



Research Article

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The Synergistic Efficacies of a Novel Combination Called Wufeizi® to Boost the Improvement of Hair Conditions Regarding Hair Loss, Hair Density and Scalp Dryness

Rumeng Jin^{1,2}, Weicheng Fei³ and Dan Cheng^{4*}¹Mama Mujer (Beijing) Technology Co., Ltd, China²Mama Mujer R&D Team, China³Huiwen Biotechnology Co., Ltd, China⁴North Carolina A&T State University, USA

***Corresponding author:** Dan Cheng, North Carolina A&T State University, Greensboro, USA.

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Abstract

Hair loss has caused a lot of anxiety, especially due to a thinning or shedding of hair caused by the early entry of the hair from anagen phase into the telogen phase. Treatments for hair loss inevitably lead to side-effects and are expensive. In our clinical study, we aimed to demonstrate the synergistic efficacies of a novel combination of topical and oral products for 28 days on preventing hair loss, which contain natural and functional food ingredients such as pea sprout extract. After combined administration for 28 days, the average hair loss of the subjects significantly reduced by 57.85%, compared to that by 39.01% from oral supplementation alone. The overall hair density significantly increased by 11.11% and the local hair density significantly increased by 8.75% after combined administration for 4 weeks, while they also increased by 7.84% and 7.39% respectively from oral supplementation alone. Combined administration reduced 15.68% scalp trans-epidermal water loss of scalp, which also outperformed that oral administration alone reduces 12.83%. The satisfaction assessment from the subjects showed higher willingness for continuing to use combined products. In general, this novel product called "WuFeiZi®" should have provide a highly efficient, natural and economic viable option for the huge vacancy of individuals bothered by hair loss, by orally application alone and its combination with topical application.

Introduction

In China, young individuals are very concerned about hair loss which led to aesthetic discomfort and anxiety. The reasons for hair loss include unhealthy life styles, pregnancy and hormonal changes that cause the early entry of the hair from anagen phase into the telogen phase and thus a hair loss with increased prevalence with aging [1-2]. The key of hair growth lies in the hair follicle that undergoes three phases of growth (anagen), apoptosis-driven

regression (catagen) and resting (telogen). The anagen phase, is the longest period of the hair life cycle, lasting one to six years on average, when a massive keratinocyte proliferation in the hair matrix occurred, followed by a rapid cellular differentiation with pigmentation by follicular melanogenesis. The catagen phase is a regression phase, lasting for a few weeks, during which the hair stops growing. The telogen phase of 3-9 months refers to the

“resting” phase during which the hair no longer grows. At the end of this phase, keratinized hair falls out and a new hair starts to grow, and the follicle goes back in the anagen phase [3]. For a normal hair life cycle, the percentages of hair in the anagen phase, catagen phase and telogen phase are between 85% and 90%, approximately 1%, and approximately 10 to 20% of the total hair respectively [4].

The highly vascularized dermal papilla, considered as the “biological engine” of the hair, is a hair bulb under the scalp surface, providing essential hair nutrition, ensure irrigation, oxygenation, and dispose cellular waste. Growth and differentiation of the matrix cells are under the influence of growth factors produced by the dermal papilla [5-6], including the epidermal growth factor (EGF)-related ligands, fibroblast growth factors (FGF), transforming growth factor-beta (TGF-beta), insulin-like growth factor (IGF), due to their crucial regulation of the hair cycle and hair growth [7].

Available treatments for hair loss include pharmaceutical products, physical and regenerative medical therapies, and hair transplant procedures. A class of medications called 5-alpha reductase inhibitors is used to treat male pattern hair loss. However, the side effects might include the problems of ejaculation, erection, and libido [8]. Nutraceuticals and cosmetics by providing essential nutrients or specific botanical extracts can be effective strategies to improve moderate hair loss [9], which are quite welcomed by sophisticated consumers in China. Low molecule weight type I collagen peptides with thick fibers provide support for the scalp skin, resulting in a firm and less wrinkly appearance, while type III collagen peptides with thin fibers promote the fibroblasts to further synthesize type III collagen and hyaluronic acid to hydrate the scalp [10]. In our clinical study, we aimed to demonstrate the synergistic efficacies of a novel combination of topical and oral products consisting of natural and functional food ingredients on preventing hair loss, given the previous in vitro studies this formulation can boost certain gene expressions such as FGF-7 for hair growth, synthesize extracellular matrix such as collagen and provide nutrients as B vitamins. The primary outcomes of the clinical trial were the number of hair loss, the overall and local density of the hair. The secondary endpoints were the trans-epidermal loss of the skin and the general self-assessment by the volunteers.

