time for making *koji* (bloom of mold) is reduced from 48h to 24h. *Koji* which is made by growing molds on rice, barley, wheat, soybeans, or a combination, contains a great variety of enzymes that digest starch, protein and lipid components in raw materials. The matured *koji* then mixed with a small volume of brine (about half the usual amount) that has about three-quarters as much salt as in the traditional method and allowed to ferment at a relatively high temperature (40-45^{o}C). Under such low-moisture, low-salt and high-temperature conditions, it takes only 3 weeks to complete fermentation. The fermented mash is transferred to another tank, mixed with additional brine, and then heated to more than 80^{o}C. This is followed by the separation of the liquid in the tank through gravity. The soy sauce may be pasteurized or mixed with benzoic acid before finally being clarified, bottled and shipped to the market. Compared with the traditional method, the new method is more economical because of the significant reduction in processing time. However, the ratio of amino acid nitrogen to total nitrogen in the final product is not as high.

Tofu may be the most popular food made of soy. It is produced from water-extracted and salt- or acid-precipitated soybean in the form of a curd, resembling a soft white cheese or a very firm yogurt. On a wet weight basis, a typical pressed tofu with a moisture content of 85% contains approximately 7.8% protein, 4.2% lipid and 2 mg/g calcium. On a dry basis, it contains about 50% protein and 27% lipid, the remaining components being carbohydrate and minerals.[4]

Tofu is inexpensive, nutritious and versatile and can be served fresh or cooked with vegetables and/or meat. It is used in hundreds of dishes or soups and as a meat or cheese substitute. Compared with meat or cheese, it has far fewer calories because of its high protein/fat ratio. It is also cholesterol-free, lactose-free and low in saturated fat. Because of its bland taste and porous texture, tofu can be prepared with virtually any other foods. It is commonly served in soups or separate dishes stir-fried with meat

Table 1. Selected traditional Chinese food items categorized by food groups, and the processing methods involved

Food group	Food item	Processing methods involved
Vegetables	Cured vegetables	Drying, dry or brine salting, fermentation
Soy products	Soy sauce	Fermentation, pasteurization, filtration
	Soy milk and beverages	Grinding, heating, pasteurization
	Tofu	Coagulation, pasteurization, molding, pressing
	Tofu-derived products	Drying, frying, fermentation, freezing, salting
Rice Products	Tang yuan	Stuffing, shaping, boiling, steaming, or frying
	Zong zi	Wrapping, boiling
	Tian jiu niang	Fermentation
	Other snack food	Extrusion
Seafood	Salted jellyfish	Multi-stage salting, pressing
	Fish balls	Mincing, washing, gelation, shapping, boiling
Poultry	Beggar's chicken	Wrapping, baking
	Salted duck	Salting, drying
	Chicken-herbal soup	Boiling with a variety of herbal ingredients
	Beggar's chicken	Wrapping, baking
Eggs	Salted eggs	Salting, immersion, boiling
	Thousand-year-old eggs (Pedian)	Alkaline-fermentation, aging

and/or vegetables. Tofu can also be further processed into various secondary tofu products, including deep-fried tofu, grilled tofu, frozen tofu, dried tofu, fermented tofu, and more. In most cases, these processed tofu products have different characteristics, taste and texture, end uses, and commercial identities than the original plain tofu.

Historians believe that the method for preparing tofu was invented by Liu An of the Han dynasty in China, in about 164 B.C. About 900 years later, it spread to Japan and then to other Far East countries. Since then, tofu has become the most popular way to consume soybeans in the Far East. Even today, there are thousands of tofu shops across China, Japan and other Southeast Asian countries or regions, where many types of tofu are produced daily for local consumption. In recent years, tofu has become increasingly popular throughout the world, as increased numbers of consumers are seeking nutritious health foods of plant origin. This has led to the development of a growing infrastructure for large-scale commercial tofu production and distribution.

Many methods are available for making tofu today, all of which are derived from the traditional Chinese method developed some 2000 years ago. Basically, the procedure starts with preparation of soymilk (Fig. 1). After the milk is boiled for about 10 min, it is transferred to another container, usually a wooden barrel or a pottery vat, and allowed to cool. At the same time, a coagulant is mixed with some hot water. Traditionally, powdered gypsum is used. When the soymilk has cooled to about 78°C, the coagulant solution is added with rigorous stirring. When tiny curds appear (normally in less than 30s), the container is covered and coagulation is allowed to continue for about 30 min until complete. The soy curd thus formed is now ready for moulding. It is first broken up by stirring and then transferred to a shallow forming box and a cloth is pulled up and folded over the curds in the box. The box is then covered with a wooden lid that is slightly smaller than the box dimensions and a few bricks or stones are placed on top of the lid. For about 30 min, whey is pressed out and the tofu becomes firm. The cooled tofu is finally cut into cakes that are ready to be served immediately or immersed in cold water for short-term storage or for sale at local markets.

