



# Evaluation of the efficacy of an eye cream on the specific early aging eye problems, including periorbital hyperpigmentation, eye bags and fine lines

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## Introduction:

Staying up late and staring at mobile phones and computer screens for long time can cause a variety of eye skin problems of some young modern women, including periorbital hyperpigmentation, eye bags and fine lines. Besides physiological characteristics and its natural aging, UV light, environmental pollution, lack of sleep, and stress would accelerate aging progress and contribute to the development and deterioration of aging signs around the eyes [1-9].

At present, some studies have reported solutions for eye skin, but there are few reports on these specific eye skin problems for young women, especially the quantitative measurement of periorbital dark circles and eye bags with instruments.

There are plenty of articles targeting in lines and wrinkles around the eyes and not a few formulations were certified to great improvements in the appearance of eye wrinkles [6-8]. Periorbital skin is an ideal site to assess the efficacy of anti-aging cosmetic formulations. Dark eye circles are normally classified as vascular type, pigmented type, mixed type and eye bag by the causes [9, 10]. There are three key causes contributing to dark eye circles despite of complex aetiology: hyperpigmentation, more dilated and thicker capillaries and thinner skin under the eyes [11]. They could be treated via different ways like cosmetic products, chemical peeling, laser, intense pulsed light, fillers and so on [12-16], in which topical application is the most convenient way but sadly has poor therapeutic efficacy in most cases. Periorbital edema beneath the eyes can be linked to mechanical friction or conditions such as inflammation and impaired lymphatic circulation. Topical caffeine gel was reported as an effective means of treating puffiness or bagginess under the eyes that results from subcutaneous vascularisation, telangiectasias and edema due to leaky vessels [17].

The purpose of our study was to evaluate the efficacy of an eye cream (containing bacillus ferment, caffeine and a blend of antioxidants) for the treatment of specific skin problems around the eyes and to explore ways to quantitatively evaluate the improvement of dark circles and puffy eyes using instruments. Bacillus ferment extract reduces the appearance of dark circles and eye bags in the periorbital area. Caffeine with unique delivery technology designed for better skin penetration and promotes cutaneous microcirculation.

## Materials & Methods:

### Subjects

Twenty-four Chinese females were screened and enrolled based on the assessment of the eye region by experienced technicians. Subjects between the ages of 20 and 45 (average age 31±6.3 years), presented with at least one of the following moderate to severe skin conditions: dark circles, eye bags, crow's feet and/or under-eye wrinkles. Subjects were not pregnant, nursing or intending to become pregnant during the study. Subjects with ocular pathology or skin disease, aesthetical or dermatological treatment that may interfere with the study, allergy to cosmetic products, toiletries, sunscreens were excluded from the study [18]. Before enrollment, each subject signed written informed consent.

### Methods

A randomized, double-blind, placebo-controlled, split-face comparative study was conducted between July and August 2020 in Hangzhou, China. A variety of skin parameters at baseline and at 2, 4, and 6 weeks were evaluated by non-invasive biometrical instruments and subject self-assessment. All the study procedures were carried out under temperature and humidity-controlled conditions (temperature 21±1°C and humidity 50±10%).

Subjects received a 6-week treatment of test product (containing bacillus ferment, caffeine and a blend of antioxidants) to one side of the eye contour area and placebo (the same formulation without the functional ingredients) to the other side. Subjects were instructed to apply eye cream to the corresponding sides and gently massage until absorbed twice daily. Concomitant use of other eye skin-care products was not permitted during the study. Considering inter-day variability of dark circle intensity over time, subjects were required to visit at the same time of the day [11].

• **Measurement of dark circles** Dark circle color was evaluated by Colorimeter and color-related parameters such as L\* and ITA\* were obtained. Dark circles erythema index were measured by Mexameter. All these measurements were conducted in the middle of the lower eye contour [4] by the same technician at every time point.



