

Development of Pilose Antler Compound Health Tea

Bing Yu^{1,2,3}, Fengqin He^{1,2,3} and Bo Wang^{1,2,3}

¹College of Biological and Environmental Engineering, Xi'an University, Xi'an 710065, China

²Key Laboratory of Genetic Engineering, Xi'an University, Xi'an 710065, China

³Xi'an Key Laboratory of Natural Product Development and Anticancer Innovative Drug Research in Qinling Mountains, Xi'an 710065, China

Keywords: Pilose Antler, Compound, Anti-Aging, Health Tea, Development.

Abstract: Pilose antler has a good anti-aging effect, but the traditional way of taking brings bad feelings and inactivation of active ingredient, in this paper, Astragalus membranaceus, Codonopsis pilosula, Eucommia ulmoides, Lycium barbarum, Poria coxburghii, Liquorice, Jujube, Tangerine peel, Coreopsis tinctoria. All these herbs and pilose antler are combined into three formulas, and then ,through single factor test and orthogonal test based on sensory evaluation, these three formulas were optimized, and finally three formula of pilose antler compound anti-aging health care tea were obtained. The optimal formula 1 is: Pilose antler 0.55g, Astragalus membranaceus 0.65g, Lycium barbarum 0.75g, Jujube 0.95g, Tangerine peel 0.85g, Coreopsis tinctoria 1.05g. The optimal formula 2 is: Pilose antler 0.55g, Codonopsis pilosula 0.75g, Poria cocos 0.35g, Lycium chinense 0.85g, Glycyrrhiza 0.25g, Coreopsis tinctoria 0.45g. The optimal formula 3 is: Pilose antler 1.05g, Polygonatum 0.95g, Eucommia ulmoides 0.95g, lycium chinense 0.95g, Glycyrrhiza 0.85g, Coreopsis tinctoria 0.85g.

1 INTRODUCTION

Because of the problem of aging population becomes more and more serious , anti-aging health care has a great demand, but there is still a lack of widely accepted products at present . Traditional Chinese medicine (TCM) theory holds that TCM is good at correcting the disorder between Yin and Yang, helping physical health, prolonging life (Wang, 2017; Xiang, 2019; Yu, 2019), it is very suitable for anti-aging health care. Pilose antler is the young horn of Sika deer in the growth stage, and its active substances include proteins, peptides, polysaccharide, lipids, bioamines, steroids and nucleosides, etc. Studies have proved that long-term consumption of pilose antler has reliable anti-aging effects (Ding, 1994; Zong, 2013; Liu, 2016). However, pilose antler has a strong fishy taste when eaten directly, and its protein, polypeptide and other active components will be destroyed when stewed at high temperature or soaked in alcohol. In recent years, with the advantages of adjustable taste and easy to take, tea bag has been widely used in health care products, Therefore, Research and development of a kind of pilose antler compound health tea bag, which

is effective and good taste, is a good solution to the above problems of pilose antler consumption (Zhang, 2017). Modern aging theory believes that aging is the result of multiple mechanisms acting on the body (Yu, 2019). Therefore, A compound of pilose antler with other herbs may have a better anti-aging effect, and it can also be easily flavored and reduced in cost. Considering that this anti-aging tea should be widely applicable to people of different genders, ages and constitutions, the compound must be mild temperament and good taste. Therefore, the herbs we selected should be limited to the catalog of medicinal and food homology, and it is also necessary to add some herbs to regulate the medicine nature and Season the taste. Based on the above principles, we selected the following herbs: Astragalus membranaceus, Codonopsis pilosula, Eucommia ulmoides, Lycium barbarum, Polygonatum, Poria coxburghii, Liquorice, Jujube, Tangerine peel, Coreopsis tinctoria (Huang, 2016; Xue, 2017; Zheng, 2019). According to the characteristics of these herbs, we combined these herbs and pilose antler to form three initial formulas. formula 1: Pilose antler, Astragalus membranaceus, Lycium chinense, Jujube, Tangerine peel, Coreopsis tinctoria; formula 2: Pilose

antler, *Codonopsis pilosula*, *Poria cocos*, *Lycium chinense*, *Glycyrrhiza*, *Coreopsis tinctoria*; formula 3: Pilose antler, *Polygonatum*, *Eucommia ulmoides*, *Lycium chinense*, *Glycyrrhiza*, *Coreopsis tinctoria*. In order to achieve the best taste for each formula, we optimize it by single factor test and orthogonal test which is based on sensory evaluation.

