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Application of *Clitoria ternatea* L. Flower Extract Lotion in Preventing the Decrease in Collagen and Epidermis Thickness in Wistar Rats Skin Given Ultraviolet-B Rays

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Abstract: Exposure to ultraviolet-B (UV-B) light contributes to a decrease in skin collagen levels, which can cause premature aging. This study aims to evaluate the effectiveness of telang flower (*Clitoria ternatea* L.) extract lotion in maintaining collagen levels and epidermal thickness of UV-B-exposed rat skin. A total of 30 Wistar male white rats (200-250 g) were divided into six treatment groups: negative control (distilled water), positive control (Vaseline), and four treatment groups of telang flower extract lotion with concentrations of 0.2, 0.5, 0.75, and 1%. Mice were exposed to UV-B light (311 nm, 70 mJ/cm² per session) for 14 days with a total dose of 420 mJ/cm². The lotion was applied twice daily, before and after UV-B exposure. Evaluation was performed by measuring collagen content and epidermal thickness using histology staining. Statistical analysis used One-Way ANOVA or Kruskal-Wallis if assumptions were not met. The results showed that the treatment group with telang flower extract significantly increased collagen content and epidermal thickness compared to the negative control ($p < 0.05$), with a dose of 0.5% showing the highest effectiveness. In conclusion, telang flower extract lotion has potential as a photoprotective agent against UV-B-induced skin damage.

Keywords: Collagen amount extract; Epidermal thickness; Palm flower

Introduction

Indonesia has a tropical climate with high humidity of up to 80% and temperatures that can reach 35°C, as well as intense sun exposure (Wilsya et al., 2020). These conditions can negatively affect the skin due to daily exposure to UV rays, such as skin damage, tanned skin, redness, dryness, burning, wrinkles, irritation, and premature aging (Endah & Suhardiana, 2020). Skin, as the outermost organ of the body with a surface area of about 2 square meters, has an important role in protecting the body from foreign objects, chemicals, ultraviolet radiation, and microorganisms, as well as having aesthetic value (Wijayaningsih, 2024). Healthy skin is characterized by an even tone, sufficient moisture, flexibility, and a smooth texture (Hidajat et al., 2023).

Sunlight reaching the Earth's surface consists of infrared light (56%), visible light with a wavelength of 400-700 nm (39%), and ultraviolet (UV) light (5%) (Ratnawati et al., 2023; Nafiah et al., 2024). The UV spectrum itself is divided into UV-A (320-400 nm) which accounts for almost 5% of the total radiation and UV-B (290-320 nm) which accounts for about 5-10% of the total UV radiation reaching the earth's surface. UV-A rays can cause hyperpigmentation, while UV-B has higher energy that can cause erythema, sunburn, premature aging, and increase the risk of skin cancer. Although UV light also has benefits, such as aiding the production of vitamin D, overexposure can still be detrimental to skin

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health and the immune system (Isfardiyana & Safitri, 2014).

Research by Son et al. (2020) showed that exposure to high-intensity ultraviolet B (UV-B) light can trigger the formation of reactive oxygen species (ROS) in the skin, which then stimulates the production of proinflammatory cytokines. This process allows the infiltration of neutrophils and other immune cells into the skin tissue, which contributes to collagen degradation and wrinkle formation (Son et al., 2020). Antioxidants can reduce ROS levels, thus helping to stop inflammation and stimulate collagen production. As a tropical country with high biodiversity, Indonesia has many plants that have potential as a source of natural antioxidants, one of which is telang flower (*Clitoria ternatea* L.) (Zhang et al., 2024; Fitrilia et al., 2020).

Telang flowers (*Clitoria ternatea* L.) are rich in bioactive compounds such as alkaloids, flavonoids, polyphenols, saponins, glycosides, tannins, and essential oils that act as natural antioxidants (Roy et al., 2019). The content of phenolic and flavonoid compounds, especially anthocyanins, kaempferol, quercetin, and myricetin in telang flowers is able to counteract free radicals by inhibiting oxidation, thus slowing down the photo-oxidation process due to UV exposure (Adaninggar, 2024; Bujak et al., 2022). This strong antioxidant activity makes telang flowers potential as a natural ingredient in sunscreens (Falya et al., 2024). Apart from being an antioxidant, telang flowers also have antidiabetic, antiobesity, anti-inflammatory, and antimicrobial properties (Lusi et al., 2024). Previous research has proven that telang flower extract in cream form is effective in reducing inflammatory responses in skin exposed to UV rays (Akmal et al., 2023).

One of the effective cosmetic dosage forms as an antioxidant carrier is lotion, which consists of various components such as stabilizers, emollients, emulgators, humectants, distilled water, preservatives, and emulsifying agents. Lotions are moisturizers in the form of liquid emulsions that are used on the hands and body to moisturize and soften the skin without leaving a greasy feeling, easy to apply, and quickly absorbed (Iskandar et al., 2021). Compared to other dosage forms such as creams, lotions have advantages in terms of wider spread and faster absorption, making them more suitable for use in protection against daily UV exposure.

Although previous studies have examined the antioxidant and anti-inflammatory effects of bay flower extract in various dosage forms, no study has specifically evaluated the effectiveness of bay flower extract lotion in preventing a decrease in the amount of collagen and epidermal thickness in skin exposed to UV-B light. This research is important because it can provide a scientific basis for the development of skin protection products based on Indonesian natural ingredients, which can be an alternative to products made from synthetic chemicals. The utilization of bayang flowers in the cosmetic industry can also provide added economic value for local farmers and support efforts to develop products based on Indonesian biodiversity. Therefore, this study aims to assess the effectiveness of lotions containing telang flower extract (*Clitoria ternatea* L.) in preventing a decrease in the amount of collagen and epidermal thickness in the skin of Wistar rats exposed to ultraviolet-B light.