Materials and Methods

Intervention

20 subjects who are from 18-60 years old with hair length between 5~40 cm but had issues of hair loss and slight thinning

of hair were enrolled for the formal trial to ensure the balance of important factors (gender, age, hair length, hair loss severity, etc.) that may affect the test results. The oral product is a liquid drink mainly consisting of pea sprout extract, collagen peptides, salmon protein peptides, B vitamins and so on. The topical product is a liquid essence mainly consisting of pea sprout extract, various oligopeptides and plant extracts. 20 subjects were evenly enrolled into two groups. For one group, 10 subjects were only orally administered with the liquid drink. For the other group, 10 subjects were administered with combined products of liquid drink and liquid essence. Testing cycle of 6 weeks includes 2-week wash-out period, 4-week intervention for efficacies and satisfaction evaluations. Before the enrollment, subjects were asked a series of questions about disease history, health status and so on, and were required to sign a written informed consent form. During the trial, subjects should not wash their hair within 48 ± 4 hours before each visit, which should be basically kept consistent for each visit. They should not comb their hair on the day of the visit. Also, no haircut within 2 weeks was allowed before each visit. During the trial period, no hair care and hairdressing measures can be taken, nor can any treatment be received for hair growth. It was necessary to maintain original living habits and avoid large emotional fluctuations.

Measurement

The hair evaluation of the subjects were conducted before and after using the product, regarding hair density evaluation and image shooting. Hair density assessment includes overall hair density assessment and local hair density assessment. Also, for each visit, a trained staff combed the hair of the subjects for 60 times, and then counted and recorded the hair loss.

Overall hair density

The hair on the head of the subjects was combed symmetrically to both sides and kept smooth. The overall hair density evaluation includes visual evaluation and image evaluation by a dermatologist using the 0-7 evaluation scale in Table 1. For image evaluation, each subject wore a black non-reflective scarf and combed the hair smoothly, and then the chin was placed on the shooting bracket. Photos of the whole head with the head as the center were taken. A standard color palette (at least black, white and gray) was also set. After the visit, a dermatologist would evaluate the hair density of the photos taken and record the grading. The average value of visual evaluation and image evaluation was calculated as the overall hair density.

Table 1: Rating table of hair density.

Rating	Description
0	No hair
1	Extremely sparse, scalp clearly visible
2	Sparse, easy to see scalp
3	Sparse, visible scalp
4	Medium density, with a small amount of scalp visible
5	Dense, with very little scalp visible
6	Dense, scalp is faintly visible
7	Very dense, scalp is almost invisible

Local hair density

For local hair density, a hair area of at least 1.5 cm × 1.5 cm on the head of the subjects was well positioned and cut, leaving the residual length for no more than 1 mm. In the process of image acquisition, the operator kept the subject in a comfortable position, place the dermal scope vertically above the center of the removal area for local hair image shooting. Image analysis software or manual counting method were used to count and record the number and density of local hair.

Scalp dehydration

Before and after the 4-week trial, the scalp dehydration was tested by Tewameter TM300 for the transcutaneous water loss in the scalp hair cutting area of the subjects.

Subjective assessment

After the trial was complete, the subjective evaluations for the product regarding its taste, efficacy and repurchase willingness were conducted. A follow-up questionnaire was issued to investigate the hair loss, adverse event and other relevant feelings during the 4 weeks after the intervention was complete.

Statistical analysis

Statistical analysis software was used for statistical analysis

of data. A normal distribution test is conducted and paired t test is used for the comparison before and after the measurement. Otherwise, the rank sum test of two related samples was used. The above statistical analysis was based on a two-tailed test, with a significance level of $\alpha = 0.05$.

