



Effect of 8% Purple Sweet Potato Extract Cream on Wrinkle Reduction, Skin Moisture, and Elasticity

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ABSTRACT

Background: Purple sweet potato has been shown to contain anthocyanins, polyphenols, flavonoids, and tannins that act as antioxidants and have the potential to correct signs of aging in the skin, such as wrinkles, lack of hydration, and pigmentation. **Purpose:** to know the potential of 8% purple sweet potato extract for wrinkles, moisture, and elasticity. **Methods:** A one-group experimental study with pre and post-test assessment. The subject is women with photoaging aged 30-45 years. A pre-test was conducted by examining wrinkles using the Glogau scale and a simple A-one scanner, treatment with 8% purple sweet potato extract cream for 6 weeks, and then a post-test at the end of the 6th week to check wrinkles, moisture, and elasticity using a simple A-one scan. Statistical tests using the SPSS program, version 25.0. The analysis performed was descriptive statistical and comparative analysis using a paired T test. **Result:** A total of 25 respondents with a mean age \pm SD of 38.22 ± 4.23 years, the most Glogau scale in type 2 is 22 respondents (88%), the most sun exposure for 30 minutes per day is 14 respondents (56%). The degree of wrinkles decreased after treatment -4.960 ± 1.353 [95% CI -7.681 - (-2.239) ; $P=0.001$]. The degree of moisture increased after treatment $8.840 \pm 2.990\%$ (95% CI 2.829 - 14.851 ; $P=0.005$). The degree of elasticity increased after treatment 14.840 ± 4.623 (95% CI 5.544 - 24.136 ; $P=0.002$). **Conclusion:** 8% purple sweet potato extract can reduce the degree of wrinkles, improve the degree of skin moisture, and improve the degree of skin elasticity.

Keywords: wrinkles, moisture, elasticity, photoaging, purple sweet potato.

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BACKGROUND

The skin has several functions, including being the body's main defense barrier that separates the internal organs from the external environment, regulating body temperature, fluid and electrolyte balance, and providing several receptors, such as touch, pain, and pressure receptors. Although the skin has many important roles, it deteriorates with age, and one of the dermatological problems that is currently of concern to the public is skin aging. This is based on the fact that the skin is the part of the body that is most exposed to external factors and is also one of the sources of a person's self-confidence.¹

Ageing is a dynamic biological process that cannot be avoided. Progressive deterioration of the body's

organ systems and a decrease in physiological capacity characterize this condition. The skin, as the largest organ in the human body, undergoes two types of aging processes, namely intrinsic and extrinsic aging. Skin undergoing intrinsic aging will appear dry, pale, and accompanied by fine wrinkles. On the other hand, skin with extrinsic aging, especially due to sun exposure, will appear darker, rougher, and often has pigmentation spots.²

Purple sweet potato is one of the plants that has been widely studied for its antioxidant effects. Purple sweet potato extract has been shown to contain anthocyanins, polyphenols, flavonoids, and tannins that act as antioxidants and have the potential to correct signs of aging in the skin, such as wrinkles, lack of

hydration, and pigmentation.³ Many animal studies have been conducted around these issues. Among them are Permata et al. (2021)⁴ and Ningrum (2019),⁵ who found benefits of this extract on collagen, as well as Krochmal-Marczak et al. (2021), who reported tyrosinase inhibitor effects.⁶

In the research of Anggraeni et al (2024), using purple sweet potato clay mask preparations can increase water content, smoothness, pore size reduction, and wrinkle reduction for four weeks of treatment in volunteers.³ The results of phytochemical analysis on purple sweet potato obtained anthocyanin levels contained of 7.1669 mg/100g with IC50 = 194.26, and an obtained 8% extract cream is able to inhibit the increase in malondialdehyde (MDA) levels and matrix metalloproteinase-1 (MMP-1) in rats exposed to UV-B rays.⁷ Various previous research results make the author interested in exploring the potential application of purple sweet potato extract cream in photoaging patients that have never been done. This study is to know the potential of 8% purple sweet potato extract for wrinkles, moisture, and elasticity

METHODS

This study is a one-group experimental study with pre- and post-test assessment. The population sample is women with photoaging aged 30-45 years.