Method

This study is a laboratory experimental study with a post-test only control group design, which aims to observe the effect of giving lotion of telang flower extract (*Clitoria ternatea* L.) on the amount of collagen and epidermal thickness in the skin of Wistar rats exposed to Ultraviolet-B (UV-B) light. Experimental research is conducted by strictly controlling and observing variables to determine the effect of a treatment on other variables under controlled conditions (Maulidza et al., 2024; Sugiyono, 2019). In this study, the antioxidant effect of telang flower extract was analyzed to see its ability to prevent collagen loss and maintain epidermal thickness due to UV-B exposure. All procedures carried out in this study have received approval from the Prima Indonesia University Health Research Ethics Committee with protocol number 049/KEPK/UNPRI/XI/2024, ensuring that this research is carried out in accordance with applicable animal research ethical standards.

This study used analytical scales (Mettler Toledo), UV-Vis spectrophotometer (Jasco V-730), rotary evaporator, waterbath, pH meter, chaff, and centrifuge for analysis and preparation. The main ingredients used were telang flower extract (*Clitoria ternatea* L.), stearic acid, Triethanolamine, alcohol, lanolin, glycerin, nipagin, nipasol, propylene glycol, ethanol, and oleic acid.

This study begins with the extraction process of telang flowers (*Clitoria ternatea* L.) using the maceration method with 70% ethanol as a solvent (Aprinaldi, 2020; Djrami et al., 2023). A total of 2 kg of telang flowers were washed, then dried in an oven at 40°C for one week until the water content was reduced. After drying, telang flowers were pulverized into powder and extracted by maceration method, accompanied by stirring to make it homogeneous. The maceration process is followed by evaporation using a vacuum rotary evaporator to obtain a solvent-free thick extract (Herlianto et al., 2023; Zebua et al., 2024). The thick extract obtained was then tested for phytochemical screening to identify the content of

secondary metabolites, including alkaloid test, terpenoid/steroid test, flavonoid test, tannin test, and saponin test (Ginting et al., 2025).

Phytochemical screening was conducted to detect bioactive compounds in *Clitoria ternatea* L. extracts by several test methods (Aprinaldi, 2020). Flavonoid test was conducted by dissolving 40 mg of extract in 100 mL of hot water, then boiled for 5 minutes and filtered. A total of 5 mL of filtrate was added 0.05 g of magnesium powder and 1 mL of HCl, then shaken at high speed. A color change to red, yellow, or orange indicates a positive result. Alkaloid test is done by mixing a little extract with 1% HCl solution, then adding 1 mL of Mayer reagent. If a precipitate or turbidity forms, then the result is positive for alkaloids. Saponin test is done by dissolving 40 mg of extract in 10 mL of water, then shaken for 1 minute and added 2 drops of HCl 1N. If a stable foam forms for about 7 minutes, then the extract contains saponins. The phenol test is done by mixing the extract solution in a test tube with $FeCl_3$ reagent in ethanol. If the solution changes color to green, red purple, blue, or black, then the extract is positive for phenol. Tannin test is done by dissolving 40 mg of extract in 4 mL of water, then 2 mL of extract solution is taken and 1 mL of $FeCl_3$ 10% is added. Positive results are characterized by the formation of black or dark blue color (Novriyanti et al., 2022).

Formulation of lotion by preparing and weighing all ingredients. The mortar and stamper were heated on a waterbath (Iskandar et al., 2021). The oil phase ingredients (stearic acid, cetyl alcohol, lanolin, propyl paraben, and oleic acid) were heated at 70°C. Meanwhile, the water phase ingredients (glycerin, methyl paraben, and propylene glycol) were also heated at the same temperature in a separate container. After all the ingredients were dissolved, the oil phase was mixed into the mortar with the water phase while stirring until homogeneous. TEA and distilled water were added slowly with constant stirring until an emulsion was formed, then telang flower extract (*Clitoria ternatea* L.) as the active substance was added. The lotion that has been formed is put into a container. The lotion formula in this study used telang flower extract with variations in concentration of 0.2, 0.5, 0.75, and 1%, with a fixed composition for other ingredients such as stearic acid (8%), TEA (2%), cetyl alcohol (1%), lanolin (1%), glycerin (10%), methyl paraben (0.02%), and propyl paraben (0.18%), as well as variations of propylene glycol (0-10%) and oleic acid (0-10%) (Jacoeb, 2020; Wilsya et al., 2020).

The evaluation test of lotion preparation includes organoleptic test conducted by observing the color, odor, and physical form of each formula. Homogeneity test was conducted by applying lotion on a glass slide to ensure the particles were evenly dispersed without any lumps (Syaputri et al., 2023). The pH test used pH paper, with an ideal range of 4.5-6.5 so as not to cause dry or irritated skin. The adhesion test was carried out by placing 0.25 g of lotion between two glass objects, given a load of 1 kg for 5 minutes, then calculated the release time after giving 80 g load. The spreadability test was carried out by placing the lotion sample on a scaled glass slide, covered with another glass, then given a gradual load for 1-2 minutes, measuring the diameter of the spread until it stops, with a standard of 5-7 cm to meet the requirements of a good formulation (Sugihartini et al., 2020).

