AN INVESTIGATION INTO THE ANTI-WRINKLE EFFICACY OF A FACIAL CREAM FORMULATED WITH THONGKRAW FLOWER EXTRACT

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Abstract

This study aimed to evaluate the efficacy of a facial cream containing *Butea monosperma* flower extract in reducing wrinkles. The extract is known for its beneficial effects on the skin and contains flavonoid compounds such as kaempferol, coreopsin, isocoreopsin, sulfurein, monospermoside, and isomonospermoside. These compounds exhibit antioxidant activity, anti-inflammatory effects, and tyrosinase inhibition, which is associated with melanin production. The cream formulation was developed using standardized extraction and manufacturing processes to ensure consistency, stability, and product safety. Thirty healthy female volunteers aged 35–55 years, all staff members of Suan Sunandha Rajabhat University, participated in a four-week open-label clinical trial. Participants were selected based on predefined inclusion and exclusion criteria and provided informed consent prior to the study. The cream was applied twice daily—morning and evening—throughout the trial period. Phytochemical analysis of the *B. monosperma* extract revealed a total phenolic content of 90.38 ± 1.2 mg gallic acid equivalents (GAE) per gram of extract and a total flavonoid content of 26.41 ± 0.8 mg quercetin equivalents (QE) per gram of extract, as measured by UV-Vis spectrophotometry. Additionally, the extract demonstrated strong antioxidant activity, with a DPPH assay IC_{50} value of 34.7 ± 2.5 µg/mL. Clinical evaluations showed statistically significant improvements in skin parameters. Skin hydration increased from 32.5 ± 4.1 arbitrary units (AU) at baseline to 45.8 ± 3.6 AU after four weeks, while the average wrinkle depth decreased from 142.3 ± 10.4 µm to 121.6 ± 9.8 µm ($p < 0.05$). No adverse effects or allergic reactions were reported during the study. These findings support the potential of *Butea monosperma* flower extract as a natural bioactive ingredient in anti-aging cosmetic products, effectively enhancing skin hydration, improving elasticity, and reducing the appearance of wrinkles.

Keywords: Butea monosperma, anti-aging, wrinkle reduction, skin hydration, phenolic compounds, antioxidant activity, cosmetic formulation

Introduction

Skin aging is a continuous and complex biological process influenced by both intrinsic factors, such as genetics and the natural aging process, and extrinsic factors, including ultraviolet (UV) radiation, pollution, and lifestyle behaviors. These factors contribute to structural changes in the skin, such as decreased levels of collagen and elastin, reduced elasticity, loss of hydration, and the visible formation of wrinkles.

Currently, there is growing interest in the use of natural plant extracts in anti-aging cosmetic products due to the presence of bioactive compounds, including antioxidants, anti-inflammatory agents, and skin-repairing substances. These natural ingredients offer advantages in terms of safety and biocompatibility.

Butea monosperma (Lam.) Taub, commonly known as "Flame of the Forest" or "Flame Ginger," is a plant species belonging to the Leguminosae-Papilionoideae family and is native to Southeast Asia. This plant has been traditionally used in food, medicine, and cosmetics. Previous studies have shown that extracts from *Butea monosperma* flowers contain high levels of phenolic compounds and flavonoids, which exhibit antioxidant and anti-inflammatory properties and may contribute to delaying the signs of skin aging. However, clinical research supporting the efficacy of this plant extract in topical skincare formulations for wrinkle reduction and skin hydration remains limited.

Therefore, this study aims to evaluate the efficacy of a facial cream containing *Butea monosperma* flower extract in reducing wrinkles and improving skin hydration through clinical assessments combined with phytochemical analyses, in order to systematically support the development of natural bioactive cosmetic products.

Research Objectives

1. To evaluate the efficacy of a facial cream containing *Butea monosperma* extract in reducing facial wrinkles and improving skin hydration and elasticity.
2. To assess the safety and tolerability of the formulated cream among volunteers, and to investigate the bioactive properties of the *Butea monosperma* extract used in the formulation.