The cream was made in Phytochemistry Laboratory and Pharmaceutical Analysis Laboratory of Pharmacy Study Program, Faculty of Pharmacy, Mahasaraswati University, Denpasar. Phytochemical examination was conducted at Phytochemistry Laboratory and Pharmaceutical Analysis Laboratory of Pharmacy Study Program, Faculty of Pharmacy, Mahasaraswati University, Denpasar. The research respondents were taken at the Medical Cosmetics Subdivision of the Skin and Gender Polyclinic of Prof. Dr. I G. N. G. Ngoerah Hospital Denpasar. The research was conducted from March to June 2023 for 16 weeks.

The inclusion criteria were as follows: women aged 30-45 who visited the Dermatology and Venereology Polyclinic of Prof. Dr. I.G.N.G. Ngoerah Denpasar Hospital, had photoaging on their visage, were in good general health, and were willing to participate in the study by signing informed consent.

Exclusion criteria are: 1) Subjects who have received treatment for skin aging, including laser therapy, filler injection, and botulinum toxin in the last six months; 2) Subjects were taking oral medications such as oral antioxidant vitamins A (dose of 5.000

IU/day), C (dose >300 mg/day), E (dose 10 mg/day), selenium E (dose 50 g/day), or zinc (dose 15 mg/day), as well as topicals such as vitamins A (concentration 0.025%), C (concentration 15%), E (concentration 1%), carotenoids (concentration 0.2%), phenolics (concentration 2.5%), co-enzyme Q-10 (concentration 1%), or peptide (concentration 30%), hormone replacement therapy or hormonal contraceptives in the past four weeks; 3) The subject is a pregnant and lactating woman; 4) The subject is suffering from chronic inflammatory skin diseases such as psoriasis and atopic dermatitis; 5) The subject is suffering from acne vulgaris; 6) The subject is a smoker; 7) The subject is a daily alcohol drinker. Drop-out criteria were subjects who did not continue the study after one month of treatment and died.

Simplisia of purple sweet potato was obtained from a research material provider in Denpasar, Bali. The tubers used were fresh purple sweet potato tubers that were blackish purple in color.

Purple sweet potato symplisia was weighed (1 kg) and extracted using 96% ethanol (10 liters) with a ratio of material to solvent of 1:10. Then maceration was carried out for 24 hours and stirred twice. The filtration results were then separated and re-macerated. The two filtration results were then mixed and heated using an evaporator until thickened with a setting of 100 rpm, 40°C, and 50 mBar.⁸

Weigh all ingredients according to the formula, then put the oil phase (stearic acid, cetyl alcohol, propyl paraben, and oleum cocos) into a vaporizer cup. Put the water phase (Methyl Paraben, Triethanolamine, Glycerin, Aquadest) into the vaporizer cup. Next, heat the oil phase and water phase on a water bath until it reaches a temperature of 70 degrees Celsius (until all ingredients in the oil phase melt and all ingredients in the water phase are homogeneously dissolved). Pour the oil phase into the water phase in a mortar, and grind until a creamy mass is formed. Add 0.8 grams of purple sweet potato ethanol extract to 18.2 grams of the previously dissolved cream base mixture. Then this cream mixture has a concentration of 8% purple sweet potato. Cream ingredients are inert and do not interfere with the active ingredients of purple sweet potato ethanol extract.⁸

Before conducting the study, an irritation test was conducted on 15 volunteers who evaluated the use of purple sweet potato extract cream on the volar forearm in 24 hours and did not cause irritation. This is in accordance with the research of Minda Lubis et al. (2019). The irritation test of purple sweet potato extract

body scrub on 15 volunteers did not cause irritating effects such as redness, itching, rough skin and edema.

The cream is applied thinly and evenly on the facial skin, daily in the morning and at night. The cream is recommended to be stored in a cool room and avoid direct sunlight.

Facial skin analysis was performed with the Glogau scale and A-One Smart Skin Analyzer before treatment and re-evaluated with A-One Smart Skin Analyzer after six weeks of treatment. The results obtained were then documented and compared.