Results

After oral supplementation for 28 days, the average number of hair loss decreased by 39.01% (Figure 1a). After combined products administration for 28 days, the average number of hair loss decreased by 57.85% (Figure 1b and Figure 1c). The overall hair density improved by 7.84% and 11.11% respectively from oral supplementation and combined products administration for 28 days (Figure 2a and Figure 2c). The local hair density improved by 7.39% and 8.75% respectively from oral supplementation and combined products administration for 28 days (Figure 3a and Figure 3c). The self-assessment questionnaire from testing subjects for both oral product and combined products are positive and promising (Figure 5). The satisfaction rates in terms of safety, taste, improvement in scalp dryness, improvement in hair quality, improvement in hair loss and willingness for continued application are above 80%. The willingness for continued administration of combined products is higher than that for taking oral product alone.

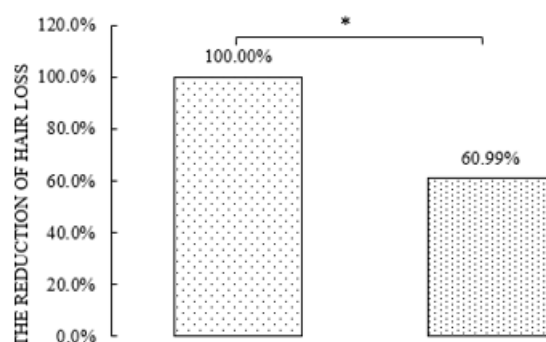


Figure 1(a): The reduction of hair loss after administration of oral product for 28 days (left: day 0, right: day 28)

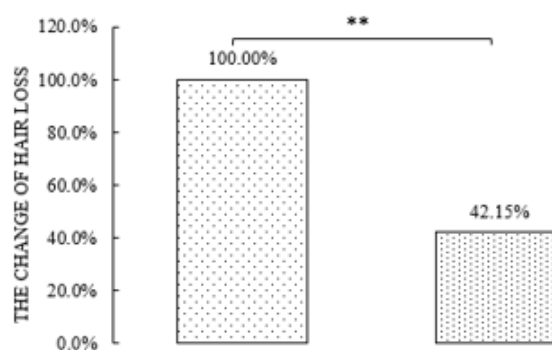


Figure 1(b): The reduction of hair loss after administration of combined products for 28 days (left: day 0, right: day 28).

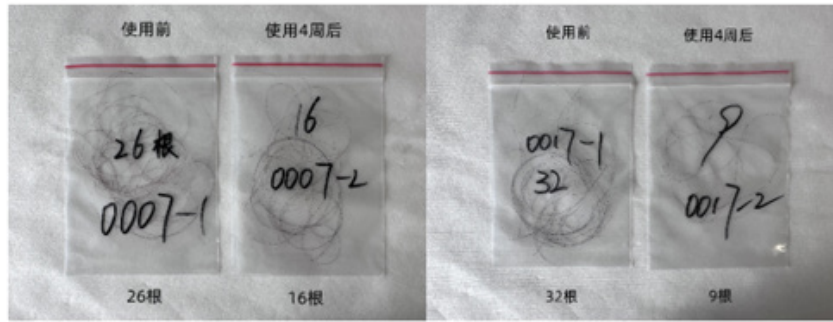


Figure 1(c): The reduction of hair loss for subjects using only oral product (left) and combined products (right). n.s. denotes not significant, *denotes significant differences (0.01<p<0.05), **denotes significant differences with p<0.01, ***denotes significant differences with p<0.001

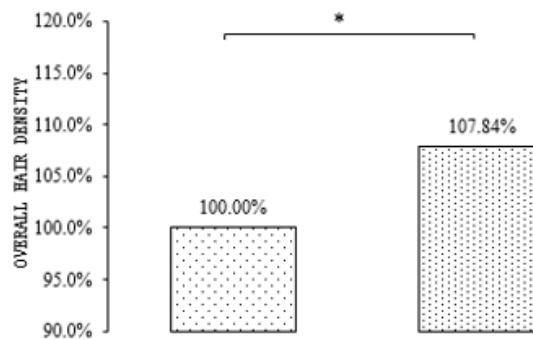


Figure 2(a): The improvement of overall hair density after administration of oral product for 28 days (left: day 0, right: day 28).



