

Development of Fenghuang Dancong Tea and Chestnut Sauce

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Abstract To produce Fenghuang Dancong tea and chestnut sauce that is more in line with people's health needs and has better flavor, the dosage of tea, tea powder, white sugar and milk was analyzed, and the optimal formula of Fenghuang Dancong tea and chestnut sauce was studied through a single factor experiment and orthogonal experiment. The results showed that the best formula of Fenghuang Dancong tea and chestnut sauce was composed of 4.5 g of tea, 1.5 g of tea powder, 60 g of milk and 5 g of white sugar. The Fenghuang Dancong tea and chestnut sauce made under these conditions was light brown, and had suitable viscosity, delicate and rich taste. It had the fragrance of Fenghuang Dancong tea and the sweet aroma of chestnuts.

Key words Fenghuang Dancong tea, Chestnuts, Sauce, Formula optimization, Sensory evaluation

1 Introduction

Fenghuang Dancong tea, a kind of rare tea originated from nature in China, is screened from variety Fenghuang Shuixian. It is famous for its unique floral aroma, strong sweetness and bubble resistance. The uniqueness of this tea variety lies in the freshness of its natural fragrance of flowers, richness of types and luscious taste. It is produced in the Fenghuang Mountains as the "roof of Chaoshan", and the special geographical altitude, climatic conditions and processing technology together form its beautiful appearance, green harmony and rich aroma. Fenghuang Dancong tea enjoys high praise around the world and is even hailed as "the national treasure of China's tea" by a Japanese tea expert. This evaluation fully confirmed the unique status and value of Fenghuang Dancong tea in the tea industry^[1].

In Chaozhou, Fenghuang Dancong tea has a remarkable effect of promoting the employment of surrounding farmers. Tea farmers have extended the industrial chain through a series of links such as tea planting, picking and processing^[2]. The historical origin of Fenghuang Dancong tea can be traced back to the late Southern Song Dynasty, and the ancient tea trees are known as "China's national treasure and rare tea trees". These ancient tea trees not only have high economic value, but also are important carriers of China's tea culture. Therefore, these precious tea resources should be cherished and protected to ensure their inheritance and development. Besides, the diversified agricultural cultural heritage value of Fenghuang Dancong tea needs to be protected and inherited^[2]. Its diversification is reflected in its unique ecological value and rich cultural connotation. On the basis of giving full play to these values, Fenghuang Dancong tea products can be used as an important carrier for protecting Fenghuang Dancong tea^[3].

Fenghuang Dancong tea, which is one of the six major teas in China, has unique quality characteristics and health benefits^[4]. Studies have shown that Fenghuang Dancong tea has many physiological effects of anti-oxidation, reducing blood lipids, preventing cardiovascular diseases, anti-diabetes, anti-cancer mutation, anti-tumor, anti-allergy, anti-pathogenic bacteria and regulating intestinal flora. This may be due to the antioxidant effects of organic components such as tea polyphenols, tea polysaccharides, and tea pigments, and trace elements such as zinc, manganese, and copper in Fenghuang Dancong tea^[5]. Antioxidants can help the body remove free radicals and reduce oxidative stress, thereby improving immunity and preventing common diseases such as colds and flu. The content of tea polyphenols is as high as 30%, and it has significant anti-radiation effect. In Fenghuang Dancong tea, tea polyphenols and tea polysaccharides have been confirmed to inhibit the proliferation and differentiation of α -amylase and 3T3-L1 precursor adipocytes. In addition, tea polysaccharides also have multiple effects such as reducing blood lipids and blood sugar, anticoagulation, antithrombus, and improving immunity^[5].

Chestnuts are prized for their high nutritional value and unique flavor. Brown chestnuts are rich in unsaturated fatty acids, minerals and carbohydrates, and their starch content accounts for 50%–80% of dry weight. They can supplement calcium, phosphorus, sulfur, iron and magnesium and other elements, and help to reduce cholesterol and prevent cardiovascular disease. Chestnuts are also a source of protein for the body and are lower in fat than other nuts. Meanwhile, they are rich in vitamin E, vitamin C that can improve immunity, all B vitamins and vitamin A (β -carotene). The protein content of chestnuts is higher than that of rice, and they are especially rich in essential amino acids, so they have the effect of strengthening the spleen and nourishing the stomach, as well as tonifying the kidney and strengthening the tendons, and they are regarded as a good tonic for anti-aging and prolonging life^[6]. According to traditional medicine, chestnuts have the functions of tonifying the kidney and strengthening the spleen, strengthening the body and bones, reinforcing the stomach and calming the liver, promoting blood circulation and stopping bleed-

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ing, clearing heat and removing toxicity, preventing diarrhea and treating cough, as well as treating lumbago and foot softness, nausea, diarrhea and vomiting. For this reason, chestnuts are known as the "fruit of the kidney"^[7].

