

Development of a Novel Compound Herbal Liquid Shampoo for Improving Oily Scalp

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Abstract [Objectives] To address the issues of oily scalp and adverse reactions (such as scalp sensitivity and redness) caused by shampoos containing chemical ingredients, a pure natural herbal liquid shampoo formulated with 19 Chinese medicinal herbs was developed. Compared with shampoos primarily composed of chemical additives and containing single or multiple herbal extracts, this formulation compensates for the limitations of existing products such as single function of removing oil and is cost-effective, highlighting the advantages of traditional Chinese medicine. [Methods] The finished product was prepared using a base of 19 Chinese medicinal herbs as the main ingredients, supplemented with plant- and animal-derived surfactants such as seaweed polysaccharides and conditioning agents. The conditioning performance and user experience of the product were evaluated through a combination of mouse water-oil tests, microscopic visual assessment of hair, and participant self-assessment data. [Results] After using this product, the oil level in mice significantly decreased. The scalp oiliness scores of participants also showed a marked reduction. [Conclusions] This product demonstrates remarkable cleaning and oil-removing efficacy. However, its hair growth-promoting, anti-hair loss, and hair-blackening effects require further validation. This study provides a new formulation concept for individuals seeking to reduce dependence on chemical ingredients in shampoos or those experiencing adverse reactions.

Key words Application of traditional Chinese medicine; Daily chemical product; Compound herbal shampoo; Preparation of herbal liquid shampoo; Application of novel raw materials; Modular formulation

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The shampoo market is trending toward products containing herbal extracts. For example, Li Lingang, based on a basic shampoo formulation, selected tea saponin extracted from tea plants and compounded it with the surfactant AES to improve the shampoo's cleaning performance^[1]. However, the extraction process of tea saponin is complex, and its market price is relatively high. Ma *et al.*^[2] applied a water extraction method to extract the juice of morning glory vines and added it to shampoo, which exhibited a certain cleaning effect and improved hair smoothness. Although some products have shown efficacy, issues such as a single target and certain adverse reactions still exist. Currently, the preparation technology for incorporating herbs and traditional Chinese medicine extracts into shampoos remains underdeveloped.

Shampoos currently on the market have a serious problem of excessively high dioxane content, and the presence of this ingredient in shampoos can have negative effects on human health^[3]. This significantly reduces the safety of chemical hair care products. Shampoos currently available on the market are primarily based on chemical syntheses such as alkylbenzene sulfonates, α -olefin sulfonates, and linear alcohol sulfates^[4]. Innovative products characterized by natural ingredients, non-irritation, environmental friendliness, and high quality have greater market potential.

With the continuous improvement in living standards, consumer demand for shampoo has evolved from simple functions such as relieving itching, degreasing, and anti-dandruff to more specific "skin-care" hair care needs, including restoration, anti-hair loss, volumizing, and fluffing^[5]. From the perspective of the green centrality of the product itself, the price of green shampoo products is generally higher than conventional shampoo products^[6]. The research and development of affordable herbal liquid shampoo has become an important trend in the industry.

The innovation of this study shifts the focus to a current hot topic in modern science, the scalp micro-ecology. The formulation of this compound herbal liquid shampoo is an original scientific prescription. Developed under the guidance of traditional Chinese medicine (TCM) professors, it takes into account clinical needs and practical experience. Grounded in the core TCM theories that "the lung governs the skin and hair" and "the kidney manifests in the luster of the hair", the formula was designed to address common scalp issues such as excessive oiliness, seborrheic dandruff, and sensitive redness. Based on the core functional requirements of "clearing heat and dampness, cooling blood and promoting hair growth, and regulating oil production and inhibiting bacteria", a total of 19 Chinese herbs were selected and rationally combined. The formulation not only draws on classical records from the *Compendium of Materia Medica*, such as the "hair growth-promoting and blackening" effects of *Platycladi Cacumen* and the "wind-removing and dirt-cleaning" property of *Sapindi Mukorossi Fructus*, but also incorporates findings from modern pharmacological research. It is not a direct citation of ancient formulas, but an innovative combination integrating theory and practice. This results in a two-dimensional mechanism involving hair follicle nutrient

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supply and keratin barrier repair, which helps regulate microbial balance and achieves synergistic efficacy from symptom relief to root-cause conditioning. The scientifically formulated water decoction of traditional Chinese medicine serves as the base, offering natural properties, safety, and functionality. It avoids the potential risks associated with adding herbal extracts to shampoos containing conventional chemically synthesized ingredients and provides greater comprehensive advantages than single-component Western medicines. Leveraging the multi-target synergistic mechanisms of traditional Chinese medicine theory and modern batch preparation processes, the product is cost-effective and meets the urgent market demand for green shampoos.

