ORIGINAL ARTICLE

The efficacy of antiaging cream with *Oxalis dehradunensis* R. ethanolic extract as skin aging care among woman agriculture workers

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J. Adv. Pharm. Technol. Res.

ABSTRACT

Skin damage and aging are potential health problems for woman agriculture workers. This study aimed to test the efficacy of *Oxalis dehradunensis* ethanol extract formulated in antiaging cream preparations as an aging treatment in women agriculture workers. The method carried out was an experimental study on woman agriculture workers who were willing to volunteer. The experimental scenario conducted related to the physical quality of antiaging cream products and the efficacy of creams on the skin as an antiaging treatment. Physical quality parameters of antiaging cream include organoleptic assessment, cream emulsion, homogeneity, viscosity, pH, distribution, and skin irritation test to evaluate potential side effects. Skin aging efficacy assessments were conducted on 12 subjects divided into four formula concentration groups. The physical skin identification parameters measured are moisture, pore size, pigmentation or spots, and wrinkles using a skin analyzer. The results found that *O. dehradunensis* leaf extract formulated as an antiaging cream can neutralize free radicals and is an effective countermeasure against premature skin aging. There were significant differences in the skin characteristics of woman agriculture workers who participated as samples. The formula with 5% concentrate and 7% extract of *O. dehradunensis* has provided a reaction and is more effective in continuous treatment. It provides skin moisture changes of more than 300%, disguises pore size and good pigmentation, and reduces wrinkles of farmers who are constantly exposed to chemicals and free radicals in their agricultural activities. The leaf extracts antiaging cream showed more significant changes in moisture and skin pigmentation. It was concluded that the use of *O. dehradunensis* leaf extract as the core ingredient of antiaging cream can be an innovation that is beneficial to the health of the farming community, especially among women agriculture workers.

Key words: Antiaging, antioxidant, cream, *Oxalis dehradunensis*, women agriculture worker

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Submitted: 06-Aug-2023 **Revised:** 25-Nov-2023
Accepted: 22-Dec-2023 **Published:** 15-Jan-2024

Access this article online	
Quick Response Code:	Website: www.japtr.org
	DOI: 10.4103/japtr.Japtr_388_23

INTRODUCTION

Indonesia is a developing country, with agriculture being the dominant sector. Women agriculture workers usually work outdoors and are exposed to sunlight and free radicals

How to cite this article: Mahyuni EL, Harahap U. The efficacy of antiaging cream with *Oxalis dehradunensis* R. ethanolic extract as skin aging care among woman agriculture workers. J Adv Pharm Technol Res 2024;15:56-61.

chronically, resulting in skin damage and premature skin aging. Ultraviolet light is very beneficial for converting Vitamin D into its active form, but prolonged exposure can cause erythema, a burning sensation, and skin cancer.[1] Free radicals are proposed as one of the main causes of premature skin aging, as they interfere with lipid metabolism and reduce skin elasticity, leading to skin dryness and wrinkles. Various skin care products including topical antiaging contain antioxidants as their active ingredients to neutralize free radicals.[2-4]

Skin aging is an inevitable natural process in which skin regeneration eventually slows down, collagen production decreases, internal support structures weaken, and the skin barrier diminishes. Reactive oxygen species (ROS)-induced intracellular and extracellular oxidative stress promotes skin aging, characterized by increased wrinkles and pigmentation.[5] Skin aging is a complicated process involving the epidermal layer and skin, initiated by the decay of skin morphology and physiology as we age. This decay affects vital skin functions, such as hemodynamic control, fluid balance, loss of electrolytes and proteins, Vitamin D production, toxin elimination, immunity, sensory perception, and protection against environmental insults.[6,7]

Technological advancements, increasing "back to nature" trends in the general public, and various natural resources in Indonesia are supporting factors in the development of natural skin care products. Natural extracts are potent chemopreventive agents and are safer against aging skin. Micronutrients, either extracted from plants or biologically synthesized, including antioxidants, are widely researched and are popularly used in antiaging treatments.[8-11]