Today, this traditional processing method is still popular at the home and village levels. However, based on the same principles, many new methods have been developed that are suitable for making various types of tofu products, and different types of equipment are used for varying scales of production. These variations on the traditional method for making tofu include new soybean varieties, different concentrations of soymilk, new ways to heat process the soymilk, new types and concentrations of coagulants, more closely-controlled coagulation temperatures and times, process automation, and modern packaging. Based on water content and textural properties, tofu is generally classified as soft (silken), regular or firm tofu. However, all tofu is essentially made in a similar fashion, except for variations in the water to soybean ratio, the type and concentration of coagulants, the way a coagulant is added, and the amount of whey being pressed out.

Rice and rice snack foods

Rice is the most important staple food in China. As much as 80-90% of the daily caloric intake of people in China is derived from rice. China contributes 38% of the world's rice production using 24% of the world's growing area.[6] There are many forms of rice products that are produced as alternative food sources due to their nutritive values and special sensory attraction. In China, rice cereals are consumed as cooked rice and are served simultaneously with prepared vegetable dishes, pork, poultry, beef, seafood, and others. In addition to its standard form, rice is consumed in the form of noodles, puffed rice, breakfast cereals, rice cakes, fermented sweet rice and snack foods made by extrusion cooking.[5] Rice is also used in making beer, wine, and vinegar.

There are many kinds of rice snack foods, prepared for more attractive taste, texture and aroma. These are served in some cases for special occasions, and in others for their special taste or for convenience. Many rice snack foods