• **Measurement of eye bags and eye wrinkles** Images of periocular skin were captured by Visia-CR and Primos. In conjunction with 3D measurement and evaluation software, the system enables to measure several skin parameters such as wrinkles count and volume, eye bags volume, roughness and so on. In this study, we evaluated crow's feet count and volume, under-eye wrinkle count and volume and eye bags volume.

• **Subject self-assessment** Self-assessments were conducted at each visit via questionnaire. Skin conditions around the eyes were assessed by the subjects using a 7-point scale (1 none, 2-3 mild, 4-5 moderate, 6-7 severe). Subjects were also required to assess improvement relative to baseline for dark circles, eye bags, under-eye wrinkles, crow's feet, smoothness, dullness and overall improvement.

### Statistics

All measured values were reported as mean. The student's t-test was used to determine within intragroup (vs. baseline) or intergroup (vs. placebo) differences. Differences were considered significant when  $P < 0.05$  (\* $P < 0.05$  compared with baseline, \*\* $P < 0.01$  compared with baseline, # $P < 0.05$  compared with the placebo, ## $P < 0.01$  compared with the placebo.).

## Results & Discussion:

### 1. Improvement in the appearance of dark circles

- Significant increases in skin brightness (L\* value) and skin color (ITA\* value) in the treated side were measured as compared with the baseline and the control at 6 weeks. Meanwhile, The L\* value and ITA\* in the control side showed a gradual decrease since 2 weeks as a result of sun exposure in summer.
- For the treated side, improvements in erythema were noted as early as 2 weeks and further improvements at 6 weeks. Erythema index of the treated side decreased more than the control side after 6 weeks with significant differences, suggesting that tested product provided a quicker reduction of vascular type dark circle appearance [20].
- Subjects' self-assessments showed that 88% of the subjects reported improvements on dark circles in the treated side, which is consistent with instrumental results, further verifying effective improvements in the appearance of dark circles. A representative case with visible improvements is shown in Figure 1.

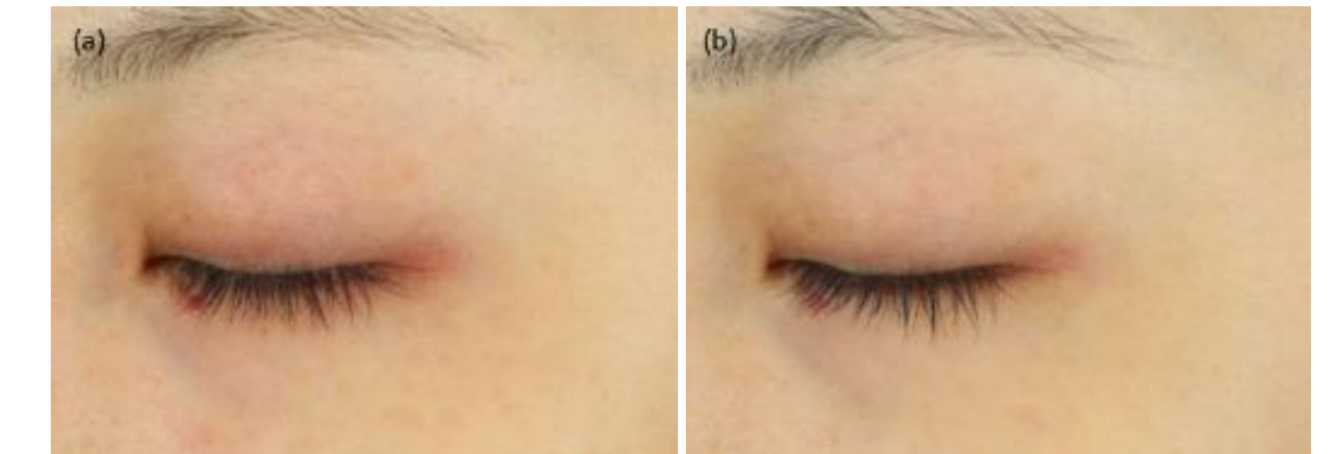


Figure 1. A 26-year old woman (a) before and (b) 6 weeks after the treatment of the test product. Dark circles improved.