Materials and Methods

Experimental materials

Instruments Electronic balance (Dongguan Kuzhu Electronics Co. , Ltd.); mixer (Foshan Ruiyi E-commerce Co. , Ltd.); beaker, glass rod (Zhengzhou Shengke Experimental Instrument Co. , Ltd.); plastic wrap; packaging bags (Jinhua Aoxi Daily Necessities Co. , Ltd.); Tongfengli portable pH meter (Huizhou Xingweiqiang Hardware Tools Co. , Ltd.); digital microscope

W01A (Shenzhen Likelong Technology Co. , Ltd.); digital moisture tester YN-19 (Hefei Yina E-commerce Information Co. , Ltd.); refrigerator; induction cooker.

Reagents Following the formulation principles of shampoo, and through blending, experimentation, and selection of raw materials, the final shampoo formulation used in this study is shown in Table 1. The Chinese medicinal materials were purchased from an ordinary health drugstore, and the following raw materials are of cosmetic grade.

Experimental methods

Preparation of herbal extract The 19 herbs were cleaned, and weighed according to the formulation table. They were dried, crushed, sterilized, and mixed into fine powder. The mixed powder was added into a medicine bag and immersed in water (2 – 3 cm above the powder) for 30 min. After the powder was fully hydrated, it was transferred to a decoction pot. Four liters of clean water were added, and the mixture was first boiled over high heat. Once boiling, the heat was reduced to low and the decoction was simmered for 30 min. After decoction, the herbal extract was sealed, packaged, and cooled.

Table 1 Formulation of the 19herb compound liquid shampoo

Ingredients	Sample content // %	Weight g	Efficacy
Gleditsiae Fructus	5	250	Resolving phlegm, opening orifices, dissipating nodules, and reducing swelling ^[7]
Ligustri Lucidi Fructus	2	100	Nourishing liver and kidney, improving eyesight, and darkening hair ^[7]
Artemisiae Argyi Folium	2	100	Removing dampness and relieving itching ^[7]
Angelicae Sinensis Radix	2	100	Tonifying blood, activating blood circulation, regulating menstruation, and alleviating pain ^[7]
Moutan Cortex	1	50	Clearing heat, cooling blood, activating blood circulation, and removing blood stasis ^[7]
Polygoni Multiflori Radix Preparata	3	150	Tonifying liver and kidney, replenishing essence and blood, and darkening hair and beard ^[7]
Citri Reticulatae Pericarpium	2	100	Drying dampness and resolving phlegm ^[7]
Sophorae Flavescents Radix	2	100	Treating skin itching ^[7]
Platycladi Cacumen	7	300	Promoting hair growth, darkening hair, and treating premature greying of hair and beard ^[7]
Drynariae Rhizoma	2	100	External use: dispelling wind, removing spots, and treating alopecia areata ^[7]
Mori Folium	2	100	Dispersing wind-heat ^[7]
Ecliptae Herba	3	150	Nourishing liver and kidney, cooling blood, and stopping bleeding ^[7]
Menthae Haplocalycis Herba	2	100	Dispersing wind-heat and promoting eruption ^[7]
Camelliae semen meal	7	300	Removing dirt, killing bacteria, and reducing inflammation ^[8]
Spirodela Herba	4	200	Promoting hair growth ^[9]
Sapindi Mukorossi Fructus	7	300	Dispelling wind, improving eyesight, removing dirt and spots ^[9]
Mori Cortex	2	100	Preventing hair loss ^[9]
Rosmarini Folium	2	100	Improving alopecia ^[10]
Herba Speranskiae Tuberculatae	2	100	Anti-inflammatory and antibacterial ^[11]
Polyol antimicrobial agent	0.6	30	Antibacterial and preservative ^[12]
Stabilizer	0.2	10	Maintaining solution stability
Moisturizing factor	1.2	60	Moisturizing and hydrating ^[13]
Sodium lauroyl amino acid	30	1.5 L	Thickening the liquid ^[14]
Amino acid thickener	3	150	Thickening the liquid ^[14]
Seaweed polysaccharide	0.8	40	Thickening the liquid ^[15]
Silk protein peptide	1.6	80	Moisturizing and preventing dryness ^[16]
Tea polyphenol	0.6	30	Antibacterial and anti-inflammatory ^[17]

The sealed herbal extract was poured into a beaker, and sodium lauroyl amino acid, polyol antimicrobial agent, stabilizer, moisturizing factor, seaweed polysaccharide, amino acid thickener, silk protein peptide, and tea polyphenol were added according to the formulation and thoroughly mixed. The mixture was aerated and stirred with a mixer to generate bubbles. It was stirred thoroughly until a high-density foam formed, then covered with plastic wrap and sealed, and cooled to stabilize the product. After the foam dissipated, the liquid became gel-like. At this point, it was heated in a water bath. When tiny bubbles began to emerge, an appropriate amount of fragrance was added and mixed evenly. The pH of the shampoo was adjusted to suit the scalp and hair environment and it was then poured into sealed bags for packaging. The prepared shampoo was tested for appearance, odor, and pH to ensure the product met the required standards.