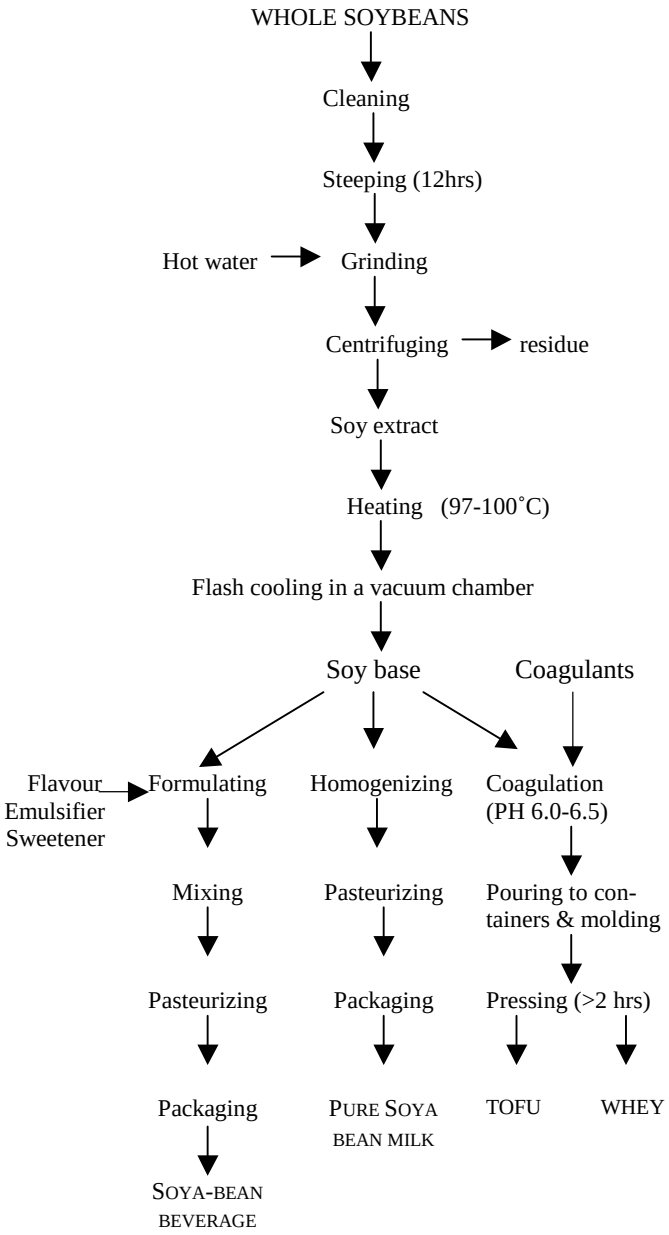

Figure 1. A traditional Chinese method for making soya bean milk and tofu

are made from glutinous rice (sweet or waxy rice) containing largely amylopectin (98% of total starch), but little amylose (less than 2% of total starch), while others are made from both types. A typical glutinous rice flour contains 11-13.5% moisture, 1% ash, 75-80% total starch, 5.5-6.5% protein and 0.5% total fat.[5] Glutinous rice flour is often used in making snack foods because the sticky characteristics resulting from its high amylopectin content are necessary in many specialty rice foods. Another reason for the application of glutinous rice in baked and popped snack foods is that glutinous rice flour expands readily and produces a more porous texture.

Tang yuan is a rice snack product made from glutinous rice flour and water. The flour is kneaded with water and some cooked rice porridge to form a dough and then kneaded again. The dough is then made into *Tang yuan* by adding fillings through hand molding or machine molding. There are two types of fillings: (1) sweet and (2) savory. Sweet fillings uses sugar, cooked red beans, sesame seed paste, lotus bean paste or jujube dates and nuts. Savory fillings are made of any meat product, such as pork, chicken, beef, lamb or shrimp, plus mushrooms, dried edible fungus and Napa cabbage, chopped and cooked with seasonings such as onion, garlic, soy sauce and monosodium glutamate. Through hand manipulation, the food ingredients are wrapped into a rice dough sheet to form round- or rectangular-shaped *Tang yuan.* The rice flour dough acts as a container for the tasty ingredients located at the center. Savory *Tang yuan* are usually elongated in shape (4-5 cm in length and 3-3.5 cm in diameter). Sweet-tasting *Tang yuan* are usually round in shape, 3-4 cm in diameter, but many vary somewhat in size in various parts of China. The taste of the product depends largely on the type of filling. The product is consumed hot after thorough cooking in boiling water or as a fried product after heating the cooked *Tang yuan*, according to the preferences of the cook. The cooked *Tang yuan* can be preserved after packing in a deep freezer at -20°C for 6 months or longer. Success in making *Tang yuan* depends on the high amylopectin content of the glutinous rice flour. Glutinous rice flour differs from long- and medium-grain rice flour in its resistance to water separation (syneresis) during freezing and thawing.[7] The texture of *Tang yuan* after cooking is related to the particle size distribution of the rice flour. Rice flour with a finer particle size makes better *Tang yuan*, which has a fine texture and smooth appearance. Glutinous rice flour is available on the market in the range of particle sizes. The consumer may order a particular size of glutinous rice flour to suit the quality of the desired product.

Zong zi is another very popular rice snack food in which glutinous rice is wrapped in bamboo leaves. The bamboo leaves give a distinctive, pleasant flavor to the rice after cooking and also serve as a packaging material for the product. *Zong zi* was made and consumed by people in memory of a famous patriotic poet, QuYuan (340-278BC), who committed suicide by drowning himself in a river to protest the corruption of the ruler during the Warring State. When people from his village heard this sad news, men tried to rescue him from the river by rowing dragon boat as fast as possible but it was too late, thus women in the village wrapped seasoned rice and meat in bamboo leaves, cooked and dropped them into the river so that the fish in the river would not disturb their beloved poet. Since then, every year on the day of Qu Yuan's death, people make and eat *zong zi* and hold dragon boat races to remember his death and patriotism. This has become the origin of the Dragon Boat Festival, one of the three major festivals in China.

Several varieties of *zong zi* such as, *chien zong* and *rou zong* are available. To make *chien zong*, about 600g of glutinous rice (round grain species) is washed and soaked in water for 1 h, drained and mixed with 12.5 g soda ash. The bamboo leaves are washed, boiled in water for 5 min, cooled, and drained. A 60g portion of this mixture is wrapped with bamboo leaves to form a tetrahedral parcel that is bound with string. The product is simmered in hot water for 1.5h. After cooking, the bamboo leaves are removed, and the product is served with honey or sugar. The use of soda ash creates a slightly alkaline taste, and develops a special aroma, but it is also possible to make