Fenghuang Dancong tea and chestnut sauce is a very distinctive food, and has the double advantages of Fenghuang Dancong tea and chestnuts, as well as many comprehensive benefits. From a nutritional point of view, this sauce is rich in a variety of nutrients, including tea polyphenols, theanine, vitamins, minerals, as well as carbohydrates and proteins found in chestnuts. These ingredients have antioxidant, anti-inflammatory, metabolic regulation and other effects, help to maintain the health of the body, and enhance the body's resistance. In terms of flavor, it combines the mellow tea with sweet chestnuts, brings a unique and rich taste experience, and can meet people's pursuit of delicacy. In addition, Fenghuang Dancong tea and chestnut sauce also helps refresh the mind, relieve stress, and also has a positive effect on improving mood. At the same time, it also has a certain regulatory effect on the digestive system, and can promote gastrointestinal peristalsis to help digestion. From the perspective of the food industry, the research on Fenghuang Dancong tea and chestnut sauce also helps promote the development and production of tea and nut food. This will provide consumers with more diversified and healthy food choices to meet the needs of modern people to pursue a healthy life.

In this paper, Fenghuang Dancong tea and chestnut sauce was made from chestnuts and Fenghuang Dancong tea. The production process of Fenghuang Dancong tea and chestnut sauce was optimized, and the effects of tea, tea powder, milk and white sugar dosage on the sensory quality of Fenghuang Dancong tea and chestnut sauce were evaluated to develop new sauce.

2 Materials and methods

2.1 Materials Main materials included peeled chestnuts, Fenghuang Dancong tea, white sugar, salt, pure milk, Nestle light cream, and Anjia butter.

2.2 Devices Major devices were electronic scale, induction cooker, and mixer.

2.3 Experimental method

2.3.1 Process flow. Basic formula: peeled chestnuts 83.5 g, tea 3.5 g, water 80 g, milk 67 g, cream 13.5 g, salt 0.3 g, sugar 3.5 g, tea powder 1 g, and butter 10 g.

Process flow: choosing raw materials → washing → making tea water (soaking tea in boiled water for 10 min) → cooking chestnuts (tea) → beating them with a blender until being smooth (adding milk, cream, salt, sugar, and tea powder) → adding butter and stir-frying until being thick.

2.3.2 Operation essentials. (i) After the tea was ground into tea powder, the powder should be sifted and sealed for storage. Fresh raw materials were selected to avoid affecting product flavor. The volume of the blender should be paid attention to when the chestnuts were beaten until the sauce became smooth to avoid affecting the taste.

(ii) Operation process: ① 80 g of boiled water and 3.5 g of tea were weighed with an electronic, and the tea was soaked for ten min to make tea water; 83.5 g of peeled chestnuts was put in

a pot, to which the tea water and tea leaves were added, and then they were boiled gently until the chestnuts were ripe. ② The cooked chestnuts, 67 g of milk, 13.5 g of cream, 0.3 g of salt, 3.5 g of sugar, and 1 g of tea powder were put into a blender and stirred well. ③ The stirred chestnut paste was poured into a non-stick pan, to which 10 g of butter was added, and it was stir-fried until there was an inverted triangle after it was lifted and hung. Stirring should be careful to avoid sticking to the pan.

(iii) Storage of the finished product. The prepared Fenghuang Dancong tea and chestnut sauce can be stored in a clean container in a refrigerator for a short period of time, while it can be stored for a long period of time after being frozen, and it can be thawed in advance when using.

