




The Effect of Sun Exposure on the Severity Degree of Photoaging and Skin Hydration on Service Workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh

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ABSTRACT

Background: Photoaging is the aging of the skin characterized by the appearance of wrinkles, telangiectasis, solar elastosis, pigmentation and keratosis. Photoaging is usually caused by external factor, such as sun exposure. The radiation from the sun causes an increase of the reactive oxygen species (ROS). Cell damage, dry skin, photoaging, and skin cancer are all caused by the accumulation of ROS in the skin. **Purpose:** The goal of this study is to find out how sun exposure affects the severity of photoaging and skin hydration at dr. Zainoel Abidin Regional General Hospital Banda Aceh. **Methods:** This is an analytic observational study with an accidental sampling technique. Sun exposure was measured by a questionnaire, the severity of photoaging was assessed based on the doctor's diagnosis, and skin hydration was assessed through an examination using a corneometer and tewameter. **Result:** This study indicates that there is an effect of sun exposure and the severity of photoaging with p value of 0.016, while skin hydration shows a significant effect of sun exposure on hydration with a corneometer parameter with a p value of 0.031 **Conclusion:** There is a substantial correlation between sun exposure and the severity of photoaging. There is a substantial relationship between sun exposure and skin moisture, as measured by the comeometer parameter.

Keywords: photoaging, sun exposure, skin hydration.

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BACKGROUND

Photoaging is external aging caused by exposure to ultraviolet radiation.¹ Indonesia is a country that is exposed to sunlight throughout the year, so the people are more susceptible to extrinsic skin aging due to long-term sun exposure.² A study conducted on subjects born in Australia and New Zealand showed that 1.400 of 2.095 subjects experienced photoaging, most of which (83%) experienced severe or very severe photoaging.³ In Indonesia, specifically in Jakarta, a study involving

136 subjects showed that there are 78 subjects experiencing premature aging due to sun exposure.⁴

Sun exposure, namely ultra violet B (UVB) photons that penetrate the epidermis, can induce sunburn. In addition, exposure to UVB rays might enhance the formation of melanin in the skin. This can result in skin pigmentation irregularities. Based on the initial survey, data on cosmetic department visits to the dermatology and venereology outpatient clinic at dr. Zainoel Abidin Regional General Hospital Banda

Aceh in 2019-2020 revealed 52 patients with pigmentation issues out of 199 cosmetic department visits.

Photoaging is known to be a risk factor for skin tumors. Based on the results of the study, it was found that patients with benign skin tumors who were registered at dr. Zainoel Abidin Regional General Hospital Banda Aceh totaled 360 patients, with the most incidents in 2019, which amounted to 132 (36.2%) patients. The number of malignant skin tumor patients was 4 patients, with the highest incidence in 2018 with a total of 3 patients (0.8%).

UVB radiation can change the morphology of the epidermis by increasing the thickness of the stratum corneum, causing an imbalance in the permeability barrier of the stratum corneum. Reduced moisture levels in the stratum corneum result in dry skin. Continuous sun exposure can cause skin damage, redness and dry skin.⁵

Service workers consist of employees concerned with maintaining the cleanliness of their working area. The duties performed by the service workers entail a high degree of danger, particularly on the exterior of high-rise buildings. This indicates that the service workers is more frequently exposed to sunlight due to its increased outdoor activities.⁶

It is common knowledge that hospital service workers have a significantly heavier workload. This may be attributed to the large number and constant turnover of patients. Obviously, patients generate garbage, including food waste and other types. This work is essential for maintaining a healthy and clean hospital environment.⁶ As a referral hospital in Banda Aceh, dr. Zainoel Abidin Regional General Hospital Banda Aceh was chosen as the research site because the number of patients receiving treatment at dr. Zainoel Abidin Regional General Hospital Banda Aceh is significantly higher than other hospital in Banda Aceh, thereby making the task of service workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh more challenging.