2 MATERIALS AND METHODS

2.1 Material

2.1.1 TCM Materials

Pilose antler (Lot. 20190902, Tongchuan Luyuan Industrial Co., LTD.); *Astragalus membranaceus*, *Codonopsis pilosula*, *Eucommia ulmoides*, *Lycium barbarum*, *Polygonatum*, *Poria coxburghii*, Liquorice, Jujube, Tangerine peel, (Lot.20190825, Xi 'an Common People Big Pharmacy East Hansen Road Store); *Coreopsis tinctoria* (Lot. 20190911, Xinjiang Baicaotang Pharmacy South Xinhua Road Store).

2.1.2 Instrument

Yhg-400-s Far-infrared Constant Temperature Quick Drying Oven, Shanghai Yuejin Medical Instrument

Co., LTD; FW100 High-speed Universal Crusher, Tianjin Tester Instrument Co., LTD; CP413 Electronic Balance, Ohaus Instrument; Corn Fiber tea bag, Zhejiang Ruikang Daily Necessities Co., LTD.

3 EXPERIMENTAL METHODS

3.1 Processing of Medicinal Materials

The slices of fresh pilose antler and other herbs were placed in a constant temperature drying oven at 45°C for 8h, and then the pilose antler was crushed to 120 mesh by a grinder, and the powder of other CMT was crushed to 80 mesh.

3.2 Formulation Optimization

3.2.1 Single Factor Test

Single factor test can help us determine the reasonable range of each ingredient in the formula (Li, 2015; Kang, 2005). According to the weight of each bag is 3g, we carried out a single factor test program with 6 factors and 5 levels (see table 1).

Table 1: Single factor test scheme.

number	A	B	C	D	E	F
1	0.2	0.5	0.5	0.5	0.5	0.5
2	0.5	0.5	0.5	0.5	0.5	0.5
3	0.8	0.5	0.5	0.5	0.5	0.5
4	1.1	0.5	0.5	0.5	0.5	0.5
5	1.4	0.5	0.5	0.5	0.5	0.5
6	0.5	0.2	0.5	0.5	0.5	0.5
7	0.5	0.5	0.5	0.5	0.5	0.5
8	0.5	0.8	0.5	0.5	0.5	0.5
9	0.5	1.1	0.5	0.5	0.5	0.5
10	0.5	1.4	0.5	0.5	0.5	0.5
11	0.5	0.5	0.2	0.5	0.5	0.5
12	0.5	0.5	0.5	0.5	0.5	0.5
13	0.5	0.5	0.8	0.5	0.5	0.5
14	0.5	0.5	1.1	0.5	0.5	0.5
15	0.5	0.5	1.4	0.5	0.5	0.5
16	0.5	0.5	0.5	0.2	0.5	0.5
17	0.5	0.5	0.5	0.5	0.5	0.5
18	0.5	0.5	0.5	0.8	0.5	0.5
19	0.5	0.5	0.5	1.1	0.5	0.5
20	0.5	0.5	0.5	1.4	0.5	0.5
21	0.5	0.5	0.5	0.5	0.2	0.5
22	0.5	0.5	0.5	0.5	0.5	0.5
23	0.5	0.5	0.5	0.5	0.8	0.5
24	0.5	0.5	0.5	0.5	1.1	0.5
25	0.5	0.5	0.5	0.5	1.4	0.5

26	0.5	0.5	0.5	0.5	0.5	0.2
27	0.5	0.5	0.5	0.5	0.5	0.5
28	0.5	0.5	0.5	0.5	0.5	0.8
29	0.5	0.5	0.5	0.5	0.5	1.1
30	0.5	0.5	0.5	0.5	0.5	1.4

Eighteen middle-aged and elderly people with rich tea drinking experience were invited to be judges. The tea bags were brewed for 3 minutes in

200 ml of 100 ° C water and then tasted and scored by the judges according to the scoring criteria in Table 2.

Table 2: Sensory evaluation criteria of Pilose antler Compound health tea

Indicator	Scale rule	Score
Soup color	Tea soup is red but not black, or a thicker golden yellow, bright color;	10~15
	Tea soup color dark red or light yellow;	5~10
	Tea soup color black red or nearly colorless;	0~5
Clarify	The tea soup was clear and transparent, and there was no precipitation after standing for 10min;	7~10
	Tea soup was slightly turbid, and a small amount of precipitation was precipitated after standing for 10min;	4~6
	The tea soup was turbid, and there was obvious precipitation after standing for 10min;	0~3
Smell	Pleasant aroma, sell not too weak or too strong, no smell of TCM;	10~15
	Aroma is too weak or too strong, with a little smell of TCM;	6~10
	There is no aroma or there is unpleasant smell of TCM;	0~5
Taste	The taste is harmonious and pleasant, long aftertaste, without TCM;	40~60
	The taste is not coordinated, the taste is weak or strong, with a little test of TCM;	20~40
	Uncoordinated taste, unpleasant, or strong taste of TCM;	0~20

3.2.2 Orthogonal Test

Based on the results of single factor tests, an orthogonal test with six factors and three levels could be designed. Tea preparation, bagging and labeling were carried out in accordance with the orthogonal test table. The evaluation was still carried out in accordance with the table 2, and the obtained scores were statistically processed to obtain the optimal formula^[11,12].