This study used healthy Wistar strain white rats, with an average weight of 200-250 grams, totaling 30 animals, and divided into 6 treatment groups, each consisting of 5 rats. The test animals underwent acclimatization for 7 days in cages, with husks at the bottom, good air circulation, temperature of 25°C, and a 12-hour light-dark cycle (Dhillon et al., 2024; Jusril et al., 2024). Treatments consisted of negative control (distilled water), positive control (Vaseline), and four groups treated with telang flower extract lotion (*Clitoria ternatea* L.) with concentrations of 0.2, 0.5, 0.75, and 1%. Prior to treatment, the back area of the rats was shaved 2×2 cm and exposed to Philips UV-B light (311 nm, 70 mJ/cm² per session) for 14 days, with a total dose of 420 mJ/cm². Lotion was applied twice a day, 20 min before and 4 h after UV-B exposure, to evaluate its effects on collagen amount and epidermal thickness of mouse skin.

Measurement of the amount of collagen was done on the 15th day after treatment in each group of rats. This analysis aims to determine the average amount of collagen in each group, which is then statistically analyzed to evaluate the effect of telang flower extract lotion (*Clitoria ternatea* L.) in preventing collagen loss in Wistar rat skin due to UV-B exposure. The amount of collagen was measured from the back skin tissue of the rats after UV-B exposure. The analysis was performed by rapid digital method, using LC Evolution camera and Olympus Bx51 photomicroscope with 400x magnification. Each preparation was photographed three times, saved in JPEG format, and analyzed for average area expression using ImageJ 1.52a software (National Institute of Health, USA) (Ariyanti et al., 2019; Gunawan et al., 2019).

Histopathology analysis was performed based on scoring the density of collagen tissue distribution in one field of view at 400x magnification (Arifiaindahsari, 2020). The histology parameters used consisted of five categories, namely 0 (no collagen found), +1 (low collagen, less than 10% per visual field), +2 (medium collagen, 10-50% per visual field), +3 (tight collagen, 50-90% per visual field), and +4 (very tight collagen, 90-100% per visual field). In addition, the thickness of the

epidermis was measured using the morphometric method with 400x magnification, starting from the surface of the epidermis to the deepest layer bordering the dermis. The number of fibroblasts was counted by spreading them evenly and photographing them at 100x magnification. With the help of Image Raster software, a 50 µm x 50 µm box was created, and then the number of fibroblasts was counted manually within the box (Amfotis et al., 2022).

Data analysis using the SPSS program. Statistical analysis began with a normality test using Shapiro-Wilk, then continued with a homogeneity test using Levene. If the data were normally distributed and homogeneous, the analysis was carried out using the One-Way ANOVA method (Tambunan et al., 2023; Haidir et al., 2022). However, if the data was not normally distributed, the Kruskal-Wallis test was used as an alternative. Analysis results were considered meaningful if the p value was < 0.05. If the data did not meet the assumptions of normality or homogeneity, data transformation was performed. If after transformation the data is still not normal and homogeneous, the Kruskal-Wallis nonparametric test is used with the same level of significance. If the analysis showed significant results, a post hoc test was conducted to identify significant differences between the tested groups (Nuralifah et al., 2022; Wardani et al., 2024).

The research flow chart can be seen in the following figure.

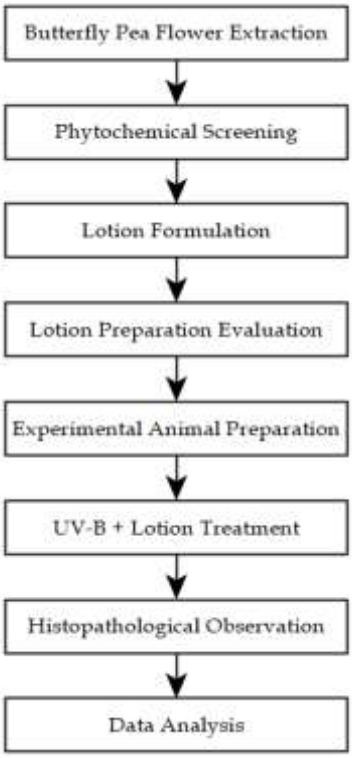

Figure 1. Research flow chart

Result and Discussion

Phytochemical screening is a qualitative test carried out as an initial stage in analyzing the content of secondary metabolites in telang flower extract (*Clitoria ternatea* L.). This test aims to identify various compounds contained in the extract. The results of phytochemical screening are presented in the following table.

Table 1. Phytochemical screening results of telang flower extract (*Clitoria ternatea* L.)

Secondary metabolite compounds	Reagents	Results
Alkaloids	Bouchardart	+
	Maeyer	+
	Dragendroff	+
	Wagner	+
Steroids and triterpenoids	Salkowsky	+
	Lieberman-burchad	+
Saponins	Aquadest + 96% alcohol	+
Flavonoids	FeCl3 5%	+
	Mg(s) + HCl(p)	+
	NaOH 10%	+
	H_2SO_4 (p)	+
Phenolic	$FeCl_3$ 1%	+
Tannins	Gelatin + H_2SO_4	+

Phytochemical screening of telang flower extract (*Clitoria ternatea* L.) showed the presence of various secondary metabolite compounds. Alkaloid test with Bouchardart, Maeyer, Dragendroff, and Wagner reagents showed positive results. Steroid and triterpenoid compounds were detected by Salkowsky and Lieberman-Burchard tests. Saponin content was confirmed through tests using distilled water and 96% alcohol. Flavonoids were identified with $FeCl_3$ 5%, Mg with HCl, NaOH 10%, and concentrated H_2SO_4 reagents, all of which gave positive results. Phenolic compounds were detected through the $FeCl_3$ 1% test, while tannin was identified through tests with gelatin and H_2SO_4. These results suggest that telang flower extract contains various bioactive compounds that have potential pharmacological benefits.

