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Research Paper

Study on the Formulation and Manufacturing Process of Medicine and Food Homologous Seasonings

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ABSTRACT: *With the continuous deepening of research on medicinal foods in China, medicinal foods are becoming more and more closely related to people's lives. This study focused on the production of three different medicine and food homologous seasonings bags, determines the best liquid-solid ratio and stewing time, and determines the content of their components. The results showed the best liquid-solid ratio of 1:40 and the best stewing time of 120min. The polysaccharide content was the highest in LHM group; total flavonoid content was the highest in GD group; and total phenol content was the highest in CRA group.*

KEYWORDS: *Medicine and Food Homologous; Seasonings; Polysaccharides; Total Phenols; Total Flavonoids*

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I. INTRODUCTION

In recent years, researches on food and medicine homology gradually increased. Not only the significant achievements have been made in the development and utilization of traditional food and medicine homologous ingredients, but there has also been active exploration of the application of modern food processing technology in food and medicine homologous products[1,2].

Varied food and medicine homologous resources could be utilized such as goji berries, jujubes, licorice, and cistanche. Utilizing these resources helps to develop food and medicine homologous products specific to the region, promoting the sustainable industrialization of these resources and enhancing the traditional Chinese medicine culture. Food and medicine homologous resources have certain advantages in pharmacological effects such as antioxidation, anti-inflammation, and immune modulation[3-5]. For instance, goji berries contain polysaccharides that can combat aging; licorice contains flavonoids with antioxidant properties, glycyrrhizic acid with anti-tumor effects, and licorice acid derivatives with antiviral activity. Licorice chalcone can induce apoptosis in rheumatoid arthritis synovial fibroblasts, while a licorice-pome peel compound provides protection against ultraviolet-induced skin photodamage. Cistanche contains polysaccharides with antioxidant properties, its petroleum ether fraction has anti-inflammatory activities, and its aqueous extract can relieve constipation, and the total glycosides of cistanche ethanol extract can protect the kidneys [6-8].

In this experiment, gradient studies were conducted on the liquid-solid ratio and simmering time of the cooking pouch. After parallel and single-factor experiments followed by sensory evaluations, the optimal water-to-solid ratio and simmering time were determined. The polysaccharides, total flavonoids, and total phenols in the soup, which contribute to its food and medicine homology properties.

II. MATERIALS AND METHODS

2.1 Preparation of the samples

（1）In this experiment, three kinds of food and medicine homologous seasonings bags were prepared (**CRA** group: consist of Codonopsis Root, Red Dates and Astragalus Root; **GD** group: consist of Goji Berries and Desert Ginseng; **LHM** group: consist of Lotus Seeds, Hawthorn and Mulberries;), and different liquid-solid ratios of 1:20, 1:30, 1:40, 1:50, and 1:60 were carried out. Each set of experiments is repeated three times in parallel.

（2）Based on the optimal liquid-solid ratio, conduct experiments with simmering times of 30 min, 60 min, 90 min, 120 min, and 150 min, each duration repeated three times in parallel. The sensory effects are averaged over the three trials.

2.2 Polysaccharide content determination

Weigh out 0.2 g of the seasonings after drying, add 50 times the volume of boiling water, reflux for 1 hour, and repeat once. Centrifuge the samples from the two refluxes at 4°C, 3000 $r \cdot min^{-1}$ for 30 minutes to obtain the supernatant. Add 95% ethanol at four times the volume of the supernatant, let it precipitate overnight at 4°C, centrifuge again at 4°C, 3000 $r \cdot min^{-1}$ for 10 minutes, and place the precipitate at 60°C to remove excess ethanol. Dissolve an appropriate amount of distilled water to dissolve the polysaccharide precipitate, pipette an appropriate amount of the polysaccharide solution into a cleaned test tube, and bring up to 2 mL with water. Add 1 mL of 5% phenol solution, shake well, then add 5 mL of concentrated sulfuric acid, quickly shake well, and place in a 25°C water bath for 30 minutes. Measure the optical density at 490 nm, and calculate the intracellular polysaccharide content per unit biomass based on the standard curve and measured optical density [9-13].