4 TEST RESULTS AND DISCUSSIONS

4.1 Single Factor Test

According to the results of single factor test, we obtained the reasonable range of each component of the three initial formulas, Shown in table 3.

Table 3: Appropriate ranges of each ingredient in formula 1-3

	A	B	C	D	E	F
Formula 1	Pilose antler	Astragalus membranaceus	Lycium chinense	jujube	Tangerine peel	Coreopsis tinctoria.
	0.55-0.75	0.55-0.75	0.55-0.75	0.85-1.05	0.85-1.05	0.85-1.05
Formula 2	Pilose antler	Codonopsis pilosula	Poria cocos	Lycium chinense	Glycyrrhiza	Coreopsis tinctoria
	0.55-0.75	0.55-0.75	0.25-0.45	0.85-1.05	0.25-0.45	0.25-0.45

Formula 3	Pilose antler	Polygonatum	Eucommia ulmoides	Lycium chinense	Glycyrrhiza	Coreopsis tinctoria
	0.85-1.05	0.85-1.05	0.85-1.05	0.85-1.05	0.85-1.05	0.85-1.05

4.2 Orthogonal Test

Table 4-6 shows the level design of orthogonal optimization test factors for formula 1-3.

Table 4: Orthogonal test factors and horizontal design of formula 1.

Level	Pilose antler	Astragalus membranaceus	Lycium chinense	Jujube	Tangerine peel	Coreopsis tinctoria.
1	0.55g	0.55g	0.55g	0.85g	0.85g	0.85g
2	0.65g	0.65g	0.65g	0.95g	0.95g	0.95g
3	0.75g	0.75g	0.75g	1.05g	1.05g	1.05g

Table 5: Orthogonal test factors and horizontal design of formula 2.

Level	Pilose antler	Codonopsis pilosula	Poria cocos	Lycium chinense	Glycyrrhiza	Coreopsis tinctoria
1	0.55g	0.55g	0.25g	0.85g	0.25g	0.25g
2	0.65g	0.65g	0.35g	0.95g	0.35g	0.35g
3	0.75g	0.75g	0.45g	1.05g	0.45g	0.45g

Table 6: Orthogonal test factors and horizontal design of formula 3.

Level	Pilose antler	Polygonatum	Eucommia ulmoides	Lycium chinense	Glycyrrhiza	Coreopsis tinctoria
1	0.85g	0.85g	0.85g	0.85g	0.85g	0.85g
2	0.95g	0.95g	0.95g	0.95g	0.95g	0.95g
3	1.05g	1.05g	1.05g	1.05g	1.05g	1.05g

The orthogonal test was designed according to L18(3⁶) orthogonal table, The results were shown in Table 7-9.

Table 7: Orthogonal test results of formula 1.

Number	Pilose antler	Astragalus membranaceus	Lycium chinense	Jujube	Tangerine peel	Coreopsis tinctoria	Comprehensive score
1	1	1	1	1	1	1	80.85417
2	1	1	2	2	3	3	86.18753
3	1	2	1	3	3	2	83.90899
4	1	2	3	1	2	3	84.25475
5	1	3	2	3	2	1	85.36488
6	1	3	3	2	1	3	83.04167
7	2	1	1	3	2	3	80.64583
8	2	1	3	1	3	2	86.41667
9	2	2	2	2	2	2	84.10417
10	2	2	3	3	1	1	79.72910
11	2	3	1	2	3	1	80.18753

12	2	3	2	1	1	3	78.47917
13	3	1	2	3	1	2	83.02083
14	3	1	3	2	2	1	79.06258
15	3	2	1	2	1	3	78.41667
16	3	2	2	1	3	1	84.10414
17	3	3	1	1	2	2	80.64583
18	3	3	3	3	3	3	78.47917
k1	82.339	82.101	81.41	80.379	82.076	81.934	
k2	82.123	82.917	81.969	82.976	81.969	81.444	
k3	81.556	81.072	82.711	82.735	82.004	82.711	
R	0.841	1.845	1.301	2.597	0.107	1.267	

From Table 7, the importance of factors affecting sensory evaluation of formula 1 is as follows: Jujube > Astragalus membranaceus > Lycium chinense > Coreopsis tinctoria > Pilose antler >

Tangerine peel. The optimal formula 1 is: Pilose antler 0.55g, Astragalus membranaceus 0.65g, Lycium barbarum 0.75g, Jujube 0.95g, Tangerine peel 0.85g, Coreopsis tinctoria 1.05g.

