

Evaluating the difference of skin elasticity value on the use of 3% superoxide dismutase cream and 10% urea

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Abstract

Introduction Skin is the outermost layer and the largest organ in the human body which has important role against extrinsic factors such as physical, chemical trauma, and exposure to ultraviolet (UV), which cause damage to its barrier function and induce photoaging, resulting in decreased skin elasticity. Furthermore, urea is a humectant moisturizer that repairs the skin barrier, while superoxide dismutase (SOD) is an antioxidant group commonly used in a series of skin care products.

Objective The study aims to investigate the difference in the value of skin elasticity after the use of 3% SOD and 10% urea cream.

Methods This experimental analytical study was conducted in Dermatotology and Venereology Department outpatient clinic of Dr. Moewardi General Hospital between October-December 2020. Patients with skin disorders and outdoors workers were excluded from this study. Superoxide dismutase 3% and urea 10% cream was applied twice daily on the patient's right and left forearm, respectively for a month. Furthermore, the elasticity values of the skin were assessed in week 2 and 4. All data were statistically analyzed with paired t-test and a p value of < 0.05 was considered significant.

Results The results showed that all the subjects (20) had skin elasticity improvement. However, SOD application gave a better skin elasticity (p=0.001) than urea cream (p=0.002).

Conclusion Antioxidant SOD cream has better effect in improving skin elasticity compared to urea.

Key words

Skin elasticity, superoxide dismutase 3%, urea 10%.

Introduction

Skin is the largest organ of the human body which interacts directly with environment. Therefore, it plays an important role in

preventing the entry of bacteria, regulates body temperature, and prevents against extrinsic factors such as physical, chemical trauma, and exposure to ultraviolet (UV) rays.^{1,2}

Skin change is recognized as visual information regarding the aging process. The factors that characterize aging include changes in skin texture, formation of fine lines, reduced elasticity, and decreased barrier function. These changes are seen especially in the facial area.^{3,4}

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Factors which cause aging are classified into external and internal factors. The main causative external factor is sun exposure which cause DNA damage (UV A and B). Intrinsic factor including age, which affects the decrease in adaptation function to stress and cell damage due to free radicals. Furthermore, elasticity is the skin's ability to return to its original position after being stretched. A reduced skin elasticity due to sun exposure (elastosis) is a natural aging process.^{5,6}

The use of moisturizers is one way to repair damaged skin by increasing skin hydration. Moreover, urea is one of the moisturizing agents that has been used since 1900 and is reported to be effective in treating dry skin and other disorders such as atopic dermatitis, ichthyosis, and psoriasis.^{7,8}

Furthermore, superoxide dismutase (SOD) is an antioxidant used in skin care products such as sunscreens, moisturizers, also as topical therapy for atopic dermatitis and pruritus. The mechanism of action of SOD is to inhibit the inflammatory process by preventing the entry of free radicals into the skin.^{9,10} Generally, antioxidants nourish the skin and prevent aging (photoaging).¹¹

Method

This experimental analytical study was conducted on patients at the Dermatovenereology Department in Dr. Moewardi Hospital, Surakarta from October-December 2020. Skin elasticity was measured using ELASTOMETER® EM25 (Courage & Khazaka electronic GmbH Cologne Germany) without cream as a control provided creams or other topical drugs were used before treatment. Furthermore, the exclusion criteria included patients with skin disorders (xerotic skin, atopic dermatitis, psoriasis) and also working outdoors. All subjects received 3% SOD cream applied to

the right forearm and 10% urea on the left. The results were measured based on the elasticity value at the second and fourth weeks. The data were analyzed using SPSS ver. 17.00 and Shapiro-Wilk test was used to measure the normality of the elastometer value results. If the p-value<0.05 (significant), then the non-parametric test (Wilcoxon Signed Ranks Test) is used, however, if the p-value>0.05 (not significant), the parametric test (paired t-test) is used.

Results

Subjects in this study consisted of 14 females (70%) and 6 male (30%) with the majority of men aged 21-30 years. Most of them were students (95%) (**Table 1**).

Based on the statistical test of skin elasticity, significant results were obtained before and after 2 weeks of treatment in both groups. For 10% urea cream, a p-value of 0.002 was obtained while for 3% SOD cream p-value was 0.001 (**Table 2 and 3**).

Table 1 Demographic data of Research Subjects.