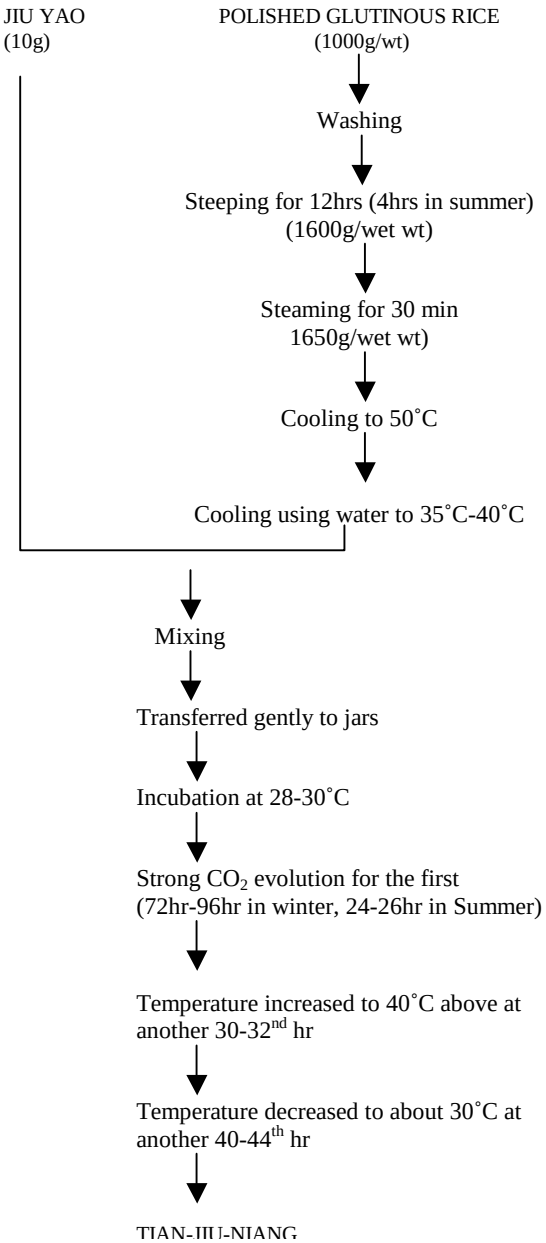

Figure 2. Flow sheet for the preparation of *Tian jiu niang* (fermented glutinous rice)

zong-zi without the addition of soda ash. From 600g of glutinous rice, 20 *chien zong* can be obtained. *Rou zong* is a savory type of *zong zi* in which pork or ham is used to enrich the nutritive value and sensory quality of the product. Six hundred grams of glutinous rice are washed, soaked in water for 1h and drained. The meat, which has been sliced and marinated, rice, and seasoning mixture is wrapped with the bamboo leaves to form a shaped parcel and bound with string. Finally, the wrapped rice product is cooked in hot water for several hours. With 600g of rice and 300g of pork, approximate 20 *rou* zong can be made. The product is served hot, with or without soy sauce, after removal of the bamboo leaves. Another type of *zong zi* is made with glutinous rice, red beans or red bean paste. It is a popular sweet rice product wrapped in bamboo leaves. *Zong zi* can be served fresh after cooking or stored in a deep freezer for months until use.

Tian jiu niang is a fermented glutinous rice product that is a popular snack food in China. It is a mixture of rice grains and saccharified liquid, which contains 1.5-2.0% alcohol with an acidity of 0.5-0.6% as lactic acid and some glucose, maltose and oligosaccharides. The method for making *tian jiu niang* is summarized in Figure 2. The steamed sweet rice is fermented with *jiu zao* (culture), which contains *Rhizopus, Mucor, Monilia* and *Aspergillus.*[8] Some yeast and bacteria may also be involved in the fermenting process. The product can be kept at 10°C for a time, but those kept at 25°C or above will continue to ferment. The acidity may increase to 1%, in the form of lactic acid, and the alcohol content may reach 5%. The product is consumed largely in the winter season and is also used as an ingredient in making special dishes because of its attractive aroma and unique flavor.

Seafood

In China, fish and fishery products are used widely in the daily diet. Fish, in one form or another, is eaten almost every day and the poor eat fish more often than the rich.[9,10] Fishery products have long been an important high-quality protein food in the Chinese diet. Like most Western countries, more than half of the fish and shellfish are consumed fresh and chilled. However, many popular traditional fishery products in China are salted, dried, fermented, and minced.[11] Based on the raw materials and ingredients used, the method of preparation and cultural differences, a variety of fishery products with different flavors and textures are prepared in different regions of the country.