Table 8: Orthogonal test results of formula 2.

Number	Pilose antler	Codonopsis pilosula	Poria cocos	Lycium chinense	Glycyrrhiza	Coreopsis tinctoria	Comprehensive score
1	1	1	1	1	1	1	87.9375
2	1	1	2	2	3	3	84.75367
3	1	2	1	3	3	2	86.14583
4	1	2	3	1	2	3	86.81251
5	1	3	2	3	2	1	85.64583
6	1	3	3	2	1	3	86.64538
7	2	1	1	3	2	3	89.75486
8	2	1	3	1	3	2	84.27083
9	2	2	2	2	2	2	85.83333
10	2	2	3	3	1	1	80.54167
11	2	3	1	2	3	1	84.77083
12	2	3	2	1	1	3	87.10417
13	3	1	2	3	1	2	84.85412
14	3	1	3	2	2	1	81.10414
15	3	2	1	2	1	3	80.37560
16	3	2	2	1	3	1	87.10419
17	3	3	1	1	2	2	80.54167
18	3	3	3	3	3	3	85.83333
k1	85.208	85.167	84.378	86.007	85.226	84.788	
k2	84.240	83.514	86.323	84.069	84.146	83.767	
k3	84.556	85.323	83.362	83.927	84.632	85.448	
R	0.968	1.809	3.021	2.088	1.083	1.681	

From Table 8, the importance of factors affecting sensory evaluation of formula 2 is as follows: Poria cocos > Lycium chinense > Codonopsis pilosula > Coreopsis tinctoria > Glycyrrhiza > Pilose antler. The optimal formula 2 is: Pilose antler 0.55g, Codonopsis pilosula 0.75g, Poria cocos 0.35g,

Lycium chinense 0.85g, Glycyrrhiza 0.25g, Coreopsis tinctoria 0.45g.

Table 9: Orthogonal test results of formula 3.

Number	Pilose antler	Polygonatum	Eucommia ulmoides	Lycium chinense	Glycyrrhiza	Coreopsis tinctoria	Comprehensive score
1	1	1	1	1	1	1	80.29167
2	1	1	2	2	3	3	81.27038
3	1	2	1	3	3	2	81.20833
4	1	2	3	1	2	3	75.68735
5	1	3	2	3	2	1	81.33333
6	1	3	3	2	1	3	78.62568
7	2	1	1	3	2	3	83.31521
8	2	1	3	1	3	2	88.18557
9	2	2	2	2	2	2	78.04167
10	2	2	3	3	1	1	80.60417
11	2	3	1	2	3	1	83.43755
12	2	3	2	1	1	3	83.89583
13	3	1	2	3	1	2	81.43750
14	3	1	3	2	2	1	84.75564
15	3	2	1	2	1	3	84.04176
16	3	2	2	1	3	1	80.91667
17	3	3	1	1	2	2	84.75534
18	3	3	3	3	3	3	83.43753
k1	81.785	80.375	81.042	82.309	82.865	82.938	
k2	80.979	83.955	82.448	82.333	80.632	82.101	
k3	83.108	81.542	82.382	81.229	82.375	82.233	
R	2.129	3.580	1.406	1.104	2.233	0.695	

From Table 9, the importance of factors affecting sensory evaluation of formula 3 is as follows: Polygonatum > Glycyrrhiza > Pilose antler > Eucommia ulmoides > Lycium chinense > Coreopsis tinctoria. The optimal formula 3 is: Pilose antler 1.05g, Polygonatum 0.95g, Eucommia ulmoides 0.95g, Lycium chinense 0.95g, Glycyrrhiza 0.85g, Coreopsis tinctoria 0.85g.