Characteristics	Total	Percentages
<i>Gender</i>		
Male	6	30%
Female	14	70%
<i>Age</i>		
21-30	19	95%
31-40	1	5%
<i>Occupation</i>		
Students	19	95%
Employee	1	5%

Table 2 Skin elasticity value before treatment, as well as 2 and 4 weeks after treatment using 3% SOD cream.

Time	Mean±SD	p
Before treatment	74.40±6.99	*.001
2 weeks after treatment	82.30±9.27	
Before treatment	74.40±6.99	.012
4 weeks after treatment	81.55±7.81	
2nd after treatment	82.30±9.27	.795
4th after treatment	81.55±7.81	

*significant value p <0.05 for the use of SOD (superoxide dismutase) cream before and after 2 weeks of the treatment.

Table 3 Description of skin elasticity value before treatment, as well as 2 weeks and 4 weeks after treatment using 10% urea cream.

Time	Mean±SD	p
Before treatment	73.70 ±7.58	*.002
2 weeks after treatment	80.25±8.52	
Before treatment	73.70±7.58	.027
4 weeks after treatment	79.90±8.89	
2 nd after treatment	80.25±8.52	.858
4 th after treatment	79.90±8.89	

*significant value $p < 0.05$ for the use of 10% urea cream before and after 2 weeks of the treatment.

Discussion

Skin plays an important role in defending against external factors, especially UV rays that induce photoaging. Factors that characterize skin aging include decreased elasticity, which produces wrinkles, blackish patches (solar lentigo), and dry skin. One method to assess the degree of photoaging is by measuring skin elasticity. This is useful in predicting the occurrence of early photoaging symptoms.^{12,13}

In this study, the average age of the subjects that are yet to experience aging and had normal skin elasticity was 21-30 years. The provision of 3% SOD cream was found to increase skin elasticity in subjects that have not undergone photoaging. Furthermore, urea is a humectant class moisturizer that has been used for a long time. It improves skin barrier function, especially to prevent the increase in the value of transepidermal water loss (TEWL).¹⁴ In this study, there was no significant increase in skin elasticity values due to the use of urea compared to SOD cream.

There are 2 types of antioxidants in the skin, which are enzymatic and non-enzymatic. Superoxide dismutase is an enzymatic antioxidant group and the highest type that neutralizes reactive oxygen species (ROS) and disrupt natural nutrients in the skin, cause cell damage, and inflammation. It plays a promising role in the field of skin cosmetics because it has

a protective effect as well as repairs damaged skin cells.^{15,16}

Furthermore, superoxide dismutase is the first-line free radical-fighting antioxidant and is available in both oral and topical supplementation forms. In several studies, SOD has been shown to prevent malignant diseases and degenerative disorders. Its protective mechanism is performed by converting superoxide into oxides and hydrogen peroxide (H_2O_2) into harmless molecules (H_2O and O_2).^{17,18}

The exposure to UVA and UVB rays activates free radicals causing the formation of ROS. This results in cell damage and reduces endogenous enzymatic antioxidants including SOD, especially after repeated exposure. However, the effect of oral supplementation and the use of antioxidants to prevent photoaging due to UV exposure still needs further investigation.¹⁹

Furthermore, UVA rays play a major role in the aging process, while UVB is involved in inflammation and DNA damage. In addition, the topical application of SOD is being developed as a prophylactic to prevent skin damage caused by UV rays. SOD is a highly hydrophilic macro molecule and is not absorbed directly into the stratum corneum. Also, the molecular size limit for percutaneous absorption is 500 Da. Meanwhile, the molecular weight is around 32.5 kDa, which is quite large, therefore drug absorption is performed via the transfollicular pathway to obtain its potent antioxidant effect.²⁰⁻²²

The results showed that 3% SOD cream increased skin elasticity higher than 10% urea after 2 and 4 weeks of use. Furthermore, the administration of 3% SOD cream has more significant effect on the value of skin elasticity. This is consistent with the role of antioxidants

on the skin to prevent photoaging by protecting the barrier from ultraviolet rays.²³

Conclusion

In this study, skin elasticity was measured to assess the effectiveness of 3% SOD cream and 10% urea. The value of skin elasticity was found to be higher after the application of 3% SOD cream. Consequently, the topical antioxidant cream (3% SOD) can be considered as a cosmetic product to prevent photoaging.

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