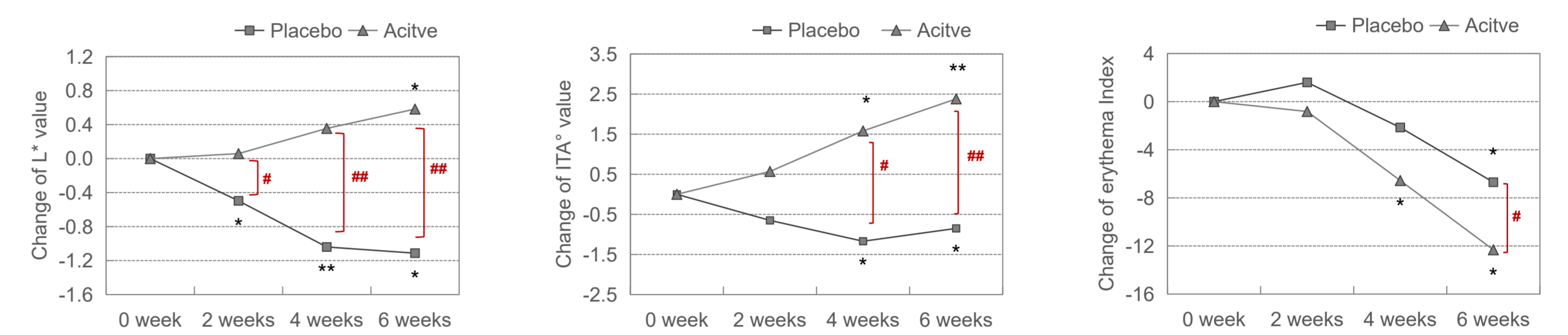


Figure 2. Changes of L\* value, ITA\* value and erythema index in mean values measured at dark circles during the treatment of the test product and the placebo in split-face randomly for 6 weeks.

### 2. Improvement in eye bags

- Eye bags on the control side showed no evident improvement both in instruments measurement and subjects' self-assessment. Significant reduction of eye bags volume in the tested side was measured as compared with the baseline and the control at 4 and 6 weeks, indicating that eye cream could relieve swelling or puffiness under the eyes. A representative case with visible improvements is shown in Figure 3.

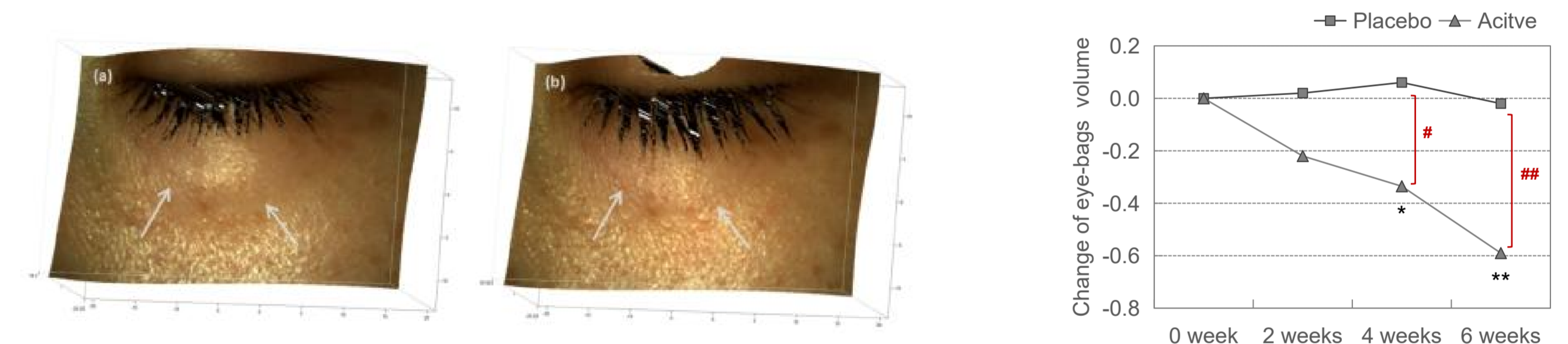


Figure 3. A 28-year old woman (a) before and (b) 6 weeks after the treatment of the test product. Eye bags improved. Changes in mean values measured at eye bags during the treatment of the test product and the placebo in split-face randomly for 6 weeks.