The *fish ball*, a *surimi*-type of fishery product, is an important animal protein source in the Chinese daily diet for many people. They are made into different sizes, flavors, and textures, from very soft to crunchy and firm, and varieties including both plain fish balls and fish balls stuffed with seasoned ground pork or vegetables are available. Surimi is mechanically deboned fish mince that has been washed with water and mixed with cryoprotectants for extended frozen storage. Fresh fish meat is deboned, minced and washed two to three times with fresh water. The washing cycle removes water-soluble proteins, fat and pigments. The washed fish meat mainly consists of myofibril proteins. The washed minced fish (*surimi*) is an intermediate material for further processing. After mixing with cryoprotectant (4% sucrose, 4% sorbitol and 0.5% sodium tripolyphosphate), the washed minced fish meat can be stored frozen up to 1 year for future use. Surimi may be used to produce a variety of shellfish analog products such as crab legs, shrimp, and lobster. In China, the most popular surimi product is fish ball. The important quality attributes of the product are its elastic texture, stable shelf life and reduced fat content.

In Taiwan, the principle sources of the fish used as the raw materials for fish balls are sharks, lizardfish, pike eel and marlin.[11] The processing method includes deboning, mincing, washing, dewatering, mixing, setting, flavoring and boiling. Starch and ingredients such as sugar, salt and polyphosphate are added in the mixing steps. When salt is added to washed minced fish meat during mixing or grinding, myosin is leached out from the fish meat to form sol, which is adhesive. The sol converts into gel during heating, forming a network structure that provides elasticity. The spherical shape is formed by machine or by hand. The shaped minced fish meat, either plain or stuffed with ground pork, is then boiled. After the fish ball is cooled, it is sold as is in the market, or it may be packaged and sold as a frozen product. In addition to finfish, shellfish such as shrimp and cuttlefish are also commonly used to produce similar products.

Salted jellyfish have been eaten in China for more than a thousand years and China is the first country to process edible jellyfish (*Rhopilema esculentum*) for human consumption. Jellyfish is more than a gourmet delicacy in China; it is a tradition. A Chinese wedding or formal banquet is rarely completed without a jellyfish salad. Today, Semi-dried salted jellyfish represent a multi-million dollar seafood business in Asia.[12]

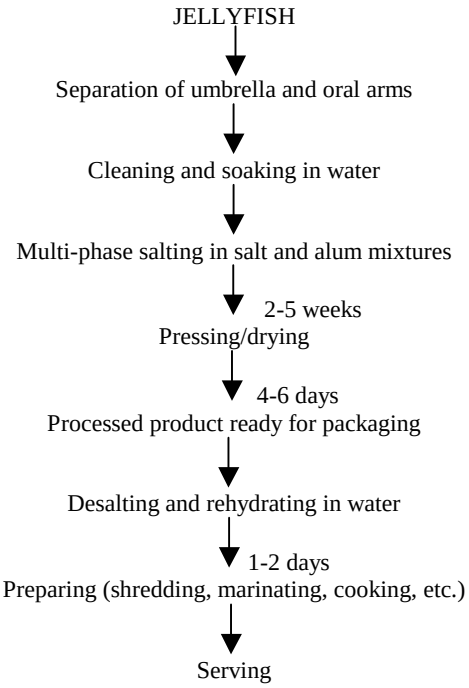

Figure 3. Jellyfish processing and preparation

Processing jellyfish is a low-cost operation that requires little capital but is labor intensive. Traditional processing methods involve a multi-phase processing procedure using a mixture of salt (NaCl) and alum ($Al_2[SO_2]\cdot 14H_2O$) to reduce the water content, decrease the pH, and firm the texture. Live jellyfish are harvested and cleaned immediately with seawater, scraped to remove mucus membranes and gonadal material. Both umbrella and oral arms are used in processing. A salt mix containing about 10% alum is used for initial salting of jellyfish. Salted jellyfish are then left in the brine for 3-4 days, followed by several transfers to another container salted with fresh mix containing a smaller amount of alum. Processing jellyfish is more of an art than an exact science, exact salt/alum formula and procedures are often kept as trade secrets.[13] The salted jellyfish can then be heaped and left dry on a draining rack at room temperature for two days. The entire process requires 20 to 40 days to produce a salted final product with 60-70% moisture and 16-25% salt.[14,15] The salted jellyfish has a stable shelf life up to one year at room temperature. The processed jellyfish should be desalted and rehydrated in water before preparing jellyfish dishes. The desalted ready-to-use (RTU) products have a special crunchy and crispy texture with little flavor but are served with sauces or as part of more elaborate dishes. The Chinese have various methods for preparing jellyfish, cooked or uncooked. They are usually shredded, scalded and served in a dressing composed of oil, soy sauce, vinegar and sugar. Sliced jellyfish may be eaten as a salad mixed with shredded vegetables and/or thin sliced meat. The overnight desalting procedure and preparation of jellyfish dish may become a barrier for modern consumers with busy life styles. This has been overcome by developing shredded RTU products with varieties of flavor and sauces. Recently, shredded jellyfish have appeared on the supermarket packaged together with condiments such as soy sauce, wasabi or mustard as a convenient ready-to-eat food. A flow chart of traditional jellyfish processing and preparation is shown in Figure 3.