2.3.3 Sensory evaluation. The sensory evaluation indicators of Fenghuang Dancong tea and chestnut sauce were tissue form, taste, colour and lustre, and flavor, in which tissue form and flavor, taste, and colour and lustre accounted for 25%, 30%, and 20%, respectively. The sum of scores of the four indicators was the total score of sensory evaluation. The assessment group, consisting of 10 assessors, conducted the sensory assessment according to Table 1 and strictly in accordance with the standard *Jam* (GB/T 22474-2008). The criteria for the sensory evaluation of Fenghuang Dancong tea and chestnut sauce are shown in Table 1.

2.3.4 Design of a single factor experiment. A single factor test was carried out on tea, tea powder, milk and white sugar respectively. By changing the single variable and taking the amount of the original formula as the basis, three variables were tested and evaluated to determine the optimal dosage of each factor, and then the optimal dosage was used to carry out the test of the subsequent variables in this order.

(i) Effects of tea dosage on Fenghuang Dancong tea and chestnut sauce. On the basis of the basic formula of Fenghuang Dancong tea and chestnut sauce, tea dosage was changed to 2.5, 3, 3.5, 4, and 4.5 g, and the dosage of milk, white sugar, and tea powder was 67, 3.5, and 1 g, respectively.

(ii) Effects of the dosage of tea powder on Fenghuang Dancong tea and chestnut sauce. Based on the basic formula of Fenghuang Dancong tea and chestnut sauce, the dosage of tea powder was changed to 1, 1.5, 2, 2.5, and 3.0 g, and the dosage of tea, milk, and white sugar was 4, 67, and 3.5 g, respectively.

(iii) Effects of milk dosage on Fenghuang Dancong tea and chestnut sauce. On the basis of the basic formula of Fenghuang Dancong tea and chestnut sauce, milk dosage was changed to 50, 55, 60, 65, and 70 g, and the dosage of tea, tea powder, and white sugar was 4, 2, and 3.5 g, respectively.

(iv) Effects of the dosage of white sugar on Fenghuang Dancong tea and chestnut sauce. On the basis of the basic formula, the dosage of white sugar was changed to 3, 4, 5, 6, and 7 g, and the dosage of tea, tea powder, and milk was 4, 2, and 60 g, respectively.

2.3.5 Design of an orthogonal experiment. According to the results of the single factor experiment, the factors and levels required for the orthogonal experiment were determined, and the main factors affecting Fenghuang Dancong tea and chestnut sauce were evaluated and analyzed through the orthogonal experiment to obtain the best production process formula.

Table 1 Criteria for the sensory evaluation of Fenghuang Dancong tea and chestnut sauce

Indicator	Scoring criteria	Sensory score
Tissue form (full score 25 points)	The paste body is uniform, and has good spreadability and suitable viscosity.	21 – 25
	The paste body is more uniform, has more suitable viscosity, and is easy to spread.	16 – 20
	The paste body is not uniform, is thin or thick in viscosity, and is difficult to spread.	0 – 15
Taste (full score 30 points)	It is moderately sweet, and has no odor. The taste is coordinated, smooth and delicate.	26 – 30
	The taste is more uncoordinated, smooth and delicate.	21 – 25
	The taste is not coordinated, and there is an odor. The taste is rough and grainy	0 – 20
Colour and lustre (full score 20 points)	It is light brown, and has obvious gloss.	16 – 20
	It is light brown, and has general gloss.	11 – 15
	It is too dark or too light in colour, and has poor gloss.	0 – 10
Flavor (full score 25 points)	It has a strong flavor of tea.	21 – 25
	It has a slight or strong flavor of tea.	16 – 20
	It has no obvious flavor of tea	0 – 15

3 Results and analysis

3.1 Determination of the optimal process formula

3.1.1 Single factor experiment. (i) Effects of tea dosage on Fenghuang Dancong tea and chestnut sauce. The effects of tea dosage on Fenghuang Dancong tea and chestnut sauce is shown in Fig. 1. When tea dosage was too high, Fenghuang Dancong tea and chestnut sauce had a bitter taste, and its color was not good. As tea dosage was too low, the tea taste of Fenghuang Dancong tea and chestnut sauce was not prominent. It can be seen from Fig. 1 that when tea dosage was 4 g, the score of Fenghuang Dancong tea and chestnut sauce was the highest, and the tea taste of the finished product was moderate. Therefore, the best dosage of tea was 4 g, and the appropriate dosage of tea ranged from 3.5 to 4 g.