Premature aging of the skin is prevalent among farmers, as they are constantly unprotected from ultraviolet rays, fertilizers, and pesticides. The damage caused by ultraviolet rays and free radicals is a big concern for women agriculture workers, who are often not familiar with skin care. Lack of awareness in caring for the skin is affected due to the unregulated use of skin care with side effects unknown to farmers. Our preliminary study shows the prevalence of farmers' skin conditions experiencing dark, wrinkled, and dull pigmentation as manifestations of premature skin aging. Chemical exposure and free radicals as some of the causes that need to be eliminated by the use of natural ingredients, one of which is the wild plant *Oxalis dehradunensis*.

This plant is widespread in Tanah Karo, Indonesia, and is classified as a type of mountain clover. It contains powerful secondary metabolites of flavonoids and antioxidants as well as saponin, steroids, and tannin.[12] The antioxidant properties of this plant can be utilized in the formulation of antiaging creams. The formula is assessed in the form of an emulsion containing semisolid water (>60%), which is formulated for external use to observe antiaging potential against ultraviolet rays and free radicals.[13,14]

MATERIALS AND METHODS

The ingredient used in this study was ethanol extract *O. dehradunensis* R. The fresh leaves of *O. dehradunensis* R. were collected in 1 day to maintain the freshness of the leaves and then dried in the laboratory. Freshwater was dried as *Simplicia* (raw, unprocessed natural material), macerated with 70% ethanol, and evaporated at ±50°C with a rotary evaporator. According to previous studies, this extract has been tested with the DPPH method and proven to have antioxidant content in moderation.[15] The research method carried out was experimental where the formulated cream was tested for physical quality and tested on the skin of female volunteer farmers. Physical quality checks are performed, organoleptic tests, cream emulsion tests, homogeneity tests, viscosity tests, pH tests, distribution tests, and skin irritation tests to evaluate potential side effects.[16] The test is carried out by cycling test method where the cream preparation is stored at 4°C for 24 h and then removed and placed at 40°C ± 2°C for 24 h. This experiment was repeated for six cycles. The physical condition of the antiaging cream preparation was compared during the experiment with the previous preparation.[17] The parameters carried out include visuals including the shape, color, and smell of the preparation. The expected preparation has a cream-colored, semisolid form and has a characteristic odor. Organoleptic observation of the preparation was carried out during storage of 12 weeks with observation every 1 week. Determination of pH was done three times on the cream against each concentration.[18] The pH of the preparation is measured using a pH meter every week for 12 weeks. Dispersion is an important characteristic in formulations that guarantees ease when the preparation is applied to the skin.[19] In cream with good dispersion, the surface area of the skin that can be in contact with the cream will be wider so that the active substance can be well distributed.[20]

The effectiveness of antiaging creams assay is done using the skin analyzer where the woman agriculture workers will be checked for initial conditions first. Examination results of the initial condition can be the basis for giving antiaging cream by a defined formula. Volunteers then tested the antiaging cream by applying it directly on the face with use for 4 weeks. The indicators assessment can be seen from the ability to moisturize (moisture), the condition of the facial pores (pore), melamine content that indicates a blemish on the face, and condition wrinkles on the face (wrinkle). The sampling method was purposive where volunteers were recruited from woman agriculture workers who had no previous history of skin care use. Other inclusion criteria include sun exposure and outdoor activities that predispose to premature skin aging, generally manifesting in dullness

and pigmentation. Assessments for the efficacy of skin aging were conducted on 12 subjects that were divided into four groups according to the formula tested, namely, formula with the composition of *O. dehradunensis* extract 0%, 3%, 5%, and 7%.