The results of the lotion preparation evaluation test in this study have appropriate sensory characteristics and do not undergo changes that can affect their quality. The results of the lotion preparation evaluation test can be seen in Table 2.

Based on the organoleptic test results presented in Table 2, formulation 1 and formulation 2 have a distinctive aroma of bay flowers with a bluish white

color and creamy texture. Meanwhile, formulation 3 and formulation 4 also showed a distinctive aroma of bay flowers, but with a purplish blue color and a dosage form that remained creamy. The amount of collagen in the skin of Wistar rats exposed to ultraviolet-B light reflects the impact of UV-B exposure on collagen levels, which play a role in the skin aging process. This decrease in collagen levels can be a key indicator in assessing the effectiveness of the treatment applied in the study, the use of anti-aging cream containing telang flower extract (*Clitoria ternatea* L).

Table 2. Organoleptic test results

Formulation	Organoleptic		
	Aroma	Color	Shape
F1	Characteristic odor	White to slightly blue	Lotion
F2	Characteristic odor	White to slightly blue	Lotion
F3	Characteristic odor	Purplish blue	Lotion
F4	Characteristic odor	Purplish blue	Lotion

Table 3. Average number of collagen decreases in the skin of wistar rats given ultraviolet-B light

Formulation	Average + std deviation
Negative control	2.50 + 0.57
Positive control	3.50 + 0.57
F1 concentration 0.2%	3.75 + 0.50
F2 concentration 0.5%	3.75 + 0.50
F3 concentration 0.75%	3.50 + 0.57
F4 concentration 1%	3.75 + 0.50

Based on the results in Table 3, the mean and standard deviation of the amount of collagen decrease in Wistar rat skin exposed to ultraviolet-B light for each formulation was obtained. The results showed that the negative control group experienced a decrease in collagen of 2.50 ± 0.57, while the positive control amounted to 3.50 ± 0.57. Formulations F1 and F2 each had an average decrease of 3.75 ± 0.50, as well as F4, while F3 showed a decrease of 3.50 ± 0.57. From this data, it can be concluded that the concentration of telang flower extract (*Clitoria ternatea* L.) in formulations F1, F2, and F4 have the same effectiveness in preventing the decrease in the amount of collagen.

The results of the Kruskal-Wallis test were used to analyze the role of telang flower extract lotion (*Clitoria ternatea* L.) in preventing a decrease in the amount of collagen in the skin of Wistar rats exposed to ultraviolet-B light. This test was conducted because the data were not normally distributed, so non-parametric analysis was the right choice. That the lotion formulation of telang flower extract has the potential to prevent a decrease in the amount of collagen due to exposure to ultraviolet-B light.

The results of the study on the role of telang flower extract lotion (*Clitoria ternatea* L.) in preventing the decrease in the amount of collagen in the skin of Wistar rats exposed to ultraviolet-B light showed that the p-value obtained was 0.10 (> 0.05). Based on this result, there is no significant difference between formulations F1, F2, F3, and F4 in preventing the decrease in the amount of collagen. In other words, the four formulations of telang flower extract lotion have equal effectiveness in maintaining collagen levels in Wistar rat skin after exposure to ultraviolet-B light.

Table 4. Kruskal-Wallis test

Formulation	P-Value
Negative control	0.10
Positive control	
F1 concentration 0.2%	
F2 concentration 0.5%	
F3 concentration 0.75%	
F4 concentration 1%	

The application of lotion of telang flower extract (*Clitoria ternatea* L.) to the thickness of the epidermis in the skin of Wistar rats exposed to ultraviolet-B light was analyzed to assess its effectiveness in protecting the skin structure. Table 5 presents data on the average thickness of the epidermis in the skin of rats that have received exposure to ultraviolet-B light with various treatments. These results provide an idea of how the use of telang flower extract lotion can affect the thickness of the epidermis, which plays an important role in maintaining the skin's protective function against external factors.

Table 5. Average epidermal thickness of wistar rat skin treated with ultraviolet-B light

Formulation	Average + std deviation
Negative control	13.82 + 3.35
Positive control	26.89 + 5.07
F1 concentration 0.2%	31.18 + 7.36
F2 concentration 0.5%	29.69 + 9.06
F3 concentration 0.75%	27.34 + 8.93
F4 concentration 1%	22.33 + 3.97

Based on the results of the study, the mean and standard deviation of epidermal thickness in the skin of Wistar rats exposed to ultraviolet-B light for each

formulation were obtained. The epidermal thickness in the negative control group was recorded at 13.82 ± 3.35, while the positive control group was 26.89 ± 5.07. Formulations with telang flower extract showed variations in epidermal thickness, where F1 (0.2%) had the highest average of 31.18 ± 7.36, followed by F2 (29.69 ± 9.06), F3 (27.34 ± 8.93), and F4 (22.33 ± 3.97). These results indicate that the F1 formulation with a concentration of 0.2% telang flower extract has the greatest effect in increasing the thickness of the epidermis on the skin of Wistar rats exposed to ultraviolet-B light.