Sensory and physical and chemical indicator testing According to the provisions of the shampoo standard (GB/T 29679-2013), a stability test was conducted on the prepared shampoo. Two randomly selected finished products were poured into six beakers. Three beakers were placed in a 40 °C water bath, and other three were stored in a refrigerator at 0 °C. After 24 h, the samples were taken out and allowed to return to room temperature before observation.

Mouse skin test method In this study, five male SPF-grade ICR mice (C57BL/6 strain), aged 10 weeks and weighing 12 (± 3) g, with intact skin, were purchased from Hunan SJA Laboratory Animal Co., Ltd. The mice were housed in the clean-grade animal facility of Guangxi University of Chinese Medicine at a temperature of 25 °C, with a relative humidity of 50% – 70%, and a 12-h light/dark cycle. During the experimental period, the mice were fed a maintenance diet and provided with free access to food and water. After taking out the mice, a water-oil tester was used to measure the initial moisture and oil levels. The abdominal hair and skin were moistened, and then cleaned with clear water or the herbal shampoo solution. After gently massaging for 3 – 5 min, the shampoo solution group was rinsed clean with clear water. After cleaning, the hair was dried, and a digital moisture tester (YN-19) was used to measure the moisture and oil levels of the mice's abdominal skin and hair, with the detection parameters set to default. All animal experiments in this study were conducted in strict accordance with the 3R principles of animal ethics.

Participants Our group conducted a survey on the hair health status of young people. A total of 66 complete data were collected. The questionnaire included questions on basic information, expectations, scalp health, and other aspects. Based on the survey results, 26 participants aged 18 to 21 years were recruited.

The inclusion criteria were as follows: (1) individuals aged 18 to 60 years with oily scalp; (2) those without allergic diseases or a history of allergies to cosmetics or other topical preparations; (3) those who voluntarily agreed to participate in the trial, actively cooperated with product use, and signed an informed consent

form after reading and understanding its contents. The volunteers were instructed to avoid using the product during their menstrual cycle. They were advised to maintain a regular daily routine and to refrain from unhealthy lifestyle habits, vigorous exercise, direct sunlight exposure, and other factors that could affect the test results. All participants had washed their hair on the evening prior to the test day.

Participant testing method

Usage by participants Each time the volunteers washed their hair, they directly applied the product to their wet hair and scalp, gently massaged for 3 – 5 min, and then rinsed their hair and scalp with clear water. The frequency of use was once every 2 – 3 d.

Participant self-assessment and observation Before using the shampoo and after 21 d of use, the scalp condition of the volunteers at a fixed site was photographed using a digital microscope under constant indoor conditions of (20 ± 1) °C and 50% relative humidity while the participants were seated quietly. The effectiveness of the shampoo on issues such as excessive sebum accumulation in pores and scalp redness was observed^[18].

On the theoretical basis, volunteers were asked to conduct a self-assessment of their scalp and hair condition 24 h after washing their hair with the shampoo. The evaluation indicators included scalp tightness, scalp dryness, scalp oiliness, hair roughness and dryness, hair fragility and breakage, hair frizz and split ends, and hair tangling (rating scale for the above: 1 = good, 2 = relatively good, 3 = moderate, 4 = poor, 5 = relatively poor); hair elasticity, scalp moisturization, hair luster, smoothness when combing with fingers, hair freshness, moisturizing sensation, and hair softness (rating scale for the above: 1 = poor, 2 = relatively poor, 3 = moderate, 4 = relatively good, 5 = good); degree of scalp itching (rating scale: 1 = severe, 2 = moderate, 3 = mild, 4 = no); and satisfaction with the product's effect on the scalp and hair (assessed only on day 21, rating scale: satisfied, relatively satisfied, moderate, relatively dissatisfied, dissatisfied)^[19].

Mouse data statistics Data analysis was performed with SPSS statistical software. Before statistical analysis, each parameter was tested for normal distribution. If the test data followed a normal distribution, paired-sample T-tests were conducted for within-group comparisons, and independent-sample T-tests were adopted for inter-group comparisons. If the test data did not follow a normal distribution, the rank-sum test was used for statistical analysis. All statistical methods employed two-tailed tests, with a significance level of $\alpha = 0.05$.

Results and Analysis

Evaluation of sensory and physical and chemical indicator tests

The results are shown in Table 2. The findings indicate that the prepared compound herbal liquid shampoo meets the standard requirements for all sensory and physical and chemical indicators.