2.3 Total flavonoids content determination

Preparation of the Rutin Standard Curve: Accurately pipette 2, 3, 4, 5, and 6 mL of the standard stock solution into 25 mL volumetric flasks. Add purified water to reach a total volume of 6 mL. Add 1 mL of 5% sodium nitrite solution, shake well, and let it stand for 6 minutes. Then add 1 mL of 10% aluminum nitrate solution, shake well, and let it stand for another 6 minutes. Afterwards, add 10 mL of 4% sodium hydroxide solution, bring up to the mark with purified water, shake well, and let it stand for 10 minutes. Measure the absorbance at 510 nm using a reagent blank as the reference. Plot the absorbance on the vertical axis against the rutin mass concentration on the horizontal axis to create the standard curve [14-16].

2.4 Total phenolic content determination

Weigh accurately 0.0025 g of gallic acid reference standard and place it in a 25 mL volumetric flask. Dissolve with methanol to prepare a gallic acid reference stock solution with a concentration of 0.1004 mg/mL. Pipette accurately 1, 2, 3, 4, and 5 mL of the reference stock solution into separate 100 mL volumetric flasks, dilute to the mark with methanol, and mix well to obtain a series of gallic acid standard solutions. Pipette accurately 1 mL of each standard solution into separate 10 mL volumetric flasks, add 0.5 mL of Folin-Ciocalteu reagent, mix well, let it react for 5 minutes, then add 2 mL of 7.5% $NaCO_3$, bring up to the mark with purified water, and let it react in the dark for 30 minutes. Measure the absorbance at 765 nm using a reagent blank as the reference. Plot the absorbance on the vertical axis against the total phenolic mass concentration on the horizontal axis to create the standard curve [17,18].

2.5 Sensory evaluation

The comprehensive sensory score of the marinated soup is calculated using a 10-point scale quantitative weighted scoring method, with the weight distribution as follows: texture accounts for 0.40, aroma accounts for 0.15, color accounts for 0.15, umami flavor accounts for 0.15, and saltiness accounts for 0.15 [19]. Ten students are invited to conduct sensory evaluations, each time removing one highest and one lowest score, then calculating the average score [20]. This process is repeated three times in parallel experiments, and the final sensory score is determined by averaging the scores from the three repetitions..

III. RESULTS AND DISCUSSION

3.1 Sensory Evaluation Results

According to Table 1, there was a significant difference ($p < 0.05$) in the sensory scores of the seasoning solutions with different liquid-solid ratios for the CRA group. The seasoning solution with a liquid-solid ratio of 1:40 was significantly higher than the other groups, therefore, the optimal liquid-solid ratio for the CRA group was 1:40. According to Table 2, the sensory scores of the seasoning solutions with different stewing time varied. The seasoning solution with a stewing time of 120 min is significantly higher than the other groups, therefore, the optimal stewing time for the CRA group is 120 min.

Table 1 Sensory evaluation of seasoning bags with different liquid-solid ratios in CRA group

Liquid-solid ratio	Sensory scores
1：20	$5.91±0.57^{b}$
1：30	$6.67±0.09^{a}$
1：40	$7.33±0.3^{a}$
1：50	$5.76±0.41^{b}$
1：60	$5.70±0.44^{b}$

Table 2 Sensory evaluation of seasoning bags with different stewing time in CRA group

Stewing time	Sensory scores
30min	$5.11±0.19^{b}$
60min	$5.30±0.16^{b}$
90min	$5.98±0.09^{a}$
120min	$6.77±0.23^{a}$
150min	$5.98±0.61^{a}$

According to Table 3, there was a significant difference ($p<0.05$) in the sensory scores of the marinated soup with different water-to-solid ratios for the GD group. The marinated soup with a liquid-solid ratio of 1:40 was significantly higher than the other groups, therefore, the optimal liquid-solid ratio for the GD group was 1:40.

According to Table 4, there was a significant difference in the sensory scores of the seasoning solutions for GD group among different stewing time ($p<0.05$). The seasoning solutions stewed for 120 minutes significantly outperforms other groups; therefore, the optimal stewing time for the seasoning solutions in GD group was 120 minutes.