Table 6. Oneway Anova test

Formulation	P-Value
Negative control	
Positive control	
F1 concentration 0.2%	0.02
F2 concentration 0.5%	
F3 concentration 0.75%	
F4 concentration 1%	

The results of one-way ANOVA test on the role of telang flower extract lotion (*Clitoria ternatea* L.) on epidermal thickness in Wistar rat skin exposed to ultraviolet-B light showed a p value of 0.02 (< 0.05). This indicates that there is a significant difference in epidermal thickness between formulations F1, F2, F3, and F4. Based on the data in Table 5, it can be seen that F1 with 0.2% extract concentration showed the highest increase in epidermal thickness (31.18 ± 7.36), followed by F2 (29.69 ± 9.06), F3 (27.34 ± 8.93), and F4 (22.33 ± 3.97). Interestingly, there was a trend of decreasing effectiveness with increasing extract concentration, indicating that the optimal concentration to increase epidermal thickness was at a lower concentration (0.2%).

This difference in epidermal thickness can be explained through the mechanism of action of bioactive compounds in telang flower extract, especially anthocyanins and flavonoids, which are able to stimulate keratinocyte proliferation as a protective response to UVB exposure. Research by Kamkaen & Wilkinson (2009) showed that the flavonoid content in *Clitoria ternatea* extracts correlated directly with their photoprotective capacity, with optimal protection achieved at low concentrations, similar to the F1 formulation (0.2%) in this study. Low concentrations likely provide better penetration or reduce molecular aggregation, thereby increasing the bioavailability of active compounds in the epidermal layer.

The results of the analysis of the amount of collagen showed different patterns. The mean and standard deviation of collagen decrease in each formulation showed that F1, F2, and F4 had a value of 3.75 ± 0.50, while F3 was 3.50 ± 0.57, compared to the negative control (2.50 ± 0.57) and positive control (3.50 ± 0.57). Despite the numerical variation in effectiveness, the Kruskal-Wallis test results showed a p value of 0.10 (>0.05), which means there is no significant difference between formulations in preventing the decrease in collagen amount.

This difference in results between epidermal thickness and collagen preservation highlights the complexity of skin protection mechanisms against UVB exposure. Increased epidermal thickness represents a short-term adaptive response that creates a physical barrier against radiation, while collagen preservation reflects long-term protection against extracellular matrix degradation. Liyanaarachchi et al. (2024) in their study demonstrated that anthocyanins from bay flowers specifically inhibited UV-induced MMP-1 expression in fibroblasts, supporting our findings regarding collagen preservation. However, this effect may require longer exposure times or different concentrations to reach statistical significance.

The results of this study are in line with a study by Bagas & Conita (2024) which examined the protective effect of telang flower extract on collagen density due to UVB exposure. In that study, the application of telang flower extract cream with doses of 2.5 and 5% was shown to significantly increase collagen levels compared to the control group. The difference in results with our study may be due to variations in formulation, duration of UVB exposure, or collagen measurement method (Bagas & Conita, 2024). The protective mechanism of telang flower extract against UVB exposure is closely related to its antioxidant content. UVB exposure triggers the formation of reactive oxygen species (ROS) that cause inflammation and collagen degradation through the activation of matrix metalloproteinases (MMPs). Bioactive compounds in telang flowers, such as kaempferol, quercetin, and mirisetin, function as free radical scavengers that protect skin cell structures from oxidative stress. The strong antioxidant activity of *C. ternatea*, with an IC50 value of 87.86 ppm (Adaninggar, 2024), explains its ability to neutralize ROS and reduce collagen damage (Tambunan et al., 2023).

The relationship between epidermal thickness and collagen preservation reflects the layered mechanism of skin protection. The increase in epidermal thickness in the group treated with bay flower extract, especially at 0.2% concentration (F1), indicates stimulation of keratinocyte proliferation in response to UVB exposure. This increase in epidermal thickness provides additional physical protection against UVB penetration into the dermis layer, where collagen is located. Although the

effect on collagen did not show a statistically significant difference, the higher mean value in the treatment group compared to the negative control indicated a protective trend.

In the skin aging process, exposure to sunlight containing ultraviolet (UV) rays is a major factor contributing to extrinsic aging, also known as photoaging. Excessive UV exposure can trigger the formation of free radicals in cells, which have the potential to damage various cellular components and cause changes in the skin, such as dryness, wrinkles, and a dull appearance (Natanael et al., 2021). Telang flowers (*Clitoria ternatea* L.) are known to contain various bioactive compounds, including kaempferol, quercetin, and mirisetin, which act as antioxidants. A previous study by Adaninggar (2024) concluded that extracts from flowers, leaves, and roots of telang flowers have the same potential in counteracting free radicals. In addition, glutathione, one of the main antioxidants in the body, plays a role in the skin depigmentation process by inhibiting melanogenesis through suppression of tyrosinase enzyme activity. Previous studies have also revealed that ethanol extracts of *C. ternatea* contain secondary metabolites such as flavonoids, saponins, terpenoids, and tannins, which provide protective effects against oxidative stress. The antioxidant activity of *C. ternatea* itself has been categorized as strong, with an Inhibition Concentration 50% (IC50) value of 87.86 ppm, thus showing its potential in fighting the negative impact of free radicals on the skin (Adaninggar, 2024).