Various studies have confirmed the relationship between sun exposure, namely UV rays, the incidence of photoaging and dry skin.⁷ However, researchers have not found any studies that identify the effect of sun exposure on the severity of photoaging and skin hydration in service workers. Therefore, researchers are interested in examining the effect of sun exposure on the severity of photoaging and skin hydration among the service workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh.

METHODS

This research was conducted at dr. Zainoel Abidin Regional General Hospital Banda Aceh between November 5th and 23rd, 2021, using a cross-sectional design and an observational analytic methodology. The sample consists of a service workers employed by dr. Zainoel Abidin Regional General Hospital Banda Aceh who satisfied the research criteria. The inclusion criteria include service workers aged 20 to 60 years and exposure to sunlight for a minimum of 30 minutes every day. While indoor service workers that always utilize sunscreen and anti-aging treatments are prohibited.

This study utilized primary data from a questionnaire on the risk of sun exposure, the results of a dermatologist valuation of the severity of photoaging, and the outcomes of skin hydration tests using tewameter and corneometer devices. The obtained data consisted of general features, sun exposure risk, the degree of photoaging, and skin moisture. The data was acquired using a non-probability sampling method, specifically accidental sampling. In this study, univariate and bivariate analyses were performed. The description of each variable or frequency distribution is determined by univariate analysis. The purpose of the bivariate study was to assess the impact of sun exposure on the severity of photoaging and skin hydration using the Mann-Whitney test with a 95% confidence level (p value $\leq 0,05$). This research has been reviewed and approved by the ethics committee for health research at dr. Zainoel Abidin Regional General Hospital Banda Aceh No. 285/EA/FK-RSUDZA/2021.

RESULT

Various factors can cause photoaging of the skin. One of the parameters that can measure the severity of photoaging is the Glogau scale. This scale can determine the severity of photoaging, which is assessed based on the clinical manifestations of the patient. The following are the results of the analysis of sun exposure and the severity of photoaging, which are listed in the Table 1.

Out of 36 participants in this study, 24 participants have a high sun exposure and 12 participants have a low sun exposure. From 24 participants with a high sun exposure, 9 participants (37.5%) have severe photoaging, 12 participants (50%) have moderate photoaging and 3 participants (12.5%) have mild photoaging. Meanwhile, from 12 participants that have a low sun exposure, it was found that 2 participants (16.7%) have severe photoaging, 3

participants (25%) have moderate photoaging and 7 participants (58.3%) have mild photoaging. This study uses the Mann-Whitney test to measure the correlation between variables while testing hypotheses.

Based on the test results, a p value of 0.015 (p value < 0.05) indicates that sun exposure have an effect on the severity of photoaging of service workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh

Table 1. The correlation between sun exposure and severity degree of photoaging on service workers

Sun Exposure	Severity of <i>Photoaging</i>						Total		<i>P value</i>
	Mild		Moderate		Severe		n	%	
	n	%	N	%	N	%			
Low	7	58.3	3	25	2	16.7	12	100	0.016
High	3	12.5	12	50	9	37.5	24	100	

Table 2. The correlation between sun exposure and skin hydration on service workers

Sun Exposure	Skin Hydration						Total		<i>P value</i>
	Good Hydration		Dry		Very Dry		n	%	
	n	%	n	%	n	%			
Low	9	75	3	25	0	0	12	100	0.031
High	10	52.8	7	27.8	7	19.4	24	100	

Table 3. The correlation between sun exposure and TEWL on service workers

Sun Exposure	TEWL										Total	<i>P value</i>		
	Very Healthy		Healthy		Normal		Border		Chronic Dry				n	%
	n	%	n	%	n	%	n	%	n	%				
Low	0	0	7	58,3	2	16,7	1	8,3	2	16,7	12	100	0,742	
High	5	20,8	3	12,5	10	41,7	2	8,3	4	16,7	24	100		