Figure 2(b): The improvement of overall hair density after administration of oral product for 28 days (left: day 0, right: day 28).

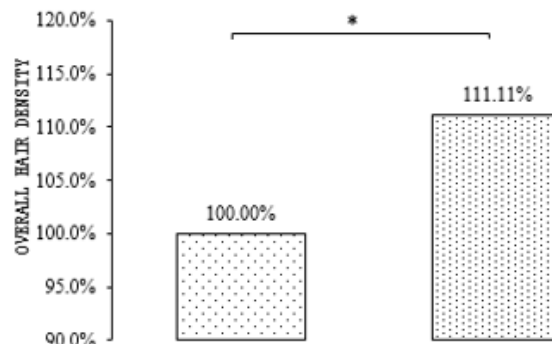


Figure 2(c): The improvement of overall hair density after administration of combined products for 28 days (left: day 0, right: day 28).



Figure 2(d): The improvement of overall hair density after administration of combined products for 28 days (left: day 0, right: day 28). n.s. denotes not significant, *denotes significant differences ($0.01 < p < 0.05$), **denotes significant differences with $p < 0.01$, ***denotes significant differences with $p < 0.001$.

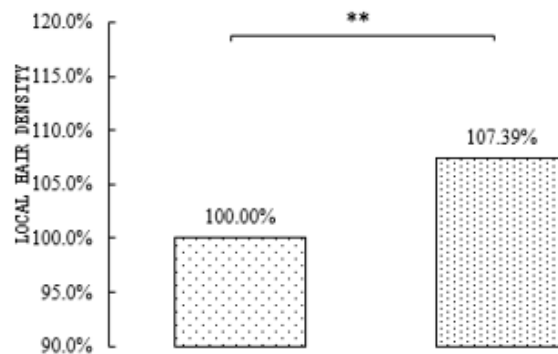


Figure 3(a): The improvement of local hair density after administration of oral product for 28 days (left: day 0, right: day 28).

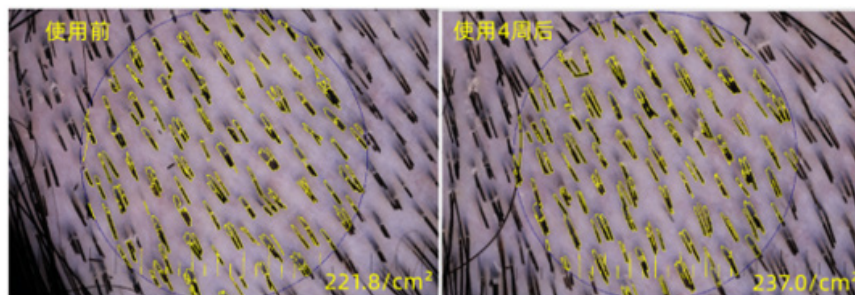


Figure 3(b): The improvement of local hair density after administration of oral product for 28 days (left: day 0, right: day 28).

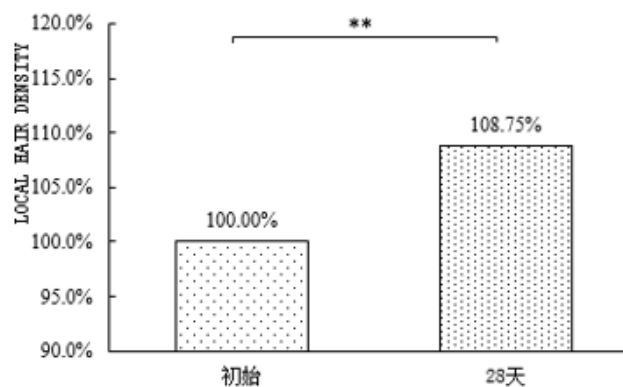


Figure 3(c): The improvement of local hair density after administration of combined products for 28 days (left: day 0, right: day 28).