Not only are they delectable, but jellyfish are a natural diet food. Desalted RTU jellyfish consists of approximately 95% water and 4-5% protein, mainly collagen. They are low in calories, with no detectable crude fat and cholesterol, and trace amount of sugar. The calculated caloric value for a normal 100 g serving of RTU jellyfish is less than 20 kcal.[13] In addition, edible jellyfish have long been recognized for medicinal value.[16] It is believed to be an effective cure for arthritis, hypertension, back pain, and ulcers, while softening skin and improving digestion. Collagen has been hypothesized to be the ingredient in jellyfish contributing to the beneficial health effects because collagen is the essential building material of muscle tissue, cartilage and bone, and has great medicinal promise.[17] Recently Hsieh *et al*.,[13] reported that laboratory rats fed with low doses of cannonball jellyfish (*Stomolophus meleagris)* collagen had significantly delayed the onset and reduced the incidence and severity of antigen-induced arthritis, a model that shares clinical, histological, immunological, and genetic features with human rheumatoid arthritis. The myths of the medicinal value of eating jellyfish should be unveiled by conducting controlled studies on animal models and human subjects.

Poultry products

Poultry is classified into chickens, turkeys, ducks, geese, guinea hens and pigeons. Each species has its own unique characteristics that influence cooking methods and organoleptic properties. As in many other areas of the world, poultry has become one of the fastest growing meat sources in China. China now ranks second in world poultry production, although the per capita consumption of poultry is still very low compared with those of more developed countries. Between 1985 and 1994, poultry meat production in China increased nearly fivefold, from 1.6 million to 7.6 million tons.[18] The combination of a more healthful image, competitive prices and the recent development of further-processed products have been largely responsible for the rapid growth of poultry consumption.

For centuries, ways to eat chicken have been developed in all corners of the world. Poultry meat can be broiled, roasted, baked, steamed, fried, boiled, fricasseed, smoked, barbecued and many more. Although many freshly prepared culinary types of poultry products are available, traditionally processed or preserved poultry products are limited. Among the many traditional Chinese foods, poultry products are recognized not only as a delicacy, but also for their nutritional and health-promoting values. Chicken soup cooked with a variety of herbs such as ginseng, ginger, black mushrooms, wolfberry fruits, dried dates and/or special ingredients such as wine and sesame oil has been commonly used for patients for a speedy recovery. For example, chicken stewed with sesame oil, rice wine and fresh ginger root is a typical food for women to eat daily during the month after delivering their babies in South China and Taiwan. These food items are often prepared at home and served to healthy people as well as invalids to enjoy the flavor and promote good health in general.

Beggar's chicken, which is cooked in leaves and clay, is a famous baked dish, specific to the southern Chinese provinces such as Zhejiang, Changshu and Guangdong. As the name suggests, beggar's chicken was originally eaten by homeless beggars, who had to invent a cooking method for a stolen chicken without using any cooking utensils. The chicken was cleaned and wrapped in lotus leaves unseasoned, with a thick layer of clay that enveloped the chicken. The clay package kept the heat around the leaf package when the chicken was cooked in a fire pit dug underground, enabling the way for beggars to hide the stolen chicken and enjoy an occasional treat at the end of a cold and dark day. Because of the leaves, clay, and slow heating, the flavor of chicken was distinctively superior. This primitive cooking method produces a tasty chicken that pleases both rich and poor. Today, because of its fine flavor and the laborious cooking procedures involved in making it, Beggar's chicken has become a famous and expensive dish served on banquet tables in modern China. The modern process of making Beggar's chicken includes selecting the chicken, cleaning the carcass, seasoning, wrapping the bird in heat-resistant paper or lotus leaves, encasing the package in a thick

layer of clay, and slowly baking the package in an open fire or oven. The finished product is unwrapped prior to consumption.