Table II Sensory evaluation of seasoning bags with different liquid-solid ratios in GD group

Liquid-solid ratio	Sensory scores
1:20	$6.22±0.11^{b}$
1:30	$7.14±0.04^{b}$
1:40	$7.60±0.45^{a}$

1:50	6.57±0.17[b]
1:60	6.14±0.24[b]

Table 4 Sensory evaluation of seasoning bags with different stewing time in GD group

Stewing time	Sensory scores
30min	5.15±0.39[b]
60min	5.60±0.51[b]
90min	6.17±0.56[b]
120min	7.64±0.49[a]
150min	6.42±0.59[a]

According to Table 5, there was a significant difference in the sensory scores of the seasoning seasoning solutions for LHM group among different liquid-solid ratios ($p < 0.05$). The soup with a liquid-solid ratio of 1:40 is significantly higher than other groups; therefore, the optimal liquid-solid ratio for LHM group is 1:40.

According to Table 6, there was a significant difference in the sensory scores of the seasoning solutions for LHM group among different stewing time ($p < 0.05$). The seasoning solutions stewed for 120 minutes was significantly higher than other groups; therefore, the optimal stewing time for the seasoning solutions in the LHM group was 120 minutes.

Table 5 Sensory evaluation of seasoning bags with different liquid-solid ratios in LHM group

Liquid-solid ratio	Sensory scores
1∶20	5.46±0.07c
1∶30	6.15±0.08b
1∶40	7.02±0.17a
1∶50	5.86±0.27b
1∶60	5.71±0.35b

Table 6 Sensory evaluation of seasoning bags with different stewing time in LHM group

Stewing time	Sensory scores
30min	5.83±0.36b
60min	5.75±0.11b
90min	5.91±0.28b
120min	6.63±0.22a
150min	6.16±0.14a

3.2 Total polysaccharide content

Table 7 indicates that there was no significant difference in polysaccharide content among different functional bags of edible and medicinal herbs ($p<0.05$), suggesting their consistency. The total polysaccharide content was the lowest in CRA group, compared with GD and LHM group. This may be attributed to the high proportion of hawthorn in the LHM bags, which contains a large amount of polysaccharides; while LHM group contains polysaccharides from goji berries, hawthorn, and mulberries, all of which are present in substantial amounts.

Table 7 The polysaccharide contents in different medicinal and food homologous seasoning bags

	Total polysaccharide content（mg/g）
CRA group	62.1±2.5c
GD group	129.0±3.4b
LHM group	275.7±2a

3.3 Total Flavonoid Content

Table 8 indicated that there was a significant difference in total flavonoid content among different food and medicinal homologous seasoning bags ($p<0.05$), with GD bag having significantly higher total flavonoid content than the other five groups. The GD bag contains kudzu root, which is rich in kudzu flavonoids.

Table 8 The effect of different medicinal and food homologous functional bags on absorbance and total flavonoid content

	Total flavonoid content（mg/g）
CRA group	2.7±0.05b
GD group	9.0±0.1a
LHM group	4.4±3.3b

3.4 Total phenolic content

There are significant differences in total phenol content among different medicinal and food homologous seasoning bags ($p < 0.05$), with the CRA bag having significantly higher total phenol content than the other five groups. The CRA bag contains high amounts of *Astragalus* and *Codonopsis*, which are rich in phenolic compounds.

Table 9 The total phenolic content in different medicinal and food homologous seasoning bags

	Total phenolic content（mgGAE/g）
CRA group	66.9±6.7a
GD group	3.3±0.5b
LHM group	5.6±0.1b

IV. CONCLUSION

There were significant differences in the sensory scores of three medicinal and food homologous seasoning groups of with different liquid-solid ratios ($p < 0.05$), and the score of seasoning solutions with a liquid-solid ratio of 1:40 was significantly higher than that of other groups, so the optimal liquid-solid ratio for all three groups was 1:40. The score of seasoning solutions stewed for 120 minutes was significantly higher. Therefore, the optimal stewing time for all three groups was 120 minutes. LHM group had the highest polysaccharide content among different medicinal and food homologous seasoning bags ($p < 0.05$). There were significant differences in total flavonoid content between different medicinal and edible homologous functional bags ($p < 0.05$), with the GD group having significantly higher total flavonoid content than the other groups. There were significant differences in total phenol content between different medicinal and food homologous functional bags ($p < 0.05$), with the GRA group having significantly higher total phenol content than the other groups.

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