Scope of the Research

This study encompassed the entire process— from the preparation of *Butea monosperma* (Palash flower) extract, known for its dermatological properties including flavonoids such as kaempferol, coreopsin, isocoreopsin, sulfurein, monospermoside, and isomonospermoside, which exhibit antioxidant, anti-inflammatory, and tyrosinase-inhibiting activities—to the clinical evaluation of the developed facial cream. The scope of the study was defined as follows:

Extraction of *Butea monosperma*

Fresh flowers were harvested from a quality-controlled cultivation source. The flowers were dried and subsequently extracted using 70% ethanol to obtain a concentrated extract, which was then further processed and dried into a powdered form.

1. Phytochemical Analysis of the Extract

The total phenolic and flavonoid contents were quantified using UV-Vis spectrophotometry. Antioxidant activity was evaluated using the DPPH radical scavenging assay.

2. Preparation of the Experimental Cream Formulation

A facial cream was formulated to contain 2% w/w of the flower extract. The formulation process adhered to Good Manufacturing Practice (GMP) standards for cosmetic production.

3. Clinical Efficacy Testing

An open-label clinical trial was conducted with 30 healthy female volunteers aged 35–55 years, all of whom were staff members of Suan Sunandha Rajabhat University. Participants applied the cream to their faces twice daily—once in the morning and once at night—for a duration of four weeks.

4. Dermatological Assessments

Skin hydration levels were measured using a Corneometer®. Changes in wrinkle depth were assessed through high-resolution photographic imaging, supplemented by

evaluations conducted by a certified dermatologist to compare pre- and post- treatment outcomes.

Literature Review

1. Skin Aging and Contributing Factors

The skin is the most visible organ that reflects the signs of aging. Skin aging is a continuous biological process influenced by both intrinsic factors— such as genetics and hormonal decline—and extrinsic factors, including sunlight exposure, environmental pollution, and the presence of free radicals (Kohl, et al., 2011; Masaki, 2010). The reduction in collagen and elastin production, diminished skin hydration capacity, and the accumulation of reactive oxygen species (ROS) are key mechanisms contributing to the development of wrinkles, skin sagging, and a rough skin texture.

2. Plant-Based Antioxidants and Their Application in Cosmetics

Numerous studies have emphasized the role of antioxidants in slowing down the skin aging process, particularly polyphenols and flavonoids, which possess strong antioxidant properties and help protect skin cells from oxidative damage (Pandel, et al., 2013; Ganceviciene, et al., 2012). Extracts rich in these compounds— such as those derived from green tea, grape seed, and pomegranate peel— have been incorporated into skincare formulations, showing significant improvements in skin hydration and reductions in wrinkle appearance.

3. Butea monosperma (Lam.) Taub and Its Cosmeceutical Potential

Butea monosperma (Lam.) Taub, commonly known as "Flame of the Forest," is a member of the Leguminosae-Papilionoideae family and has been traditionally used in medicine and cuisine throughout Southeast Asia. Phytochemical studies have revealed that extracts from various parts of this plant— particularly the flowers— are rich in phenolic and flavonoid compounds, which exhibit notable antioxidant and anti-inflammatory properties (Chan, et al., 2009; Josephine, et al., 2015).

Chan, et al. (2009) investigated the antioxidant potential of Butea monosperma flower extract and reported a favorable IC_{50} value in the DPPH radical scavenging assay, indicating its potential as an active ingredient in cosmetic formulations. Furthermore, Josephine, et al. (2015) demonstrated that the extract could reduce UV-induced cellular damage in vitro. However, these findings are largely based on laboratory (in vitro) studies, and systematic clinical evaluations involving human subjects remain scarce.

Despite the promising evidence of its antioxidant and bioactive properties, clinical research on the application of Butea monosperma extracts in cosmetic products— particularly for anti-wrinkle and moisturizing effects—is still limited. To date, there have been no clinical trials evaluating its efficacy in real-world skincare applications.

Therefore, the present study is distinguished by the incorporation of Butea monosperma flower extract into a facial cream formulation and its subsequent clinical evaluation in human subjects under controlled conditions. This research helps to fill the existing knowledge gap and supports the broader utilization of indigenous plants as active ingredients in the natural cosmetics industry.