Conclusion

Telang flower extract is proven to contain bioactive compounds such as flavonoids, alkaloids, saponins, phenols, and tannins. telang flower extract (*Clitoria ternatea* L.) provides a protective effect against skin damage due to UVB exposure, with optimal effectiveness at a concentration of 0.2% (F1) in increasing epidermal thickness. Although the effect on collagen preservation was not statistically significant, there is an indication of potential protection that needs to be further investigated with a longer treatment duration or a more sensitive measurement method. This protective mechanism most likely involves the antioxidant and anti-inflammatory activities of the bioactive compounds in telang flower extract, which play a role in neutralizing free radicals and inhibiting collagen degradation due to UVB exposure. The results of this study support the potential of telang flower extract as a natural ingredient that can be used in skin care formulations to reduce the effects of aging due to UV-B exposure.

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Conceptualization and methodology, writing-review and editing, I.G., E.G., and A.N.N.; formal analysis, I.G. and A.N.N.; investigation, I.G. and J.Y.; writing-preparation of initial draft, I.G.; visualization, I.G. and R.V.P. All authors have approved the published version of the manuscript.

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The authors declare no conflict of interest.

References

Adaninggar, R. (2024). *Pengaruh Pemberian Gel Ekstrak Bunga Telang (Clitoria ternatea L.) Terhadap Kadar Interleukin-6 (IL-6) dan Kadar Vascular Endothelial Growth Factor (VEGF) (Studi Eksperimental In Vivo pada Tikus Wistar Jantan yang Dipapar Sinar UV-B)* (Thesis). Universitas Islam Sultan Agung Semarang. Retrieved from http://repository.unissula.ac.id/33934/

Akmal, T., Julianti, A. I., & Syamsudin, S. S. (2023). Polyherbal Formulation Optimization from Clitoria ternatea, Rosmarinus officinalis and Aquilaria malaccensis Using Simplex Lattice Design. *International Journal of Applied Pharmaceutics*, *15*(2), 79–84. https://doi.org/10.22159/ijap.2023.v15s2.15

Amfotis, M. L., Suarni, N. M. R., & Arpiwi, N. L. (2022). Wound Healing of Cuts in the Skin of White Rat (Rattus norvegicus) Is Given Kirinyuh (Chromolaena odorata) Leaf Extract. Metamorfosa: *Journal of Biological Sciences*, *9*(1), 139. https://doi.org/10.24843/metamorfosa.2022.v09.i01.p14

Aprinaldi, B. (2020). Phytochemical Screening and Activity Test of Ethanol Extract of Red Seaweed (Gracilaria verrucosa) on Wound Healing in Male Wistar Rats. *Journal of Pharmacopolium*, *3*(1). https://doi.org/10.36465/jop.v3i1.571

Arifiaindahsari, E. (2020). *Ethanol Extract of Durian Seed (Durio zibethinus Murr.) as a Free Radical Repressor on Pancreas Histology* (Undergraduate Thesis). Faculty of Medicine and Health Science Muhammadiyah University Yogyakarta. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://etd.umy.ac.id/id/eprint/3340/1/Halaman%20Judul.pdf

Ariyanti, A., Masruriati, E., Tyas, S. M., & Khasanah, K. A. N. (2019). Moisture Test of Blood Clam (Anadara granosa) and Green Clam (Mytilus viridis) Shell Collagen Cream on the Skin of Male White Rats (Rattus novergicus). *Health Information Research*, *8*(2), 99. https://doi.org/10.30644/rik.v8i2.240

Bagas, W., & Conita, Y. (2024). Protective Effect of Telang Flower Extract (Clitoria ternatea L.) on Collagen Density from UVB Exposure. *Jurnal Sehat Indonesia (JUSINDO)*, *6*(1). https://doi.org/10.59141/jsi.v6i01.66

Bujak, T., Zagórska-Dziok, M., Ziemlewska, A., Nizioł-Łukaszewska, Z., Lal, K., Wasilewski, T., & Hordyjewicz-Baran, Z. (2022). Flower Extracts as Multifunctional Dyes in the Cosmetics Industry. *Molecules*, *27*(3), 922. https://doi.org/10.3390/molecules27030922

Dhillon, J. M. K., Chiuman, L., & Rusip, G. (2024). Effectiveness of Andaliman Extract on Blood Sugar Levels of White Mice Induced by STZ HOMA-IR. *Jurnal Penelitian Pendidikan IPA*, *10*(12), 9915–9925. https://doi.org/10.29303/jppipa.v10i12.9163

Djrami, J., Niwele, A., & Polpoke, N. (2023). Pharmacological Test of 70% Etanol Extract of Kersen Leaves (Muntigua calabula L) on Reduction of Blood Glucosa Rate in Mencites (Mus musculus). *Journal of Health Science Research*, *1*(1), 133–149. https://doi.org/10.55606/jurrikes.v1i1.897

Endah, S. R. N, & Suhardiana, E. (2020). Evaluation of Natural Solar Tabir Formulation of Aloe vera and Red Seaweed (Eucheuma cottonii) Gel Availability. *Journal of Indonesian Pharmaceutical Insan*, *3*(1), 169–176. https://doi.org/10.36387/jifi.v3i1.455

Falya, Y., Pratama, S. P., Liu, L. D., Syafiq, M. F., Mulyani, A., & Suharyani, I. (2024). Aims to Increase the Knowledge of Students of SMAN 5 Cirebon on Earth Flowers (Clitoria ternatea L.) as a Healthy Drink. *Gemakes: Journal of Community Service*, *4*(1), 39-43. https://doi.org/10.36082/gemakes.v4i1.1440