All subjects underwent a physical skin examination before treatment and weekly after regular use of the cream. The measured parameters are:

1. Humidity, using Aramo Skin Analyzer Moisture Checker
2. Pore size, lens magnification below ×60 with blue light sensor
3. Pigmentation/spot, lens magnification below ×60 with orange light sensor
4. Wrinkles, lens magnification below ×10 with blue light sensor.

This study also fulfilled ethical clearance requirements 90/KEP/USU/2020. Number 90/KEP/USU/2020. Informed consent was provided by the woman agriculture farmers. Data were collected weekly for 1 month starting from the initiation of use, using a skin analyzer to observe differences before and after treatment. The data were then analyzed using one-way ANOVA (confidence interval 95%, $P < 0.05$).

Formulation of antiaging cream with *Oxalis dehradunensis* extract

The extraction process carried out by maceration produces blackish-brown ethanol extract in the form of thick extract and is hygroscopic. This extract is assumed to produce a brownish-green cream depending on how much extract is included in the cream formulation. The extracts to be tested will be included in the percentage formula of antiaging cream as 3%, 5%, and 7% with control that not using extracts (0%). The basic formulation carried out homogeneously from the oil and water phases of making the cream is listed in Table 1 as the base formulation.[21]

RESULTS AND DISCUSSIONS

The woman agriculture workers are routinely exposed to ultraviolet light during work. This, combined with climate change, is subject to free radicals, and ozone layer depletion, increasing the incidence of premature skin aging as well as skin conditions such as jars, wrinkles, and an increased risk of skin cancer.[22-25] Several studies have focused on the efficacy of sunscreen to reduce the harmful effects of ultraviolet rays on the skin. Fruit extracts, dietary fiber like seaweed, and natural herbs are emerging as interesting ingredients because of their proposed role in delaying skin aging or as antioxidants.[26-29]

Table 1: Base formulation of antiaging cream

Formula	F0	F1	F2	F3
R/stearic acid (g)	12	12	12	12
Acetyl alcohol (g)	0.5	0.5	0.5	0.5
Propylene glycol (g)	3	3	3	3
Triethanolamine (g)	1	1	1	1
Glycerin (g)	1	1	1	1
Methylparaben	q.s	q.s	q.s	q.s
Extract (g)	0	3	5	7
Aquadest ad (mL)	100	100	100	100

Antiaging products include all preparations capable of slowing or preventing the premature aging process.[30] Skin aging is clinically visible as the appearance of wrinkles, roughness, loss of elasticity, hyperpigmentation, and dullness.[31] The use of antiaging products is expected to not only stop the aging process but also repair damaged skin structure and protect and maintain the integrity of the skin.

Preparation of *Oxalis dehradunensis* R. extract antiaging cream

Physical quality assessment of organoleptic tests performed by storing the antiaging cream for 12 weeks under weekly observation to discover the physical properties of the cream. Visually, the resulting shape, color, and smell are greenish-cream in color, semisolid, and with a distinct aroma. After six cycles, where the cream was tested at different temperatures for specific time intervals at 4ºC for 24 h and then at 40ºC for 24 h, no change in shape, color, or odor was noted in the preparation of *O. dehradunensis* leaf extract cream.[32]

The pH testing showed that after 12 weeks of storage in a low room, room, and high temperature, a slight decrease in pH was observed. However, the pH is still physiologically compatible with the pH of the skin in the range of 4.5–6.5 and is preferred because it is considered safe and nonirritating. A pH below 4.5 will cause skin irritation.[33] The more alkaline or acidic the material, the harder it is for the skin to neutralize the pH, which can lead to dryness, cracked skin, sensitivity, and increased susceptibility to infection. The preparation can meet the requirements of the distribution test (5–7 cm) and feels good when applied.[34]

The more cycles completed, the lower the pH becomes. At F0, the pH is 6.7, and at F3, the pH decreases to 6.4. F0 cream performed best in distribution tests (3.7–5.6 cm) and F3 performed worst (2.9–4.1), indicating that the greater the load imposed, the greater the distribution. F0 (blank) indicates a high viscosity (average score of 12133 cPs), and F3 indicates a lower viscosity (average score of 2239 cPs). Overall, the quality of antiaging cream looks green in color and is good in use.