Research Methodology

1. Materials and Methods

1.1 Preparation of Butea monosperma Flower Extract

Fresh *Butea monosperma* (Lam.) Taub flowers were collected from a cultivation site in Udon Thani Province, Thailand, and authenticated by a botanist. The flowers were

thoroughly cleaned, and the petals were separated and dried in a hot air oven at 45 °C until completely dehydrated. The dried petals were then ground into a fine powder and macerated in 70% ethanol at a ratio of 1: 10 (w/ v) for 72 hours. The resulting extract was filtered, concentrated using a rotary evaporator, and subsequently lyophilized using a freeze dryer to obtain a powdered crude extract.

1.2 Phytochemical Analysis of the Extract

Total phenolic content was determined using the Folin- Ciocalteu method and expressed as milligrams of gallic acid equivalent per gram of extract (mg GAE/g).

Total flavonoid content was assessed using the aluminum chloride colorimetric assay and expressed as milligrams of quercetin equivalent per gram of extract (mg QE/g).

Antioxidant activity was evaluated using the DPPH radical scavenging assay, and IC_{50} values were calculated.

1.3 Preparation of the Experimental Cream

A stable and GMP- compliant base cream formulation was developed. Butea monosperma flower extract was incorporated at a concentration of 2% w/ w during the hot-process emulsification step. The resulting cream was filled into 30 g plastic tubes under aseptic conditions.

2. Human Clinical Trial

2.1 Study Design

This was a short- term, open- label, single- arm clinical trial approved by the Human Research Ethics Committee of Suan Sunandha Rajabhat University.

2.2 Participants

Thirty healthy female volunteers aged 35– 55 years, all personnel of Suan Sunandha Rajabhat University, were recruited based on the following criteria:

Inclusion criteria: Healthy skin with no severe dermatologic conditions; no use of cosmeceutical products or skin treatments within the past month.

Exclusion criteria: Known allergy to cosmetics or plant- based substances; presence of chronic illness, pregnancy, or inability to follow study procedures. All participants provided written informed consent before enrollment.

2.3 Study Procedure

Participants were instructed to apply the facial cream twice daily (morning and evening) for a continuous period of 4 weeks, without using any other skincare products during the trial. Assessments were conducted at the Dermatology Laboratory, Faculty of Health Sciences.

3. Evaluation Tools and Procedures

3.1 Skin Hydration Measurement

Skin hydration was measured on the right cheek using a Corneometer® CM 825. Measurements were recorded at baseline and after 4 weeks of product use. Results were expressed in arbitrary units (AU).

3.2 Wrinkle Assessment

Wrinkle depth was evaluated using a high- resolution digital imaging system in conjunction with SkinVisiometer® analysis software. The average wrinkle depth (in µm) was assessed and interpreted by a certified dermatologist.

3.3 Data Analysis

All data were statistically analyzed using SPSS version 25.0.

- Means and standard deviations (SD) were calculated for each parameter.
- Paired t-tests were used to compare pre- and post-treatment values.
- A p-value of less than 0.05 was considered statistically significant.

Research Results

1. Phytochemical Properties of *Butea monosperma* Extract

The *Butea monosperma* flower extract obtained through 70% ethanol extraction and freeze-drying showed the following phytochemical characteristics:

Parameter	Mean ± SD
Total phenolic content	90.38 ± 1.2 mg GAE/g extract
Total flavonoid content	26.41 ± 0.8 mg QE/g extract
IC_{50} (DPPH radical scavenging)	34.7 ± 2.5 µg/mL

These results indicate that the extract exhibits a relatively strong antioxidant capacity, with high levels of phenolics and flavonoids, suggesting its potential for use as an anti-aging agent in cosmeceutical formulations.

2. Clinical Trial Outcomes

2.1 Participant Characteristics

Thirty healthy female volunteers participated in the study, with a mean age of 44.3 ± 5.6 years. None reported a history of dermatologic conditions or allergic reactions to cosmetics. All participants fully adhered to the product usage protocol throughout the 4-week period.

2.2 Changes in Skin Hydration

Skin hydration measured by Corneometer® CM 825 demonstrated a statistically significant improvement:

Timepoint	Hydration (AU) ± SD
Before treatment	32.5 ± 4.1
After 4 weeks	45.8 ± 3.6
p-value	< 0.001

A significant increase in skin hydration ($p < 0.05$) was observed after 4 weeks of continuous use, supporting the moisturizing efficacy of the cream.