Statistical analysis was performed only after database locking. The collected data were checked, coded, processed, and analyzed using computer software. Statistical tests were conducted with the Statistical Package for Social Sciences (SPSS) program, version 25.0. Statistical data analysis involved descriptive statistics to characterize the study subjects, specifically regarding age, gender, wrinkles, moisture, and skin elasticity. Comparative analysis using a paired T test (normal data distribution) to determine the effect of 8% purple sweet potato cream on wrinkles, moisture, and elasticity of facial skin. The researcher has received research approval from Prof. Dr. I.G.N.G. Ngoerah Hospital certificate of ethical feasibility from the Research Ethics Commission Unit of the Faculty of Medicine, Udayana University with number 764/UN14.2.2.VII.14/LT/2023.

RESULT

In this study, 26 research respondents were obtained before treatment; after treatment, 1 respondent was not present when collecting data on treatment results because he was outside Denpasar, so he was not included in the calculation of research participants. Table 1 displays the characteristics of the study. All respondents found no side effects in the administration of this 8% sweet potato cream.

In the study, the mean age \pm SD was 38.22 ± 4.23 years; he most occupations were civil servants (PNS) as many as 9 respondents (36.0%), high school education, diploma 3, and undergraduate obtained the same number of respondents, namely 7 respondents each (28%); the Glogau scale obtained the most results in type 2, namely 22 respondents (88%); the most sun exposure for 30 minutes per day, namely 14 respondents (56%).

The degree of wrinkles was obtained with an average before treatment of $44.00 \pm 5.058\%$ and decreased after treatment with an average result of $39.04 \pm 4.49\%$. The degree of moisture was obtained with an average before treatment of $35.32 \pm 8.75\%$ and

increased after treatment with an average result of $44.16 \pm 12.12\%$, and the degree of elasticity was obtained with an average before treatment of $20.44 \pm 10.39\%$, and increased after treatment with an average result of $35.28 \pm 20.67\%$.

Table 1. Characteristics of research respondents

Variables	Before	After
Age (Mean \pm SD)	38.22 \pm 4,23	
Gender		
Female	25 (100%)	
Male	0 (0%)	
Jobs		
Not working	2 (8.0%)	
Private Employee	7 (28.0%)	
Self-employed	4 (16.0%)	
Civil Servant	9 (36.0%)	
Farmers	1 (4.0%)	
Labor	2 (8.0%)	
Education		
Junior High School	3 (12.0%)	
Late Middle School	7 (28.0%)	
Diploma 1	1 (4.0%)	
Diploma 3	7 (28.0%)	
Bachelor	7 (28.0%)	
Glogau scale		
Type 2	22 (88.0%)	
Type 3	3 (12.0%)	
Sun exposure		
30 minutes	14 (56.0%)	
1 hour	9 (36.0%)	
2 hours	2 (8.0%)	
Wrinkles (%)	44.00 \pm 5.058	39.04 \pm 4.49
Humidity (%)	35.32 \pm 8.75	44.16 \pm 12.12
Elasticity (%)	20.44 \pm 10.39	35.28 \pm 20.67

Table 2. Paired T Test Results

Variables	Average difference ±SD	95% CI		P-value
		Lower Limit	Upper limit	
Wrinkles (%)	-4.960±1.353	-7.681	-2.239	0.001*
Humidity (%)	8.840±2.990	2.829	14.851	0.005*
Elasticity (%)	14.840±4.623	5.544	24.136	0.002*

SD: standard deviation; * significant

The results of the comparison test using the paired T-test obtained in Table 2 show that the degree of wrinkles has a significant difference that decreases with the mean difference before and after : 4.960 ± 1.353 [95% CI -7.681-(-2.239); $P = 0.001$].

The results of the degree of humidity were significantly different before and after the study, with a significantly increased difference of $8.840 \pm 2.990\%$ (95% CI 2.829-14.851; $p = 0.005$).

In the degree of elasticity, there is a significant difference that increases with the mean difference before and after : 14.840 ± 4.623 (95% CI 5.544-24.136; $P = 0.002$).