### 3. Improvement in wrinkles around the eyes

- Significant improvement of crow's feet and under-eye wrinkles in the tested side was measured as compared with the baseline and the control as early as 2 weeks with continuous slight improvement up to 6 weeks. The control side also showed some significant improvement at 2, 4 and 6 weeks as compared with the baseline, but less than the treated side.
- Significant improvements of both crow's feet and under-eye wrinkles after a period of application imply that the test product had an anti-wrinkle effect as actives, although base placebo contributed to some effects on the wrinkles' reduction. Representative cases with visible improvements are shown in Figure 4 and Figure 5.



Figure 4. A 44-year old woman (a) before and (b) 6 weeks after the treatment of the test product. Crow's feet improved.

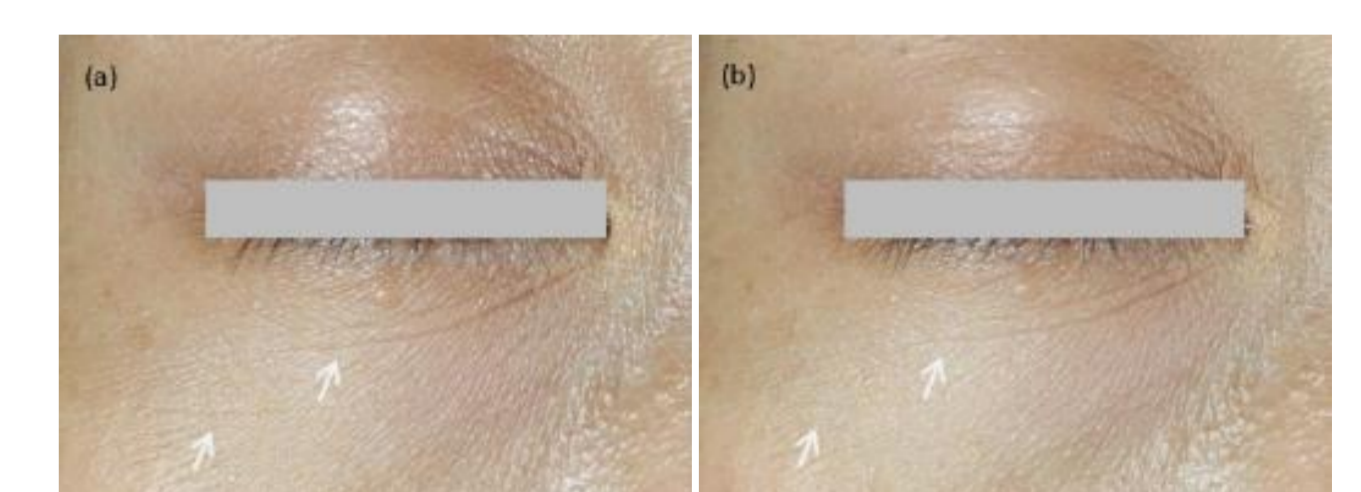


Figure 5. A 38-year old woman (a) before and (b) 6 weeks after the treatment of the test product. Under-eye wrinkles decreased.

## Conclusions:

We found topical application of the eye cream containing bacillus ferment, caffeine and a blend of antioxidants was significantly effective in improving periorbital dark circles and under-eye bags compared with the placebo product over a 6-week treatment period. Besides, both the test product and placebo showed apparent improvements in fine wrinkles around the eyes compared with pre-application. The test product exerts a synergistic effect on relieving early aging skin problems around the eyes. Furthermore, instrumental quantitative assessments of periorbital hyperpigmentation and eye bags have been developed, which also provides a new and valuable direction for the development of products that target specific eye skin problems.

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