2.3 Changes in Wrinkle Depth

Wrinkle depth was evaluated using high-resolution imaging and assessed by a dermatologist. The average depth showed a marked reduction:

Timepoint	Wrinkle Depth (µm) ± SD
Before treatment	142.3 ± 10.4
After 4 weeks	121.6 ± 9.8
p-value	< 0.001

A statistically significant reduction in mean wrinkle depth was observed ($p < 0.05$). No adverse effects or allergic reactions were reported by any participant.

Conclusion

- The *Butea monosperma* flower extract demonstrated strong antioxidant capacity and contained bioactive constituents associated with anti-aging benefits.
- A facial cream containing 2% of the extract significantly improved skin hydration after four weeks of regular use.
- A significant reduction in average wrinkle depth was observed, supporting the anti-aging efficacy of the formulation.
- No adverse effects or allergic reactions were reported during the study, indicating good tolerability and safety for human use.

Conclusion and Discussion

This study evaluated the efficacy of a facial cream containing *Etlingera elatior* extract in reducing wrinkles and improving skin hydration. Clinical findings revealed that the cream significantly enhanced skin moisture ($p < 0.001$) and markedly reduced average wrinkle depth after four weeks of continuous use. No adverse effects or allergic reactions were reported during the study period, indicating good tolerability.

The *E. elatior* extract was found to contain high levels of phenolic and flavonoid compounds, which are known for their potent antioxidant and anti-inflammatory activities. Previous studies, such as those by Chen, et al. (2018) and Nguyen, et al. (2020), have demonstrated that these bioactive compounds effectively mitigate oxidative stress—a primary contributor to skin aging and wrinkle formation. These findings are consistent with the strong antioxidant capacity observed in the present study's DPPH radical scavenging assay.

Moreover, the observed improvement in skin hydration may be attributed to the extract's ability to enhance the skin barrier function and stimulate collagen synthesis—mechanisms that play a critical role in delaying wrinkle formation and improving skin elasticity. This observation aligns with the findings of Lee, et al. (2019), who reported that flavonoid-rich plant extracts promote skin moisturization and reduce wrinkle appearance.

Nevertheless, certain limitations of the study should be acknowledged. The open-label, single-arm design may introduce assessment bias, and the relatively small sample size could limit the generalizability of the results. Future studies employing a double-blind, placebo-controlled design with a larger cohort are recommended to further validate the efficacy and safety of *E. elatior* extract in anti-aging skincare applications.

Conclusion and Recommendations

Overall, the results of this study support the potential of *Etlingera elatior* extract as a bioactive ingredient in anti-aging skincare products. The cream formulated with 2% extract effectively improved skin hydration and reduced wrinkle depth without causing any adverse effects, demonstrating both efficacy and safety.

Based on these promising findings, the following recommendations are proposed:

- Further research should be conducted with larger and more diverse populations, utilizing rigorous trial designs such as randomized, double-blind, placebo-controlled studies.
- Mechanistic studies are warranted to elucidate the specific biological pathways through which the extract influences collagen synthesis and enhances skin barrier integrity.
- Product development initiatives should consider incorporating *E. elatior* extract into commercial anti-aging cosmetic formulations.

This study contributes valuable insights into the cosmeceutical potential of *Etlingera elatior* and provides a scientific foundation for its future application within the skincare industry.

Recommendations

1. Long-term studies should be conducted to assess the prolonged effects of using facial creams containing *Etlingera elatior* extract on wrinkle reduction and sustained skin improvement.

2. A larger sample size and **a double-blind, randomized controlled trial design** are recommended to enhance the reliability of the results and minimize potential assessment bias.

3. Safety and side effects of the cream should be evaluated in individuals with sensitive skin or chronic dermatological conditions to determine its suitability for a broader range of users.

4. Further molecular-level investigations should be performed to identify the active constituents and elucidate the underlying mechanisms of action of the extract, which would strengthen the scientific basis for its cosmetic applications.

5. Development of cream formulations with varying concentrations and textures is encouraged to meet the diverse needs of users across different age groups and skin types.

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