Eggs

China has been the number one egg-producing country in the world for many years and in 1995 egg production reached 15 million tons. Eggs are a highly nutritious and economical food containing many essential nutrients. They are quick, convenient and easy to prepare and are appetizing and easily digestible. The mild flavor of eggs and some of the natural compounds in the white and yolk that exhibit functional properties such as leavening, binding, foaming, thickening, retardation of sugar crystallization, emulsification, clarification, coating, and coloring, make them an ideal ingredient for use with other food materials.

Pidan has been an alkaline-fermented ethnic food for many generations in China. The dark greenish color and sophisticate flavor of this product has resulted in it being known as the "thousand-year-old egg" in Western society. Mixing crushed or cut-up *pidan* and tofu and seasoning with soy sauce and sesame oil makes a delicious, easy-to-fix family side dish often served at table for any meal when the housewife is busy. Today, this side dish often appears on restaurant menus due to its increased popularity.

Depending on the processing methods, several types of *pidan* are available, such as the pine-floral *pidan*, soft-yolk *pidan* and hard-yolk *pidan*. In traditional *pidan* processing, many variations of methods can be found from different sources. Wang and Fung[19] reviewed the processing methods and chemical changes involved in making *pidan* and indicated that the traditional processing of *pidan* can be classified into three types: the rolling powder method, the coating method and the immersion method.

Rolling powder method

Traditionally, fresh duck eggs are used. The eggs are coated with a thin layer of mud paste and rolled in the rolling powder, in which all the ingredients have been included, before being packed and sealed in the jar. The powder-rolled eggs are allowed to ferment for 20-30 days at room temperature. The ingredients used for the rolling powder method vary slightly according to the season (Table 2).[19] The rolling powder method produces hard-yolk *pidan*. The advantages of this method are its low cost and ease in handling.

Coating method

A muddy paste containing the coating ingredients is prepared (Table 2). Fresh duck eggs are completely coated with the prepared muddy paste and rolled in rice hulls. The rice hulls prevent the coated eggs from sticking together. They are then placed into jars, sealed with mud and allowed to ferment for 40 days in the summer and 50 days in the winter.

Immersion method

In this method, all of the ingredients are mixed into a curing solution. Eggs are immersed in the solution for 45 days at 20-25°C. After the curing process is completed, the eggs are removed, washed with water and allowed to air dry. The eggs are further coated with liquid paraffin before packaging and marketing.

Table 2. Ingredients (kg) used to prepare 1000 fermented eggs (*pidan*)[20]

Ingredients	Rolling Powder Method	Coating Method	Immersion Method
Na_2CO_3	1.5	10	3.6
CaO	3.8-4.2 (Spring & Fall) 4.5-5.5 (Summer)	25	14
PbO	-	0.45	0.37
Salt	1.4	4	2
Tea	0.1	5	1.5
Yellow mud	2.0	-	-
Dry mud	-	25	0.5
Wood ash	-	25	1
Water	3.0	50	50

The formulation of *pidan* is caused by the chemical reaction of sodium hydroxide and the egg components. Sodium hydroxide is generated to form the action of sodium carbonate and calcium oxide with water in the pickling or mud coating. The alkali penetrates the eggshell and membrane and causes chemical changes in the egg components, which results in gelation of the albumen. Milliard reactions between the glucose of the albumen and amino acids, combined with the pigment of the tea in the fermentation ingredient, contribute to the development of the brown-colored albumen gel. The albumen gel in the *pidan* solubilizes at 40°C, which contributes to its digestibility. The decomposition of proteins produces polypeptide and amino acids. Cystine and cystine produced by protein hydrolysis can be continually decomposed into ammonia and hydrogen sulfide, which contributes to the unique flavor of *pidan*. Hydrogen sulfide produced from the decomposed protein reacts with the iron in the yolk, which gives *pidan* its typical dark-green-colored yolk. The pine-floral-like structures formed between the yolk and albumen of *pidan* come from the degraded protein products such as alkalinized amino acids. Usually, high-quality *pidan* has more pine-floral crystals."