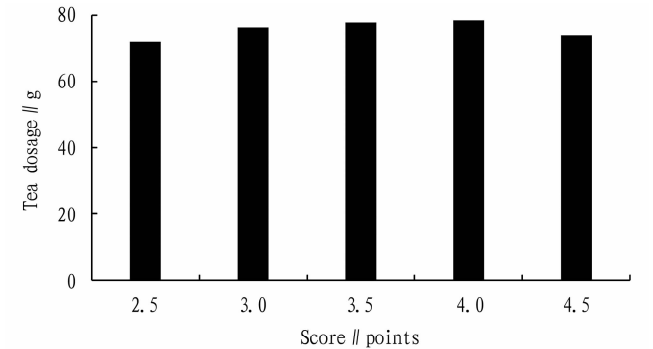


Fig. 1 Effects of tea dosage on the sensory quality of the finished product

(ii) Effects of the dosage of tea powder on Fenghuang Dancong tea and chestnut sauce. The effects of the dosage of tea powder on Fenghuang Dancong tea and chestnut sauce is shown in Fig. 2. Tea powder determines the aroma of tea in Fenghuang Dancong tea and chestnut sauce. If the dosage of tea powder was too high, the taste of Fenghuang Dancong tea and chestnut sauce was not good, and the bitter taste was strong. When the dosage of tea powder was too low, and the aroma of Fenghuang Dancong tea and chestnut sauce was insufficient. It can be seen from Fig. 2 that as the dosage of tea powder was 2 g, the score of Fenghuang Dancong tea and chestnut sauce was the highest. Therefore, the best dosage of tea powder was 2 g, and the appropriate dosage of tea powder was 1.5 – 2.0 g.

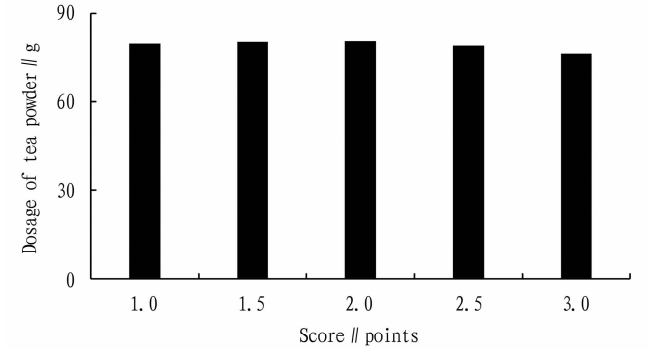


Fig. 2 Effects of the dosage of tea powder on the sensory quality of the finished product

(iii) Effects of milk dosage on Fenghuang Dancong tea and chestnut sauce. The effects of milk dosage on Fenghuang Dancong tea and chestnut sauce are shown in Fig. 3. Milk adjusts the aromatic flavour of Fenghuang Dancong tea and chestnut sauce. As shown Fig. 3 that as milk dosage was 60 g, the score of Fenghuang Dancong tea and chestnut sauce was the highest. Hence, the optimal dosage of milk was 60 g, and the appropriate dosage of milk was 55 – 60 g.

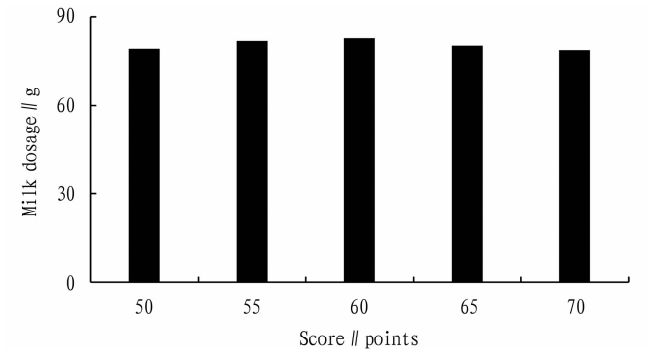


Fig. 3 Effects of milk dosage on the sensory quality of the finished product

(iv) Effects of the dosage of white sugar on Fenghuang Dancong tea and chestnut sauce. The effects of the dosage of white sugar on Fenghuang Dancong tea and chestnut sauce is shown in

Fig. 4. White sugar can adjust the taste of Fenghuang Dancong tea and chestnut sauce. If the dosage of white sugar was too high, Fenghuang Dancong tea and chestnut sauce was too sweet. The dosage of white sugar was too low, the sweetness of Fenghuang Dancong tea and chestnut sauce was insufficient, which didn't match the taste of tea. Seen from Fig. 4, when the dosage of white sugar was 5 g, the score of Fenghuang Dancong tea and chestnut sauce was the highest. Hence, the optimal dosage of white sugar was 5 g, and the appropriate dosage of white sugar ranged from 4 to 5 g.