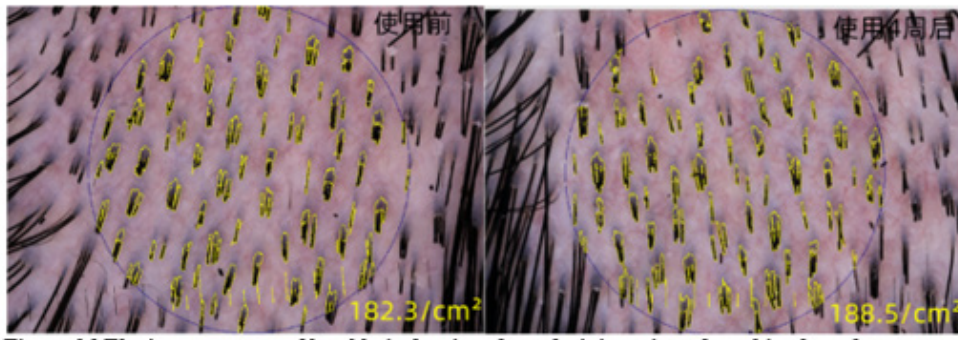


Figure 3(d): The improvement of local hair density after administration of combined products for 28 days (left: day 0, right: day 28). The trans-epidermal water loss of scalp reduced by 12.83% and 15.68% respectively from oral supplementation and combined products administration for 28 days (Figure 4a and Figure 4b).

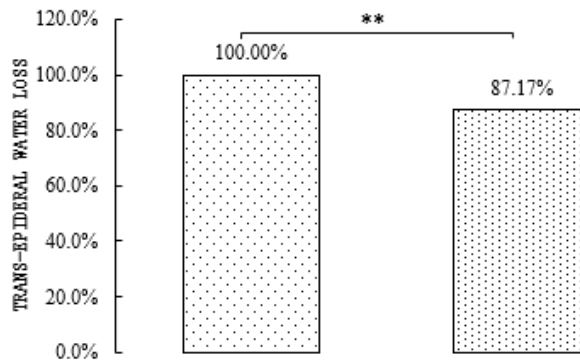


Figure 4(a): The improvement of trans-epidermal water loss after administration of oral product for 28 days (left: day 0, right: day 28).

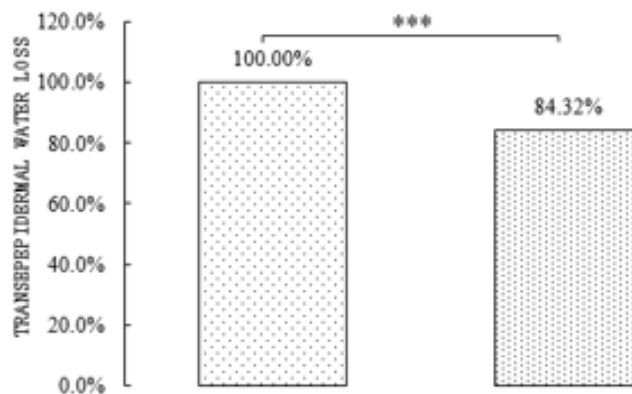


Figure 4(b): The improvement of trans-epidermal water loss after administration of combined products for 28 days (left: day 0, right: day 28). n.s. denotes not significant, *denotes significant differences (0.01<p<0.05), **denotes significant differences with p<0.01, ***denotes significant differences with p<0.001

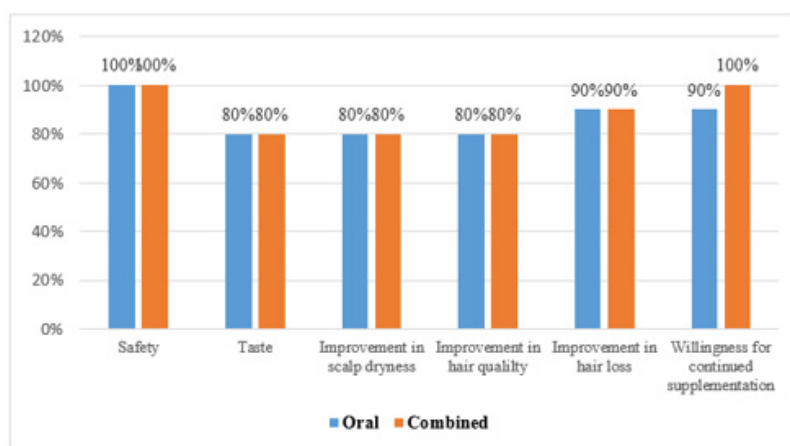


Figure 5: Self-assessment of the product after the intervention.