Fitrilia, T., Kurniawan, M. F., Kurniawati, F. R., & Setiawan, T. (2020). The Potential of Butterfly Pea Flower Methanol Extract as an Antioxidant by in Silico. *Indonesian Journal of Applied Research (IJAR)*, *1*(3), 163–169. https://doi.org/10.30997/ijar.v1i3.64

Ginting, A. N. B., Ginting, C. N., Rusip, G., & Chiuman, L. (2025). Antidiabetic Activity of Cep-Cepan Leaf Extract Nanoparticles (Castanopsis costata) in Streptozotocin-Induced White Rat Models. *Jurnal Penelitian Pendidikan IPA*, *11*(2), 64–70. https://doi.org/10.29303/jppipa.v11i2.9408

Gunawan, S. A., Berata, I. K., & Wirata, I. W. (2019). Histopatologi Kulit pada Kesembuhan Luka Insisi Tikus Putih Pasca Pemberian Extracellular Matrix (ECM) yang Berasal dari Vesica Urinaria Babi. *Indonesia Medicus Veterinus*, *8*(3), 313-324. Retrieved from https://ojs.unud.ac.id/index.php/imv/article/view/51218?articlesBySameAuthorPage=5

Haidir, Y. P., Saputri, G. A. R., & Hermawan, D. (2022). Uji Efektivitas Kombinasi Umbi Bawang Dayak (Eleutherine palmifolia (L.) Merr) dan Daun Insulin (Tithonia diversifolia) Terhadap Penurunan Kadar Glukosa Darah pada Tikus Putih (Rattus norvegicus) Diinduksi NA2EDTA. *Jurnal Farmasi Malahayati*, *5*(1), 86-97. Retrieved from https://ejurnalmalahayati.ac.id/index.php/farmasi/article/viewFile/7004/pdf

Herlianto, M. F. J., Hendrawan, S., & Ferdinal, F. (2023). Phytochemical Test and Total Antioxidant Capacity of Bay Leaf Extract (Syzygium polyanthum). *Jurnal Kesehatan Tambusai*, *4*(4), 5012-5018. https://doi.org/10.31004/jkt.v4i4.16330

Hidajat, D., Tilana, F. G., & Kusuma, I. G. B. S. A. (2023). Dampak Polusi Udara Terhadap Kesehatan Kulit. *Unram Medical Journal*, *12*(4), 371-378. https://doi.org/10.29303/jku.v12i4.1021

Isfardiyana, S. H., & Safitri, S. R. (2014). The Importance of Protecting Skin from Ultraviolet Rays and How to Protect Skin with Homemade Sunblock. *Asian Journal of Innovation and Entrepreneurship (AJIE)*, *3*(2). Retrieved from https://journal.uii.ac.id/ajie/article/view/7819

Iskandar, B., Sidabutar, S. E. B., & Leny, L. (2021). Formulation and Evaluation of Avocado (Persea americana) Extract Lotion as Skin Moisturizer. *Journal of Islamic Pharmacy*, *6*(1), 14–21. https://doi.org/10.18860/jip.v6i1.11822

Jacoeb, A. M. (2020). Characteristics of Gracillaria Verrucosa and Turbinaria conoides as Body Lotion Making Materials. *Jurnal Akuatek*, *1*(2), 73-83. Retrieved from https://jurnal.unpad.ac.id/akuatek/article/view/29945

Jusril, M., Prajitno, A., & Fadjar, M. (2024). Effectiveness of Administering Red Belt Leaf Extract (Piper crocatum) Against Aeromonas hydrophila Bacteria in Vitro. *Jurnal Penelitian Pendidikan IPA*, *10*(3), 1025–1031. https://doi.org/10.29303/jppipa.v10i3.6074

Kamkaen, N., & Wilkinson, J. M. (2009). The Antioxidant Activity of Clitoria ternatea Flower Petal Extracts and Eye Gel. *Phytotherapy Research*, *23*(11), 1624-1625. https://doi.org/10.1002/ptr.2832

Liyanaarachchi, G., Mifsud, M., & Viglia, G. (2024). Virtual Influencers and Data Privacy: Introducing the Multi-Privacy Paradox. *Journal of Business*

Research, *176*, 114584. https://doi.org/10.1016/j.jbusres.2024.114584

Lusi, H., Adi, S., & Syirril, I. (2024). Influence of Adding Earl Flower Extract (Clitoria ternatea L.) on the Fruit Leather Quality of Kersen Fruit (Muntingia calabura L.). *Journal of Agritechnology and Food Processing*. Retrieved from https://journal.ummat.ac.id/index.php/JAFP/article/download/24265/pdf

Maulidza, C. P., Halim, B., Chiuman, L., Nasution, A. R., & Theresia, Y. (2024). The Effect of Andaliman Fruit Extract (Zanthoxylum acanthopodium DC) on α-Synuclein Levels in Rotenon-Induced Wistar Rats. *Jurnal Penelitian Pendidikan IPA*, *11*(2), 516–524. https://doi.org/10.29303/jppipa.v11i2.10362

Nafiah, S. R., Fitraneti, E., Rizal, Y., Primawati, I., & Hamama, D. A. (2024). Pengaruh Paparan Sinar Ultraviolet Terhadap Kesehatan Kulit dan Upaya Pencegahannya: Tinjauan Literatur. *Scientific Journal*, *3*(3), 185–194. https://doi.org/10.56260/sciena.v3i3.147