Note: TEWL = Transepidermal Water Loss

DISCUSSION

The results of this study shows that the service workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh which were diagnosed with photoaging with moderate and severe degree of photoaging often work under the sun, neither using personal protective equipment nor sunscreen. Sun exposure can cause an increase in Reactive Oxygen Species (ROS) that can activate AP-1. Activation of AP-1 plays a role in increasing matrix metalloproteinases (MMP), which triggers collagen degradation.⁸ Therefore, clinical manifestations of photoaging such as wrinkles, pigmentation, solar elastosis and telangiectasis arise. Pigmentation occurs due to the process of melanogenesis, which is triggered by sun exposure. This is in line with Bambang Susanto's research in 2013, that there is a relationship between sunlight and hyperpigmentation on street sweepers in Medan City, with the chi-square test results of p = 0.016.⁹

Due to the high danger of sun exposure, this study indicated that the service workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh normally encounters a moderate degree of photoaging. Photoaging is characterized by complicated skin changes brought on by prolonged sun exposure. The skin ages prematurely as a result. The degree of photoaging depends on geographic location, solar exposure associated with occupational activities and lifestyle, and prevention against sun exposure, namely the usage of sunscreen.¹⁰ This is consistent with Dewiastuti's 2016 findings that sun exposure is one of the primary causes of photoaging.⁴ A corneometer can measure the moisture level in the skin. The level of moisture level in the skin is an essential indicator of dry skin.¹¹ One of the clinical indications of photoaging is dry skin.⁵

Table 2 displays the results of an investigation of sun exposure and skin hydration using corneometer parameters. It was found that of 36 subjects experiencing photoaging with a high risk of sun exposure, 24 were dominated by well-hydrated skin of

subjects' skin were well hydrated: the rest were identified as having dry skin (25%).

The Mann-Whitney test was utilized to evaluate the association in this study. Based on the test result, a p value of 0.031 ($p \text{ value} \leq 0.05$) indicates that H_0 is rejected and H_a is approved, indicating that there is a relationship between sun exposure and skin hydration in the service workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh. Good skin hydration is very important for maintaining healthy skin. Moisturizer is a major component of skin care. The ability of the skin to retain water is closely related to the stratum corneum which acts as a skin barrier.¹² Skin hydration in the stratum corneum is lower when exposed to sunlight compared to when it is not exposed to sunlight. People who live in areas exposed to higher UV rays show lower skin hydration.¹³

The results of this study indicate that there is a significant relationship between sun exposure and skin hydration in the service workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh. This is in line with a study conducted by Liu et al. (2011), which showed that the hydration of the stratum corneum, which was examined on the forehead and back of the woman's hand using a corneometer, resulted in significantly lower stratum corneum hydration in sun-exposed skin than in unexposed skin.¹⁴ In addition to a corneometer, TEWL can be used to determine skin hydration. Table 3 displays the findings of the examination of sun exposure and skin hydration using TEWL parameters.

It was found that of 36 subjects experiencing photoaging with a high risk of sun exposure, 24 participants had varied TEWL values. Five people (20.8%) having very healthy skin, 3 people (12.5%) having healthy skin, 10 people (41.7%) having normal skin, 2 (8.3%) having borderline skin and the remaining 4 (16.7%) having chronic dry skin.

The Mann-Whitney test was utilized to evaluate the association in this study. Based on the test results, which yielded a p value of 0.742 ($p \text{ value} > 0.05$), indicated that there is no correlation between sun exposure and TEWL and the service workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh.

Trans Epidermal Water Loss (TEWL) is characterized by water evaporation beginning in the epidermis and dermis layers and travelling back to the stratum corneum, a more superficial layer. If the barrier in the stratum corneum is broken, more water will escape and TEWL will rise. An increase in

TEWL is closely related to stratum corneum moisture.¹⁵ In 2010, Liu et al. found that sun exposure had no effect on the hydration of the stratum corneum in neither young nor elderly individu.¹⁶ This is consistent with the findings of this study. The TEWL in the service workers at dr. Zainoel Abidin Regional General Hospital Banda Aceh is unaffected by sun exposure.

There is a substantial correlation between sun exposure and the severity of photoaging. There is a substantial relationship between sun exposure and skin moisture, as measured by the corneometer parameter.

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