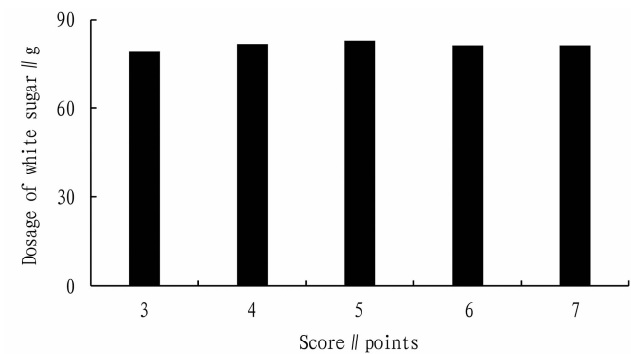


Fig. 4 Effects of the dosage of white sugar on the sensory quality of the finished product

3.1.2 Results of the orthogonal experiment. In order to comprehensively examine the influencing factors and determine the level table of influencing factors of Fenghuang Dancong tea and chestnut sauce, a four-factor and three-level orthogonal experiment was designed according to the results of the single factor experiment to optimize the formula of Fenghuang Dancong tea and chestnut sauce. The effects of tea, tea powder, milk and white sugar dosage on the quality of Fenghuang Dancong tea and chestnut sauce were studied to obtain the optimal formula of the product. The influencing factors and level of Fenghuang Dancong tea and chestnut sauce are shown in Table 2, and the results of the orthogonal experiment are shown in Table 3.

Table 2 Influencing factors and level design of Fenghuang Dancong tea and chestnut sauce

Level	Tea dosage	Dosage of tea powder	Milk dosage	Dosage of white sugar
1	3.5	1.5	55.0	4.0
2	4.0	2.0	60.0	5.0
3	4.5	2.5	65.0	6.0

It can be seen from Table 3 that the order of influencing factors of the quality of Fenghuang Dancong tea and chestnut sauce is as follows: A > D > B > C. The score of formula 7 was the highest (84.9 points), namely A₃B₁C₂D₂. The optimal formula obtained by calculation was A₃B₃C₂D₂. After comparison, the score of A₃B₁C₂D₂ was highest, and it was composed of 4.5 g of tea, 1.5 g of tea powder, 60 g of milk and 5 g of white sugar.

Table 3 Results of the orthogonal experiment

No. 1	A	B	C	D	Comprehensive score points
1	1	1	1	1	73.3
2	1	2	3	2	79.0
3	1	3	2	3	78.6
4	2	1	3	3	74.1
5	2	2	2	1	76.4
6	2	3	1	2	80.2
7	3	1	2	2	84.1
8	3	2	1	3	79.5
9	3	3	3	1	83.7
K ₁	76.97	77.17	77.67	77.80	
K ₂	76.90	78.30	79.70	81.10	
K ₃	82.43	80.83	78.93	77.40	
R	5.53	3.66	2.03	3.70	

4 Conclusions

The results show that the production process of Fenghuang Dancong tea and chestnut sauce includes selection of raw materials, preparation and other steps, among which the selection of raw materials and preparation were the key links. Through the comparison of different formulations and process conditions in the experiments, it is found that the best formula was composed of 4.5 g of tea, 1.5 g of tea powder, 60 g of milk and 5 g of white sugar. The Fenghuang Dancong tea and chestnut sauce had rich taste, sweet and delicious, as well as the unique fragrance of Fenghuang Dancong tea and the sweet aroma of chestnuts, and it can be as tea, hand gifts and other food. It can be seen from the results of the orthogonal experiment that the order of influencing factors of the quality of Fenghuang Dancong tea and chestnut sauce is as follows: tea dosage > dosage of white sugar > dosage of tea powder > milk dosage. Fenghuang Dancong tea and chestnut sauce not only has the advantages of high nutritional value and good taste, but also can increase the variety of sauces in the market.

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