DISCUSSION

The process of getting older will cause a decrease in the body's function and ability to adapt to damage that occurs in it. One of the risk factors for the aging process is external factors, which include unhealthy diet, unhealthy lifestyle, environmental pollution, radiation, UV rays, cigarette smoke, and stress. This aging results in a decrease in elastin, collagen, and hyaluronic acid, which causes a loss of skin strength and flexibility that results in wrinkles.^{9,10}

As we age, cell proliferation in the basal layer decreases. The epidermis then becomes thinner, and the contact surface area between the dermis and epidermis is reduced, resulting in a lower surface for nutrient supply to the epidermis. This further decreases the proliferation ability of basal cells. The process of decreasing the proliferation ability of cells, including keratinocytes, fibroblasts, and melanocytes, is called cellular senescence.¹¹⁻¹³ The aging dermis not only shows fewer mast cells and fibroblasts than young skin but also fewer collagen and elastic fibers. The downregulation of TGF- β /Smad signaling decreases the production of Type I procollagen and also leads to a decrease in connective tissue growth factors. The downregulation of TGF- β /Smad signaling decreases the production of Type I procollagen and also leads to a decrease in connective tissue growth factors.⁷

In the study, the mean±SD age was 38.22 ± 4.23 years, with the most results having the Glogau scale type 2, namely 22 respondents (88%). Type II is characterized by wrinkles during movement and signs of early to moderate photoaging. Type II is marked by early visible senile lentigines, palpable but not visible keratoses, and parallel smile lines that start to appear in people in their late 30s to early 40s, which is the age range of the respondents who participated in this study.¹⁴

Age is one of the causes of facial wrinkles. External factors are still the most influential factor in the process of wrinkles. These external factors can include UV exposure, unhealthy diet, unhealthy lifestyle, environmental pollution, radiation, cigarette smoke, and stress.¹⁵

Sun exposure (ultraviolet [UV] light) is one of the risk factors that play an important role in skin aging. The aging process caused primarily by sun exposure is known as photoaging. The effects of UV light are estimated to play a role in 90% of clinically visible skin aging.¹⁶ There are three components of UV light based on photon wavelength, including UVA (314-400 nm), UVB (290-320 nm), and UVC (100-289 nm). UVA light plays a role in photoaging, along with UVB, and also contributes to skin immunosuppression and skin cancers such as malignant melanoma, basal cell carcinoma, and squamous cell carcinoma.^{17,18}

Skin exposure to the outdoor environment ≥ 2 hours increases the risk of premature skin aging.¹⁴ In addition, there is a decrease in skin elasticity and moisture. In addition, there is a decrease in skin elasticity and moisture.¹⁹ In a Korean study on 89 women with an average age of 29.7 ± 6.2 years who worked outdoors for ≥ 2 hours by measuring moisture, brightness, elasticity, sebum, and wrinkles in the facial area over a duration of 13 months, the results showed a significant decrease in skin elasticity, moisture, and brightness, which reached 75%. There was an increase in the number of wrinkles on the face, and the amount of sebum reached 45%.²⁰

UVB rays have the ability to cause sunburn greater than UVA rays, while UVA rays have the ability to penetrate deeper into the skin layer and can damage the skin's DNA indirectly, which can cause skin aging (photoaging). UVA rays are stable throughout the day: can penetrate clouds and glass, while UVB rays are greatest at 10:00-14:00 and can be absorbed by glass and clouds. Sander et al. (2020) found that exposure to the sun for 15-30 minutes per day can cause photoaging.²¹

This study identified two respondents with over two hours of sun exposure who exhibited the Glogau scale type 3. This type 3 exhibits evidence of wrinkles at rest and indications of advanced photoaging. Type 3 is characterized by pronounced dyschromia, telangiectasia, visible keratoses, and wrinkles, observable even at rest, typically occurring in individuals over the age of 50.