Mouse test results

As shown in Table 3, the results of the independent-sample *T*-test revealed that immediately after washing, the oil reduction in the herbal shampoo group (group 2) was significantly greater than that in the clear water group (group 1) ($P < 0.05$). Regarding the

sustained effect after 10 min, the herbal shampoo group demonstrated better long-lasting oil control, with a significantly greater change in oil level than the clear water group ($P < 0.05$), indicating that the herbal shampoo can more effectively inhibit sebum secretion over time and provide better moisturization.

Table 2 Evaluation of the shampoo

	Indicator Name	Standard Requirement	Testing result	Evaluation of single item
Sensory indicators	Appearance	No foreign matter	No foreign matter	Qualified
	Color	Complies with specified color	Brown	Qualified
	Fragrance	Complies with specified fragrance	Meets fragrance requirement	Qualified
Physical and chemical indicators	Heat resistance	No stratification after being kept at (40 ± 1) °C for 24 h and then returned to room temperature	No significant change	Qualified
	Cold resistance	No stratification after being kept at (− 8 ± 2) °C for 24 h and then returned to room temperature	No significant change	Qualified
	pH	4.5 – 8.5	6.77 ± 0.3	Qualified

Table 3 Statistical results

Indicator	Sample size (group 1/ group 2)	Mean (group 1/group 2)	Standard deviation (group 1/ group 2)	Homogeneity of variances (<i>F</i> value/ <i>P</i> value)	Results of <i>t</i> -test (<i>t</i> value/ <i>df</i> / <i>P</i> value)	Statistical significance between groups
Moisture change value afer washing	4/4	7.575/7.950	0.050 8/0.051 96	<i>F</i> = 0.000, <i>P</i> = 1.000	<i>T</i> = − 1.034, <i>df</i> = 6, <i>p</i> = 0.341	No ($P > 0.05$)
Moisture change value at 10 min afer washing	4/4	5.325/6.950	0.094 65/0.037 86	<i>F</i> = 3.411, <i>P</i> = 0.114	<i>T</i> = − 3.188, <i>df</i> = 6, <i>P</i> = 0.019	Yes ($P < 0.05$)
Oil change value afer washing	4/4	− 0.090/ − 0.322 5	0.078 74/0.050 58	<i>F</i> = 0.270, <i>P</i> = 0.622	<i>T</i> = 4.949, <i>df</i> = 6, <i>P</i> = 0.003	Yes ($P < 0.05$)
Oil change value at 10 min afer washing	4/4	− 0.150/ − 0.350	0.098 32/0.042 43	<i>F</i> = 6.231, <i>P</i> = 0.047 (unequal variances)	<i>T</i> = 3.735, <i>df</i> = 4.080, <i>P</i> = 0.019 (equal variances not assumed)	Yes ($P < 0.05$)

Results of the questionnaire survey

In the survey, male participants accounted for 27.27%, and female participants accounted for 72.73%. The majority were aged 18 – 25 years. The questionnaire results showed that 87.88% of participants were concerned about hair and scalp health issues, 71.21% experienced trouble with oily hair, and 78.79% suffered from hair loss. Staying up late is a major contributing factor to hair loss. Fig. 1 shows that learning, office work, and entertainment activities such as watching Douyin are significant reasons for staying up late, causing considerable distress among young people. As many as 84.85% of participants expressed a desire to take measures to improve the situation. As shown in Fig. 2, most people wish to improve by adjusting their daily routine and relieving stress. However, if they are unable to relax, using targeted shampoos and massaging the scalp are also popular choices among the majority. As shown in Fig. 3, consumers' primary concerns when choosing a shampoo are efficacy and ingredients, followed by brand. According to Fig. 4, well-known hair care brands such as L'Oréal and Schwarzkopf have greater influence, while products containing herbal ingredients receive relatively less attention.

Participant self-assessment results

Fig. 5 shows that the mean scores for scalp tightness, dryness,

and oiliness decreased from their initial higher values (*e.g.*, 4.50) to approximately 2.50, indicating that the shampoo had a certain effect on relieving scalp tightness, dryness, and oiliness in a short time. The mean score for scalp itching was 3.00, suggesting that the shampoo demonstrated acceptable immediate efficacy in relieving scalp itching. The mean scores for hair roughness and dryness, fragility and breakage, frizz and split ends, and hair tangling decreased from an initial value of 4.50 to 3.00, indicating that the shampoo provided initial relief for hair quality issues in the short term. The mean scores for hair elasticity, luster, moisturizing sensation, and softness were 3.50, suggesting that the shampoo could temporarily improve hair feel and shine. The mean scores for smoothness and freshness were 4.00, indicating that the shampoo performed well in providing immediate softness and oil control, meeting users' needs for a short-term refreshing experience.

The subjective evaluation results obtained after participants used the shampoo showed that it effectively improved hair smoothness, freshness, and luster within 24 h, with a relatively noticeable oil-control effect. These findings align with users' needs for immediate cleansing and appearance enhancement.