Salt-cured eggs, a popular side dish for the Chinese at breakfast time, are made from duck eggs. However, recently, chicken eggs have also been used. There are two methods used in the preparation of this product, namely, immersion and smearing methods. For the immersion method, 100 eggs are immersed in a container containing a mixture of 1.2 kg salt, 1L wine, 2-3 kg of wood ash and 2.5-3.0 L of red tea for 1 month at ambient temperature. For the smearing method, the same liquid mixture used for the immersion method is mixed with red clay at a ratio of 1:3 (v/v) to form a paste. The egg surfaces are coated with this paste and dusted with rice hulls before aging in a container for approximately 1 month. Several modified

salt-cured egg immersion formulas are available. Regardless of the preparation method, the eggs used should be fresh in quality and free from any cracks. Salt-cured eggs are high in ash and free amino acid contents. The yolk particles aggregate and release yolk oil, which gives a shiny appearance and rich flavor for the product. The cured eggs are boiled in water before serving. The whole yolks of cooked salt-cured eggs are also used in manufacturing several traditional Chinese snack foods, such as mooncake and *zong zi*.

It is of interest to examine the effect of ethnic background on the preference for salt-cured eggs. Trongpanish and Dawson[20] evaluated duck eggs and brine-pickled eggs for their flavor, texture and color with the help of panel members consisting of equal numbers of American and Thai ethnic origin. Their report indicated that American panel members preferred the flavor, texture and color of the control eggs and rejected or disliked the flavor, texture and color of the salt-pickled eggs. Thai panel members preferred the flavor, texture and color of all the salt-pickled eggs. Culture and tradition heavily influence peoples' taste and food preferences.

Future developments

At present, most traditional Chinese food industries remain small-scale, with uncontrolled processes and low efficiency. Sometimes the raw materials cannot be provided in sufficient quantity and/or arrive at predictable times, which results in considerable instability of the market supply as well as poor quality finished products. However, advances in modern science and technology have been accompanied by corresponding improvements in agricultural and processing technologies. Many traditional Chinese foods, such as tofu, *tang yuan*, and fish balls, are now processed using modern technologies that offer quality controlled end products, reducing the processing time and cost, and increasing the production, while other traditional foods, such as salted jellyfish, have hardly changed their traditional processing techniques because their special flavors or delicate textures cannot be reproduced using industrialized methods. However, industrialization involving standardized systems, scaled-up production, and science-based, technically advanced processing methods, is necessary; this development trend is unavoidable in order to meet the modern consumer's demand for large volumes of high quality products. Research in these areas is needed. In addition, consumers have an increased awareness of health and well-being issues. It is anticipated that the health impact of some of the traditional foods will soon be scientifically investigated.

As a result of the globalization of the food market and China's entry into the World Trade Organization, the industrialization of traditional Chinese food will rejuvenate the Chinese food industry, facilitating its penetration into the world market. Development of modern Chinese foods, with their traditional sensory characteristics, is expected to produce economic, social and health benefits. Traditional Chinese foods will continue to find a special niche in history, preserving the Chinese culture and remaining essential in the modern diet for generations to come.

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传统的食品技术和烹饪

Traditional Chinese food technology and cuisine

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从早期的先哲到现代的科技，基于漫长的中国历史文化底蕴，中国烹饪在世界上享有盛誉。传统中国食品和烹饪展示了中国文化、艺术并且在中国人的日常生活中扮演着重要的角色。近年来，中国传统食品由于其巨大的潜在价值正日益引起世界各地食品科学家、食品工程师、食品工业界和健康组织的广泛关注。这些传统食品包括很多品种，如酱菜、咸鱼、海蛰、豆腐和其它豆制品、米面制品、酱油、鱼圆、皮蛋等。本文概括和介绍了几种常见的中国传统食品及其加工工艺，这些食品的配方和生产等传统技术的开发和生产，将有望促进经济、社会和健康的进一步发展。

From ancient wisdom to modern science and technology, Chinese cuisine has been established from a long history of the country and gained a global reputation of its sophistication. Traditional Chinese foods and cuisine that exhibit Chinese culture, art and reality play an essential role in Chinese people's everyday lives. Recently, traditional Chinese foods have drawn a great degree of attention from food scientists and technologists, the food industry, and health promotion institutions worldwide due to the extensive values they offer beyond being merely another ethnic food. These traditional foods comprise a wide variety of products, such as pickled vegetables, salted fish and jellyfish, tofu and tofu derived products, rice and rice snack foods, fermented sauces, fish balls and thousand-year-old eggs. An overview of selected popular traditional Chinese foods and their processing techniques are included in this paper. Further development of the traditional techniques for formulation and production of these foods is expected to produce economic, social and health benefits.

Key words: Chinese food, cuisine, traditional food, processing, health