4.3 Discussions

Pilose antler is a kind of traditional Chinese medicine, it is often used in tonic prescriptions. The effective ingredients of Pilose antler include protein polypeptide, amino acid, polysaccharide, biological amine, steroid and lipid. Protein polypeptides are the main active components of Pilose antler, Enzymes and growth factors in protein polypeptides are the main anti-aging components, Enzymes include Superoxide dismutase (SOD), Catalase (CAT), Monoamine oxidase (MAO), All these enzymes have good anti-oxidation and anti-aging effects. Growth factors, including insulin-like growth factor, epidermal growth factor, etc., can enhance cell function and promote tissue regeneration. The polysaccharide in pilose antler include chondroitin sulfate, acid mucopolysaccharides, neutral sugars, galactosamine and so on, which often have antioxidant effects. Antler polyamine can resist lipid

peroxidation and promote the synthesis of nucleic acid and protein. The steroids in pilose antler include estradiol, cholesterol, 5 α -Male sterane-1,3-diketone, and testosterone, which can compensate for the decline in hormone levels associated with aging^[4-6]. Astragalus membranaceus, Codonopsis pilosula, Eucommia ulmoides, Lycium barbarum, Poria coxburghii, Liquorice, Jujube, Tangerine peel, Coreopsis tinctoria, these herbs are rich in ketones, phenols, polysaccharides which can effectively remove free radicals, enhance the vitality of SOD, and reduce the lipid peroxide^[8-10]. Therefore, these compounds can effectively anti-aging.

5 CONCLUSION

Based on the results and discussions presented above, the conclusions are obtained as below:

(1) The optimal formula 1 is: Pilose antler 0.55g, Astragalus membranaceus 0.65g, Lycium barbarum 0.75g, Jujube 0.95g, Tangerine peel 0.85g, Coreopsis tinctoria 1.05g. The optimal formula 2 is: Pilose antler 0.55g, Codonopsis pilosula 0.75g, Poria cocos 0.35g, Lycium chinense 0.85g, Glycyrrhiza 0.25g, Coreopsis tinctoria 0.45g. The optimal formula 3 is: Pilose antler 1.05g, Polygonatum 0.95g, Eucommia ulmoides 0.95g, Lycium chinense 0.95g, Glycyrrhiza 0.85g, Coreopsis tinctoria 0.85g.

(2) These three formulas of pilose antler compound health care tea have the following characteristics: soup was clear, red in color, mellow and delicious in taste, with a slight aroma, without the taste of Chinese medicine.

(3) We will conduct further studies on the anti-aging efficacy of these three formulas in the future.

tinctoria [J]. Science and Technology of Food Industry, 2019 (13): 335-339.

ACKNOWLEDGMENTS

This work was financially supported by the Xi 'an Science and Technology Planning Project

REFERENCES

- Ding Kexiang, Chen Huadong. Anti-aging effect and mechanism of antler antler [J]. Chinese Journal of Gerontology, 1994, 14(02):108-110.
- Huang Bin, Liu Renghai, Liu Wei, et al. Progress of Singer Chinese Herb in Anti-aging [J]. Chinese Archives of Traditional Chinese, 2016, 34 (12): 2874-2877.
- Kang Mengli, Xue Xuchu, Chen Huiyun, et al. Resarch of Compound teabag [J]. Academic Periodical of Farm Products Processing, 2005 (8): 36-40.
- Liu Jia, Zhao Haiping, Li Chunyi. Research Progress in Compositions of Deer Velvet Antler [J]. Special Wild Economic Animal and Plant, 2016 (4): 50-54.
- Li Dongbo, Zhou Tianlin. Development of Honeysuckle Chrysanthemum and Acanthopanax teabag [J]. Gansu Science and Technology, 2015, 31(06):107-110.
- Wang Xuquan, Xu Rongpeng, Ren Haitao. A complete collection of Chinese medicine ointments [M]. Beijing. China Medical and Technology Publishing, 2017:1-2.
- Xiang Minhong, Wen Hang, Zhao Yanqing, et al. The understanding of aging in traditional Chinese medicine and its research progress [J]. China Medical Herald, 2019, 16(09):47-51.
- Xue Liying, Gao Li, Qin Xuemei, et al. A Review of Recent Literature on Anti-aging Activity of Medicinal and Edible Traditional Chinese Herbs [J]. Food Science, 2017, 38 (15): 302 -309.
- Yu Bing, Wang Bo. Progress in Research and Development of Anti-aging and Health-care Drugs of Traditional Chinese Medicine [J]. Journal of Xi'an University (Natural Science Edition), 2019, 22(5):82-84.
- Zong Ying, Liu Tong, Wang Zhiying, et al. Study on the components and pharmacological action of antler polypeptide [J]. Jilin Journal of Chinese Medicine, 2013, 33 (11): 1135-1137.
- Zhang Ziyang, Wei Danni, Li Haonan, et al. Market analysis of Traditional Chinese medicine health tea [J]. Co-Operative Economy & Science, 2017(13):74-75.
- Zheng Xiaoman, He Xiaoyun. Research Progress on Chemical Composition and Efficacy of Coreopsis