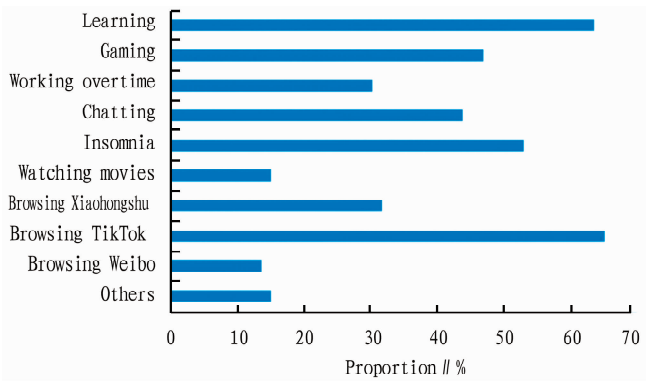
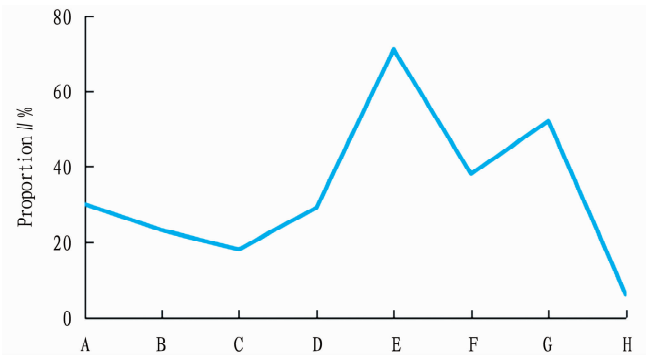


Fig. 1 Primary reasons for staying up late



A. Using hair tonic or hair mask; B. Taking no measures; C. Choosing a high-quality hair dryer; D. Herbal health regimen; E. Adjusting daily routine and relieving stress; F. Using targeted shampoo; G. Frequent brushing and scalp massage; H. Others.

Fig. 2 Solutions for scalp health

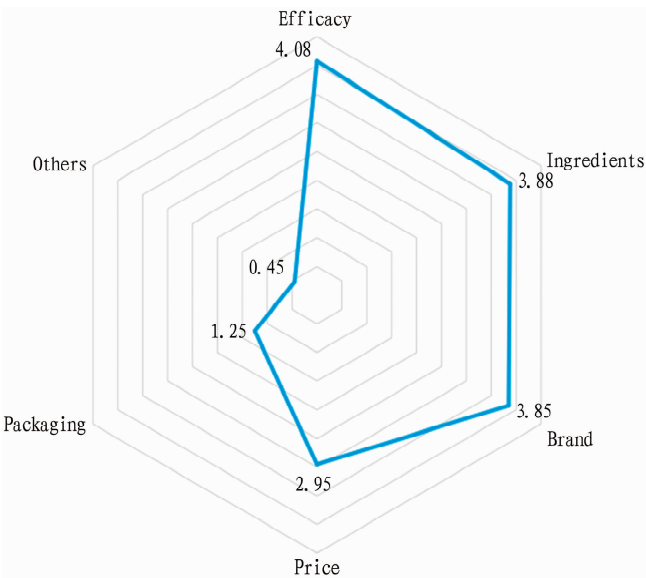


Fig. 3 Main factors influencing shampoo choice

Conclusions and Discussion

This study evaluated the efficacy and safety of the shampoo from multiple perspectives. In the mouse tests, the herbal shampoo group effectively removed oil while maintaining good moisture balance in the hair. Overall, the herbal shampoo group was signif-

icantly superior to the clear water group in terms of cleaning efficiency, durability, and moisturizing performance. After 21 d of using the herbal liquid shampoo, participants generally approved of the product and agreed that it provided a good cleaning effect, with its oil-removing and fluffing properties being well recognized. Combined with the subjective evaluation results, this indicates that the product has good moisturizing and oil-removing effects. However, the sample size in this experimental study was limited, and certain limitations still exist.