Discussion

Periods of hair loss can last for more than 6 months, due to disturbances of the hair cycle from the anagen phase to the telogen phase, which takes up to 30% or more of total hair volume. Treatments targeting pathological and hormonal hair loss by medicines may not fit for the physiological and non-hormonal telogen hair loss. In our clinical study, we proposed an innovative, alternative, and nutritional solution for reversible hair loss caused by the abnormal hair cycle. For individuals with telogen hair loss, we demonstrated that a 28-day supplementation of WuFeiZi® combined products of a liquid drink and a liquid essence significantly reduced the hair loss by 57.85%. The overall hair density significantly increased by 11.11% and the local hair density significantly increased by 8.75% after combined administration for 28 days. The trans-epidermal water loss for the scalp by combined administration reduced by 15.68%. In the meantime, the oral supplementation of WuFeiZi® liquid product alone generated benefits for hair growth, from perspectives of 39.01% reduction for hair loss, 7.84% improvement for overall hair density, 7.39% improvement for local hair density, and 12.83% reduction for trans-epidermal water loss. Fundamentally, orally supplemented with the liquid drink could beneficially impact on hair conditions from our previous research and we also observed the similar phenomenon. More importantly, it is the combined products that can bring about synergistic improvement for hair conditions from perspectives of hair loss reduction, scalp hydration and so on. The first priority to boost hair growth lies in the positive regulation of three phases for hair follicles. The herbal extract from pea sprout from this vulnerable growth phase contained a lot of nutrients as B vitamins and adenosines [10]. In a clinical study with 20 volunteers, it was clearly found the number of hairs in the anagen phase was increased and the amount hair in the telogen hair was reduced by orally administration of this pea sprout extract, as a result of the significant increase of the expression of fibroblast growth factor-7 (FGF7) by several times, a dermal papilla signal instructing hair

germ cells to proliferate and initiate a new hair cycle [11-12]. On the other hand, noggin, a gene that shortens the telogen phase and initiates a new hair growth phase was even more stimulated.

Moreover, the collagen peptides and salmon protein peptides contained in this product might stimulate the proliferation of the fibroblasts that synthesize extracellular matrix for hair growth. The type III collagen content is at its peak when we are in fetus form, accounting for 60% of the total amount of collagen [13]. However, type III collagen dwindles continuously to less than 20% for adults, resulting in the inability of the skin to repair scars, sharply deteriorated elasticity, skin hydration and shrunk skin [14]. The type I and III collagen peptides by a patented enzyme degradation technology from salmon of North Europe with very little human pollution definitely reduce the speed of scalp aging and thus improve its hydration. Also, the active peptides contained in salmon help promote the body's absorption of dietary iron and increase hemoglobin levels, which might facilitate the transportation of more oxygen for energizing dermal papilla cells for hair growth [15]. Moreover, rapidly regenerating tissues as hair follicle need sufficient polyamine synthesis for hair growth. The prototypic polyamine, spermidine contained in the wheat germ could promoted hair shaft elongation and prolonged hair growth (anagen). Spermidine also upregulated expression of the epithelial stem cell-associated keratins [16].

After the trial was complete, the satisfaction assessment from the subjects were high regarding the efficacy, safety, taste and willingness for continued supplementation. In particular, individuals are more willing to purchase combined products in the future. Due to the tremendous needs of healthy hair for individuals while there is a lack of effective, safe and tasty functional food, this product should have been valuable, economically viable and filled the huge vacancy.

Acknowledgement

None.

Conflict of Interest

No Conflict of interest.

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