The effectiveness *of Oxalis dehradunensis* R. antiaging cream extract

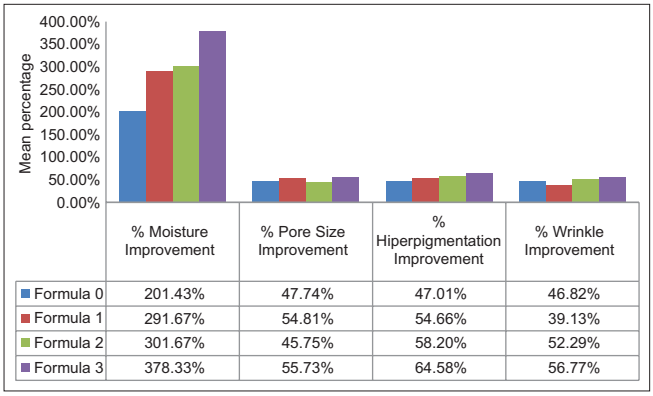
Effectiveness testing was conducted using a skin analyzer on female volunteer farmers with previous skin examinations

before starting the treatment. The initial assessment provides basic data for the determination of the cream formulation. Subjects were instructed to apply a thin antiaging cream on their facial skin for 4 weeks. The indicators measured are humidity, pore size, melanin content, and wrinkles [Figure 1].

Skin moisture is shown to increase after the use of antiaging creams. The highest increase occurred in the F3 group (378.33%). Natural extracts protect the skin through various mechanisms, some of which are by reducing ROS activity, preventing oxidation, absorbing ultraviolet rays, reducing enzymatic activity, delaying wrinkle formation, and protecting skin from aging. Maintaining a healthy lifestyle, preventing excessive sun exposure, and oral and topical administration of antioxidants are beneficial in preventing premature aging.[35-37] As we age, the pores of the face are enlarged by free radicals, for which various nutra-therapeutic efforts to find antiaging agents are carried out.[38,39] Subjects who received antiaging treatment, especially formula group 3, showed the highest pore size reduction (55.73%). The decrease in facial hyperpigmentation forms the potential of *O. dehradunensis* leaf extract to reduce dark spots due to free radical exposure. After 4 weeks of treatment, hyperpigmentation decreased, especially in the F3 formulation group (64.53%).

Skin aging is a complex biological process, which takes into account endogenous or intrinsic factors (genetics, cell metabolism, hormones, and metabolism) and exogenous or extrinsic factors (chronic exposure to light, pollution, ionizing radiation, chemicals, and toxins) that trigger progressive structural and physiological changes, leading to wrinkles and hyperpigmentation. Oxidative stress damages skin cells and tissues. For countermeasures, antiaging agents can be administered either topically, systematically, or even invasively.[40]

Wrinkled skin is one of the indicators of premature skin aging. The use of antiaging creams can reduce wrinkles and regenerate the skin, slowing down premature skin aging. After administration of *O. dehradunensis* extract cream, a reduction in wrinkle scores was noted, with Formula 3 showing the most reduction (56.77%). Antiaging creams were shown to be more effective among subjects aged 30 years and above, whose frown lines were more visible compared to those aged 25–29 years.[41] Consistent weekly improvements were noted, with preparations containing a higher percentage of the extract giving better results. Thus, our study was able to establish that *O. dehradunensis* R. The extract can minimize the negative impact of free radicals, delay skin aging, and improve the health of women agriculture workers in general. One of the ways ANOVA is used to determine the significance of the effectiveness of antiaging creams. Of the four parameters measured, the difference between increased skin moisture and decreased hyperpigmentation was statistically significant [Table 2].