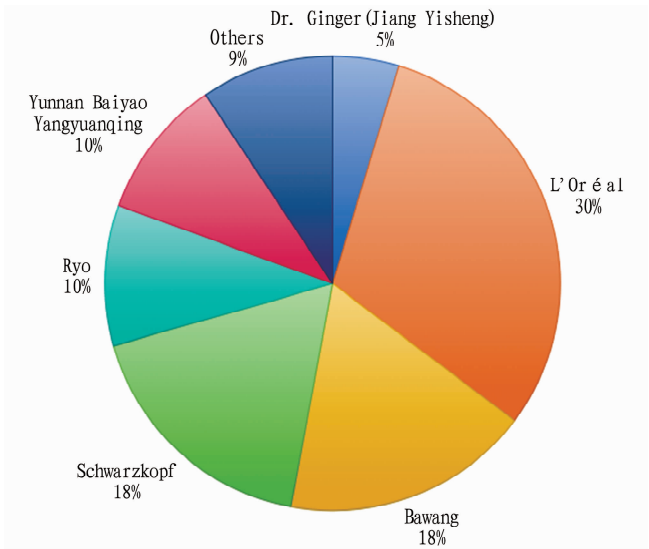


Fig. 4 Attention to daily hair care products

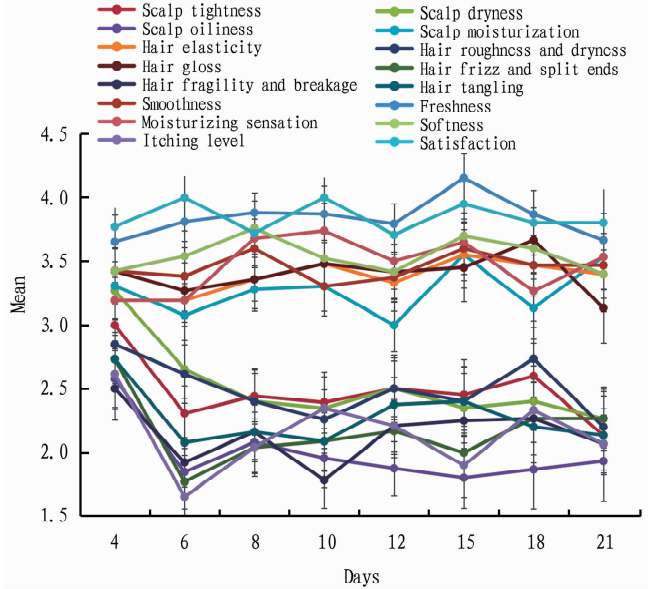


Fig. 5 Performance of the shampoo

Analysis of herbal composition and functions

The active ingredients complement each other to provide comprehensive hair care. In specific, Fructus Ligustri Lucidi, Polygoni Multiflori Radix Preparata, and Ecliptae Herba nourish the liver and kidneys, replenish essence and blood, and promote dark hair

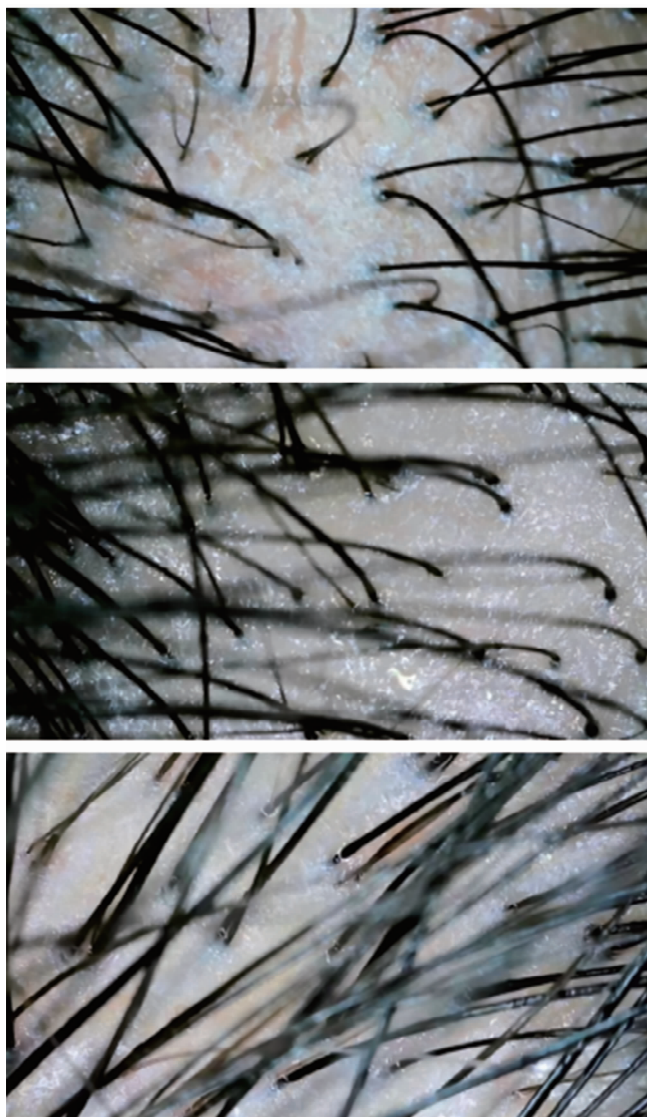


Fig. 6 Before use (50 ×)