The most common occupation was civil servant (PNS), accounting for as many as 9 respondents (36.0%), and the highest amount of sun exposure for 30 minutes per day was reported by 14 respondents (56%). This makes the respondents of this study the most still in the Glogau scale type 2. Most jobs are outdoors with 120 minutes of sun exposure, at least at 10.00-16.00 in a day, which is known to create skin wrinkles and signs of photoaging.²² Exposure to work-related solar ultraviolet radiation was significantly positively associated with the occurrence of facial wrinkles ($\alpha = 0.05$). A Danish study looked at the effects of photoaging and actinic keratosis workers who were indoors or outdoors for ≥ 2 hours a day. They found that actinic keratosis was more common in outdoor workers (OR = 4.272, CI [1.045-17.471; $p < 0.001$], and photoaging conditions were twice greater ($P < 0.001$; 95% CI [1.077-1.262]). The decrease in moisture and elasticity was found to be 2.14 times faster (95% CI 0.89-4.56; $P < 0.001$) in outdoor workers compared to indoor workers. An increase in the degree of wrinkles was also found to be significant 4.27 times (95% CI 1.04-17.4; $P < 0.001$) in outdoor workers.²³

An equal number of respondents, totaling 7 individuals each, attained both high school and bachelor's degrees, representing 28% of the sample. A study by Nitiyaron et al. (2022) in Thailand found no correlation between education level and skin disorders. Conversely, Ngoc et al. (2023) emphasized that the critical factor in photoaging issues is not education level but rather the knowledge and awareness of respondents regarding the use of skin care products for protection against sunlight and pollution.²⁵

Before treatment, wrinkles had an average of $44.00 \pm 5.058\%$, and after treatment, they had an average of $39.04 \pm 4.49\%$. Statistical analysis showed that wrinkles have a significant difference that decreases, with an average difference of $-4.960 \pm 1.353\%$ [95% CI -7.681-(-2.239)%; $P = 0.001$] between before and after treatment. The findings are comparable to those reported by Anggraeni et al (2024), who utilized a 5% concentration of purple sweet potato extract. Their anti-aging effectiveness test indicated a 57.35%

reduction in wrinkles after 4 weeks of treatment, with no irritation observed on facial skin.³

Chronic exposure to UVB light results in the formation of wrinkles on human skin.¹⁴ It is reported that a single exposure to solar UV radiation can disrupt connective tissue by causing an almost complete disruption of collagen synthesis for 24 hours, followed by recovery 48-72 hours later. In addition, collagen degradation also occurs due to a significant increase in MMP-1 levels, namely about 4.4 ± 0.2 times when compared to skin that is not exposed to UV radiation. UV light can also spur MMP-1 synthesis through the release of tumor necrosis factor-alpha (TNF- α) by keratinocytes and fibroblasts and cause a decrease in transforming growth factor-beta (TGF- β).²⁶ In human skin, MMP-1 is the type most affected by solar UV induction and is responsible for collagen degradation in photoaged skin.¹¹

Purple sweet potato contains anthocyanins, which function as antioxidants by interrupting the chain oxidation reactions of free radicals or by scavenging free radicals, including superoxide (O₂⁻), singlet oxygen (O₂), peroxide (ROO⁻), hydrogen peroxide (H₂O₂) and hydroxyl radicals (OH[.]). That way anthocyanins are able to inhibit the formation of ROS due to free radicals from UV radiation to the skin and inhibit the increase in MMP-1.²⁷ Purple sweet potato extract cream enhances the levels of type I and type III dermis collagen relative to the control group. Purple sweet potato extract can inhibit MMP-1 activity, thereby preventing the degradation of collagen types I and III.²⁸

The initial humidity level was measured at $35.32 \pm 8.75\%$, which increased to $44.16 \pm 12.12\%$ following treatment, as indicated by the statistical analysis results. The humidity levels exhibited a significant difference before and after the study, with a notable increase of $8.840 \pm 2.990\%$ (95% CI 2.829-14.851; $p = 0.005$). The findings of this study align closely with those of Wulandari et al. (2021), who investigated solid bath soap formulated with an ethanol extract of purple sweet potato. Their research indicated that a concentration of 5.5% yielded the highest skin moisturizing ability at 57.83%, effectively hydrating the skin without causing irritation. Additionally, a concentration of 4.5% provided a moderate moisturizing effect at 48.3%, while a concentration of 3.5% resulted in a lower moisturizing capacity of 43.00%.²⁹

The results of the purple sweet potato pH test at a concentration of 8% yielded a pH of 6, which is nearly equivalent to the average pH of normal adult skin,

approximately 5.5. This indicates that the cream is effective in maintaining skin moisture. Acidity in the skin inhibits bacterial colonization and contributes to the skin's moisture barrier because amino acids, salts, and other compounds in the acid mantle absorb water.³⁰