Natanael, G. I., Simorangkir, G. F., Parariski, N., Tambunan, M. P. B., Nasution, A. N., & Amansyah, A. (2021). Potensi Antioksidan dan Anti-Elastase Ekstrak Daun Kelor (Moringa oleifera) Terhadap Antiaging. *Jurnal Keperawatan Priority*, *4*(1), 69-76. https://doi.org/10.34012/jukep.v4i1.1432

Novriyanti, R., Putri, N. E. K., & Rijai, L. (2022). Testing Ethanol Extract of Lime Skin (Citrus aurantifolia) Using DPPH Method. *Proceeding of Mulawarman Pharmaceuticals Conferences*, *15*, 165–170. https://doi.org/10.25026/mpc.v15i1.637

Nuralifah, N., Fitrawan, L. O. M., Parawansah, P., & Trisetya, M. (2022). Histopathology of Pancreatic Organs of Type 2 DM Rats Treated with Ethanol Extract of Red Gedi Leaves. *Syifa Sciences and Clinical Research (JSSCR)*, *4*(1), 141–151. Retrieved from https://ejurnal.ung.ac.id/index.php/jsscr/article/view/13566

Ratnawati, I. G. A. A., Putra, I. K., Suryatika, I. B. M., Sutapa, G. N., & Trisnawati, N. L. P. (2023). Pengaruh Sinar Ultraviolet Terhadap Jamur Aspergillus Niger. *Kappa Journal*, *7*(1), 58–62. https://doi.org/10.29408/kpj.v7i1.12252

Roy, S., Sil, A., & Chakraborty, T. (2019). Potentiating Apoptosis and Modulation of p53, Bcl2, and Bax by a Novel Chrysin Ruthenium Complex for Effective Chemotherapeutic Efficacy Against Breast Cancer. *Journal of Cellular Physiology*, *234*(4), 4888–4909. https://doi.org/10.1002/jcp.27287

Son, D. J., Jung, J. C., Choi, Y. M., Ryu, H. Y., Lee, S., & Davis, B. A. (2020). Wheat Extract Oil (WEO) Attenuates UVB-Induced Photoaging Via Collagen Synthesis in Human Keratinocytes and Hairless Mice. *Nutrients*, *12*(2), 300. https://doi.org/10.3390/nu12020300

Sugihartini, N., Jannah, S., & Yuwono, T. (2020). Gel Formulation of Moringa Leaf Extract (Moringa oleifera Lamk) as an Anti-inflammatory Preparation. *Pharmaceutical Sciences and Research*, *7*(1). https://doi.org/10.7454/psr.v7i1.1065

Sugiyono, S. (2019). *Metodelogi Quantitative and Qualitative Research and R&D*. Bandung: ALFABETA. Retrieved from https://fia.ub.ac.id/katalog/index.php?p=show_detail&id=643

Syaputri, F. N., Mulya, R. A., Tugon, T. D. A., & Wulandari, F. W. (2023). Formulation and Characteristic Test of Handbody Lotion Containing Ethanol Extract of Red Betel Leaf (Piper crocatum). *FARMASIS: Journal of Pharmaceutical Science*, *4*(1), 13–22. https://doi.org/10.36456/farmasis.v4i1.6915

Tambunan, G. C. A., Girsang, E., & Nasution, A. N. (2023). Pengaruh Pemberian Gel Ekstrak Daun Pegagan (Cantella asiatica) sebagai Peningkat Neovaskularisasi, Fibroblast dan Epitalisasi dalam Penyembuhan Luka Tikus Jantan. *Health Information: Jurnal Penelitian*, *15*(1). Retrieved from https://myjurnal.poltekkes-kdi.ac.id/index.php/hijp/article/view/957

Wardani, Y., Dewi, N. P., Alaydrus, S., & Rachmawati, M. (2024). Subchronic Toxicity Test of Purple Leaves Ethanol Extract (PLEE) on the Histopathological Picture of the Pancreas of Wistar Rats. *Jurnal Penelitian Pendidikan IPA*, *10*(6), 3325–3333. https://doi.org/10.29303/jppipa.v10i6.8069

Wijayaningsih, R. (2024). *The Relationship of the Duration of Ultraviolet Ray Exposure to the Incident of Sunburn on Athlete's Skin in The City of Parepare* (Undergraduate Thesis). Fakultas Kedokteran dan Ilmu Kesehatan, Universitas Muhammadiyah Makassar. Retrieved from https://digilibadmin.unismuh.ac.id/upload/39003-Full_Text.pdf

Wilsya, M., Hardiansyah, S. C., & Sari, D. P. (2020). Formulation and Antioxidant Activity Test of Gandarusa Leaf Extract Lotion (Justicia gendarussa Burm f.). *Jurnal Kesehatan: Jurnal Ilmiah Multi Sciences*, *10*(2), 105–115. https://doi.org/10.52395/jkjims.v10i02.292

Zebua, W. I., Chiuman, L., & Fachrial, E. (2024). Histopathological Evaluation of Green Betel Leaf Extract Ointment on Incision Wounds Infected with Staphylococcus aureus in Wistar Rats. *Jurnal Teknologi Laboratorium*, *13*(2), 71–82.

https://doi.org/10.29238/teknolabjournal.v13i2.475

Zhang, J., Yu, H., Man, M., & Hu, L. (2024). Aging in the Dermis: Fibroblast Senescence and Its Significance. *Aging Cell*, *23*(2), e14054. https://doi.org/10.1111/acel.14054