Fig. 7 After use (50 ×)

growth. *Platycladi Cacumen* stimulates hair growth, darkens hair, and improves premature graying. *Drynariae Rhizoma*, when applied externally, helps treat alopecia areata. Together, these herbs synergistically address the root causes of gray hair and hair loss. Preventing hair loss and strengthening hair: *Cortex Mori* prevents hair loss, while *Rosmarini Folium* improves alopecia. When combined with *Angelicae Sinensis Radix*, which replenishes blood and activates blood circulation, and *Moutan Cortex*, which promotes blood circulation and removes stasis, these herbs enhance scalp blood circulation, provide nutrients to hair follicles, and reduce hair loss. In addition, *Drynariae Rhizoma* and *Herba Speranskiae Tuberculatae* dispel wind, remove spots, and exhibit anti-inflammatory and antibacterial effects, which also help alleviate alopecia areata and other hair loss conditions. Itching-relieving, anti-inflammation and antibacterial effects: *Artemisiae Argyi Folium* removes dampness and relieves itching; *Sophorae Flavescens*

Radix externally treats skin itching; *Herba Speranskiae Tuberculatae* provides antiinflammatory and antibacterial effects; polyol antimicrobial agents and tea polyphenols offer antimicrobial, antiinflammatory, and preservative actions; *Sapindi Mukorossi Fructus* and *Camelliae seed meal* remove dirt and kill bacteria; and *Menthae Haplocalycis Herba* disperses windheat. Together, these ingredients target scalp itching and inflammation, inhibit microbial growth, and maintain a healthy scalp. Cleaning, moisturizing and restoring: Soft soap, *Sapindi Mukorossi Fructus*, and *Camelliae seed meal* remove dirt and grime, achieving basic cleansing. Moisturizing factors and silk protein peptides hydrate, lock in moisture, and combat dryness, while sodium lauroyl amino acid optimizes the shampoo's texture, helping to keep the scalp and hair hydrated after cleaning and reducing dry damage. Regulating the scalp environment: *Citri Reticulatae Pericarpium* dries dampness and resolves phlegm; *Spirodela Herba* promotes beard and

hair growth; and Mori Folium disperses windheat.

Analysis based on traditional Chinese medicine theory

In *Tiaobian of Warm Diseases* (*Wen Bing Tiao Bian*), Wu Tang explained the Huazheng Huisheng Dan derived from the Biejiajian Pill and Huisheng Dan in the *Golden Chamber*: This formula uses Ginseng Radix et Rhizoma, Cinnamomi Cortex, Zanthoxyli Pericarpium, and Zingiberis Rhizoma Recens to unblock and supplement yang qi, Paeoniae Radix Alba and Rehmanniae Radix Praeparata to consolidate and supplement yin fluids, Leonuri Herba extract to unblock and supplement yin qi while resolving water retention, and Trionycis Carapax (processed as gelatin) to unblock and supplement liver qi while resolving abdominal masses (zhengjia). The remaining ingredients are aromatic medicinal herbs that enter the collateral channels and transform turbidity. Moreover, blood-eating insects are used. Flying insects enter the qi aspect of the collateral channels, while those that crawl enter the blood aspect of the collateral channels, so that they penetrate every minute part and break up the hardest masses. Furthermore, Rhei Radix et Rhizoma is stir-baked with vinegar three times, so that it reaches the diseased site without harming other organs. For long-standing concretions that do not disperse, such a forceful approach is indispensable. One might object to the numerous ingredients, but such an objection reflects a misunderstanding of the principle of medicinal usage: a single, strong medicinal used alone acts quickly and forcefully, while many medicinal herbs used together distribute their effects and moderate the action. The ancient method of slow resolution of masses follows exactly this principle, and as the saying goes, "An organized army is not to be feared for its numbers, but a disorganized army, even if small, brings chaos." This formula contains a total of 36 ingredients, combining vinegar and honey, which corresponds to the number 36—the product of 4 multiplied by 9. This represents the number associated with the generation of Metal qi. The product of 4 multiplied by 9 mentioned by Wu Tang refers to the number of the Western direction on the He Tu (Yellow River Chart). As it is said: Heaven generates Water with the number one, and Earth completes it with the number six; Earth generates Fire with the number two, and Heaven completes it with the number seven; Heaven generates Wood with the number three, and Earth completes it with the number eight; Earth generates Metal with the number four, and Heaven completes it with the number nine; Earth generates the element of Earth with the number five, and Heaven completes it with the number ten. The number 36 (the product of 4 multiplied by 9) corresponds to the Western direction, and they are both associated with the Metal element. Metal possesses the ability to break and penetrate, thereby allowing it to move qi and unblock blood stasis. By the same principle, Liuwei Dihuang Pills nourishes kidney yin and is a formula for treating kidney yin deficiency. As the saying goes: "Heaven generates Water with the number one, and Earth completes it with the number six." In traditional Chinese medicine, the Kidney organ corresponds to the Water element. Therefore, using six herbs