	% Moisture Improvement	% Pore Size Improvement	% Hiperpigmentation Improvement	% Wrinkle Improvement
Formula 0	201.43%	47.74%	47.01%	46.82%
Formula 1	291.67%	54.81%	54.66%	39.13%
Formula 2	301.67%	45.75%	58.20%	52.29%
Formula 3	378.33%	55.73%	64.58%	56.77%

Figure 1: Efficacy of *Oxalis dehradunensis* R. extract antiaging cream among subjects

O. dehradunensis leaf extract is validated as an antiaging cream, primarily due to its moisturizing effect and ability to reduce facial hyperpigmentation. A decrease in pore size and wrinkles was also observed although not statistically significant. It is proposed that increased pore size and wrinkles may require a longer treatment time to show a significant difference.

Skin aging is mainly caused by increased exposure to free radicals due to age, or ultraviolet rays, which inflict damage to skin cells, skin layers, and adnexa, manifesting in clinical signs of skin aging.[42] Antioxidant botanical ingredients containing polyphenols and flavonoids are trending, especially appealing to those concerned with skin health and beauty. Intrinsic and extrinsic factors influence each other in complex biological processes; ultraviolet light is the main cause of photoaging.[43,44] Subjects were shown to favor the preparation of Formula 3 (7% extract) because many felt it produced the most rapid changes in moisture, pigmentation, pore size, and increased wrinkles. The formulation can be adjusted to provide more protection against sunlight.

CONCLUSIONS

We concluded that *O. dehradunensis* leaf extract formulated as an antiaging cream can neutralize free radicals and is an effective countermeasure against premature skin aging. We observed changes in skin moisture, pore size, pigmentation, and a decrease in wrinkles of farmers who were constantly exposed to chemicals and free radicals in their agricultural activities. *O. dehradunensis* leaf extract antiaging cream shows significant changes in moisture and skin pigmentation.

Acknowledgment

We would like to express our gratitude toward the farmers involved in our study: farmers in Secanggang village,

Table 2: Significance of various formulations for *Oxalis dehradunensis* leaf extract antiaging cream

Skin analyzer	Formula (%)	Mean	Significant	LSD	Duncan	
Moisture	0	201.4267	0.037		201.4267	
	1 (3)	291.6667		0.096	291.6667	291.6667
	2 (5)	301.6667		0.069	301.6667	301.6667
	3 (7)	378.3333		0.006		378.3333
Pore size	0	47.7367	0.224		54.8100	
	1 (3)	54.8100		0.216	45.7500	
	2 (5)	45.7500		0.716	47.7367	
	3 (7)	55.7267		0.167	55.7267	
Melanin (node)	0	47.0100	0.102		47.0100	
	1 (3)	54.6667		0.244	54.6667	54.6667
	2 (5)	58.1967		0.104	58.1967	58.1967
	3 (7)	64.5733		0.020		64.5733
Face wrinkles	0	46.8167	0.504		39.1300	
	1 (3)	39.1300		0.527	46.8167	
	2 (5)	52.2867		0.651	52.2867	
	3 (7)	56.7667		0.417	56.7667	

SD: Standard deviation, LSD: Least significant difference

Kabanjahe subdistrict, for providing the *O. dehradunensis* leaves as raw material in this research, and farmers from Kelompok Wanita Tani Tangguh Karang Gading Village, Secanggang subdistrict, for participating in the testing of our antiaging cream. We would also like to thank Lembaga Penelitian Universitas Sumatera Utara for their financial support through the TALENTA program with contract ID 6789/UN5.1.R/PPM/2021, dated June 16, 2021, as well as all parties whose contributions are indispensable throughout our study. We would also thank to the Cosmetic Laboratorium for participating in the production of our antiaging cream.

Financial support and sponsorship

This study was supported by Lembaga Penelitian Universitas Sumatera Utara for the TALENTA program in applied research scheme with contract number 388/UN5.2.3.1 /PPM/SPP-TALENTA USU/2021, dated June 18, 2021.

Conflicts of interest

There are no conflicts of interest.

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