Level of elasticity went from an average of $20.44 \pm 10.39\%$ before treatment to $35.28 \pm 20.67\%$ after treatment. Statistically, there is a significant difference between the two, with the average difference between before and after being 14.840 ± 4.623 (95% CI 5.544-24.136; $P = 0.002$). The anthocyanin content of purple sweet potato extract can increase the degree of skin elasticity by 30-50%.³⁰

At a young age, skin regeneration occurs every 28-30 days. Regeneration slows down as we age. By the age of 50, skin regeneration occurs every 37 days. The organ responsible for skin elasticity and smoothness is the epidermis. The epidermis is the second layer of skin that serves as the foundation for collagen and elastin. Adulthood (24-45 years old) generally sees a decline in antioxidant status, necessitating the use of antioxidants in treatment.³¹

The purple colour in sweet potatoes is due to the presence of natural dyes called anthocyanins. Anthocyanins are a group of pigments that cause a reddish colour. They are located in cell fluids that are soluble in water. The anthocyanin components of purple sweet potatoes are mono- or diacetyl derivatives of 3-(2-glucosyl) glucosyl-5-glucosyl peonidin and cyanidin. Anthocyanin compounds function as antioxidants and free radical catchers, thus playing a role in preventing premature aging. The presence of anthocyanin compounds as a source of natural antioxidants in purple sweet potatoes that suppress the phosphorylation of MAPKs, such as JNK, ERK, p38, inhibit the expression of pro-inflammatory cytokines and interferes with the nuclear translocation of NF- κ B, and is also able to inhibit the decrease in the activity of antioxidant enzymes such as superoxide dismutase, catalase, and glutathione peroxidase so as to maintain skin elasticity.^{27,32}

Anthocyanins, through their phytoestrogen activity, can improve skin problems due to decreased estrogen levels. Studies on menopausal animal models support the beneficial effects of anthocyanins on the skin.³³ Feeding a diet of 3% blackcurrant extract to rats for 3 months increased skin collagen, elastin, and hyaluronic acid.³⁴ Other phytoestrogens have also shown positive effects on the skin through antioxidant activity and regulation of extracellular matrix production. The isoflavone phytoestrogens genistein and S-equol improve skin elasticity, reduce wrinkles, and increase

type 1 procollagen production.³⁵ Anthocyanin-rich purple cabbage ethanol extract cream is able to prevent skin damage due to UV-B exposure in Wistar rats.³³

Administration of purple sweet potato extract to experimental animals can increase serum antioxidant potential through radical scavenging activity and through increased levels of mRNACu/Zn-superoxide dismutase (SOD), Mn-SOD, and glutathione peroxidase (GSH-Px). Anthocyanins induce antioxidant enzymes, and are reported to upregulate the antioxidant response element (ARE) pathway, as and enhance antioxidant SOD and hemoxygenase-1 (HO-1).³⁶

In this study, all respondents were female, so it is necessary to observe male respondents to determine the differences in wrinkles, moisture, and elasticity of 8% purple sweet potato extract cream, and it is also necessary to observe the differences in men and women with the same effectiveness. Further research recommends long-term use. Another drawback is also the research method, which is only a one-group pretest-posttest design, so that the sample subjects have been determined with a certain age limit so that they cannot see the effectiveness of the drug compared to the control. This study found, the Glogau scale type 2 to be the most, so it is hoped to be evaluated at an older age with type 3. Respondents complained about the pungent odor of the cream given, accompanied by instability in its texture. When the cream is placed at room temperature it will melt and become soft, so it is necessary to place it at a temperature of 40-70 C (refrigerator Chiller). Further research is expected to be able to make a concoction with a better emulsion so that it does not affect temperature, color, and odor.

This study demonstrates that the topical application of purple sweet potato (*Ipomoea batatas* L.) extract cream can significantly enhances wrinkle reduction, moisture levels, and skin elasticity in photoaging patients. Overall, it can be concluded that. Purple sweet potato extract cream 8% can reduce the degree of skin wrinkles by 5%, Purple sweet potato extract cream 8% can improve skin moisture level by 8.8%, Purple sweet potato extract cream 8% can improve skin elasticity by 14.8%,

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