corresponding to the Kidney meridian to tonify the Kidney can be said to achieve twice the result with half the effort. Moreover, Liuwei Dihuang Pills is to be taken with light salt water. Since the Kidney corresponds to the Water element, its natural flavor is salty. Hence, taking the formula with salt water further enhances its efficacy. This formula contains a total of 19 herbs. With the number one corresponding to Water, Polygoni Multiflori Radix Preparata serves as the "Heavenly one water" to enrich kidney yin. It is assisted by Ecliptae Herba and Ligustri Lucidi Fructus, representing the "Earthly six yin", which are mutually rooted and interdependent, ensuring the storage of essence and the promotion of hair growth. The number ten corresponds to Earth, wherein Citri Reticulatae Pericarpium promotes qi transformation, Speranskiae Herba unblocks the interstitial spaces, and Camelliae semen meal absorbs turbid greasiness, acting as the Earth-element pivot. The number nine corresponds to Metal, wherein Platycladi Cacumen clears lung heat and moistens the skin and hair, Spirodelae Herba floats lightly upward and penetrates the scalp, and Menthae Haplocalycis Herba disperses wind-heat, unblocks heat, and relieves rashes, treating ailments of the skin and hair.

From the perspective of Yin-Yang and the Five Elements, the Lung corresponds to Metal and governs the skin and hair. Hair is also considered part of the skin and hair system. Mori Cortex clears lung heat and descends turbid qi, while Mori Folium diffuses lung qi and expels turbid qi from the skin and hair. Spirodelae Herba carries the medicinal action upward, and Menthae Haplocalycis Herba disperses windheat. Kidney water moistens the hair, and the kidney's luster is manifested in the hair. Polygoni Multiflori Radix Preparata tonifies the kidney and replenishes essence. Ecliptae Herba and Ligustri Lucidi Fructus together form the Erzhi Pills, which nourishes yin, cools blood, and eliminates deficient heat from the scalp. Drynariae Rhizoma strengthens the root and stabilizes hair growth. The Liver wood governs ascending and spreading. If the ascending qi is excessive, the hair becomes oily. Platycladi Cacumen and Moutan Cortex cool the blood and soothe the liver, improving blood heat and reducing hair oiliness. The Heart governs blood, and hair is considered the surplus of blood. Hair growth also relies on yang qi. Artemisiae Argyi Folium, Rosmarini Folium, and Speranskiae Herba warm and unblock the hair follicles, promoting drug absorption. The Spleen earth transforms and transports dampness and turbidity. Camelliae seed meal and Citri Reticulatae Pericarpium harmonize the medicinal properties, reducing the greasy and cloying nature of the formula. Polygoni Multiflori Radix Preparata uses Kidney water to moisten the Wood nature of Platycladi Cacumen, thereby promoting hair growth and darkening hair. Mori Folium uses its Wood nature to assist the Fire of Artemisiae Argyi Folium in warming the meridians and unblocking vessels. Rosmarini Folium uses its moving and penetrating Fire nature to guide the medicinal action to the Earth element for transformation and transport. Speranskiae Herba uses its Earth nature to promote the descending and purifying Metal qi of Mori Cortex. Gleditsiae Fructus uses Metal to clear turbidity, thereby

assisting the Kidney water's luster, which is stored in the hair. In terms of the controlling cycle of the Five Elements, Sophorae Flavescens Radix uses Wood to suppress excessive hair oiliness (Earth), while Camelliae seed meal uses Earth to absorb greasiness and prevent the herbal liquid from becoming overly cloying and stagnant.

Regarding the use of guiding herbs, Rosmarini Folium directs the medicinal action specifically to the top of the head; Spirodelae Herba carries the medicinal effect upward; and Speranskiae Herba penetrates the hair follicles. For the harmonization of yin and yang, pungent-warm herbs such as Gleditsiae Fructus and Artemisiae Argyi Folium are combined with yin-nourishing, moistening herbs such as Ecliptae Herba and Ligustri Lucidi Fructus to prevent damage to yin. For the interdependence of ascending and descending, Rosmarini Folium and Spirodelae Herba guide the medicinal action upward, while Mori Cortex and Sophorae Flavescens Radix clear dampness and drain heat.

This study involves a preliminary evaluation of the effectiveness of a shampoo product, conducted in accordance with relevant ethical guidelines. All 30 volunteers who used the shampoo were fully informed about the study and signed informed consent forms. In the preliminary safety assessment, the product was found to pose no significant risk to humans. Therefore, prior ethical approval was not sought. Additionally, to verify the product's efficacy, skin tests were also performed on mice. All animal experimental procedures followed the principles of laboratory animal welfare and ethics, minimizing both discomfort and the number of animals used.

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