

The Effect of Lifestyle on Skin Aging

Yasmin Adzra Nabila¹, Damayanti², Samsriyaningsih Handayani³, Trisniartami Setyaningrum²

¹Undergraduate of Medicine Program, Faculty of Medicine Universitas Airlangga, Surabaya, Indonesia

²Department of Dermatology and Venereology, Faculty of Medicine Universitas Airlangga, /Dr. Soetomo General Academic Teaching Hospital, Surabaya, Indonesia

³ Department of Public Health Sciences, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

ABSTRACT

Background: Skin aging is a natural process, and it has many causes. Skin aging can be a result of a process of deterioration of the skin structure and a decrease in normal skin function. As much as 97% of skin aging factors is extrinsic, while the remaining 3% of the factors is intrinsic. Extrinsic factors are closely related to lifestyle; therefore it is necessary to further investigate the effects of lifestyle on skin aging. Skin aging may not have a direct correlation to mortality but the process of aging itself can lead to depression, demoralization, and shame at the extreme to the point of accepting the changes that occur with age. This shows that aging plays an important role in decreasing the quality of human life and youth well-being index, especially in women. **Purpose:** To determine the effects of lifestyle on skin aging. **Methods:** This was a case-control study. A case means a person with heavy aging, and control means an individual with mild aging. The data were obtained from medical records and anamneses. Data on lifestyle were collected through interviews with open-ended questions. Subjects who met the inclusion criteria were shortlisted, and their skins were examined as per the Glogau scale. **Result:** Multivariate test results showed significant results on the variable UV light exposure ($p = 0.017$), use of sunscreen ($p = 0.002$), use of anti-aging cream ($p = 0.036$), and Vitamin D ($p = 0.040$) against skin aging. Meanwhile, other variables showed no significant results. **Conclusion:** Lifestyle has an important role in the occurrence of skin aging. However, an in-depth research is needed to determine how many external factors affect skin aging.

Keywords: Lifestyle, skin aging, youth well-being index

Correspondence: Damayanti, Department of Dermatology and Venereology, Faculty of Medicine, Universitas Airlangga, Dr. Soetomo General Academic Teaching Hospital, Jl. Mayjen Prof. Dr. Moestopo No. 6-8 Surabaya 60131, Indonesia. Phone: +62315501609, e-mail: dr_damayanti_bs@yahoo.com.

BACKGROUND

Skin aging is a physiological process that normally occurs in geriatrics, and it is characterized by a decreased skin barrier, decreased sebum production, and slower regeneration of epidermal cells. Such conditions will cause skin aging manifestations such as hyperpigmentation, dry skin, lack of elasticity, lack of firmness, and lack of skin smoothness.¹ Human, especially women, want to look attractive and young. In 2000–2005, the life expectancy of the Indonesian population (women and men) was 70.76 years. Furthermore, the life expectancy of women was 73.38 years, and 68.26 years for men. However, 42% of women in Indonesia, by the age of below 30 have already shown signs of aging.²

According to *Kamus Besar Bahasa Indonesia*, lifestyle means a pattern of the daily behavior of a group of people. Lifestyle is expressed in activities, interests, and opinions, and it influences behavior which ultimately determines an individual's consumption pattern.³

In a broader sense, lifestyle means a way of life that is identified by how other people spend their time (activities) in regards to their occupations, hobbies, spending, sports, and social activities as well as interests in food, fashion, family, recreation, and opinion. The opinion includes how they perceive themselves, social issues, business, and products. Lifestyle includes something more than just an individual's social class or personality.⁴ Skin aging process has a strong relationship with a degenerative process that every individual will experience. The aging process does not work the same for every individual. Many factors influence skin aging, one of which is a lifestyle. Lifestyle has many factors, including consumption of healthy foods (vegetables and fruits), consumption of vitamins, adequate consumption of mineral water, exposure to ultraviolet (UV) rays, exposure to pollution, smoking habits, drinking alcoholic beverages, use of antiaging creams and sunscreen, and exercise. The incidence of sun-induced skin aging is quite high, and it is mostly caused

by improper use of sunscreen.⁵ Furthermore, obesity can also accelerate the aging process through the formation of free radicals which will trigger the inflammatory response and accelerate telomere shortening, causing the aging process.⁶

To date, research on the effects of lifestyle on skin aging is still limited. Skin aging does not have a significant effect on mortality rates in Indonesia. However, skin aging can affect the psychological and social life of patients. This study aims to determine the effect of lifestyle on skin aging. It is expected that this research can contribute to the study of anti-aging.

METHODS

This was a case-control study that aimed to determine the relationship between lifestyle and skin aging using primary data through interviews with

questionnaires involving 100 patients diagnosed with mild or severe skin aging based on Glogau's criteria. 38 of the respondents were control respondents, and the remaining 62 were case respondents.

The data were processed using univariate, bivariate, and multivariate analysis methods using the IBM SPSS Statistic 25 application.

RESULT

The characteristics of the respondents studied were age, Glogau scale, occupation, frequency of exposure to UV rays, frequency of exposure to vehicle smoke pollution, exposure to cigarette smoke, smoking habits, drinking alcoholic beverages, use of sunscreen, use of anti-aging creams, physical exercise, and nutrition. The frequency distribution of respondents is presented in Table 1.

Table 1. Respondents characteristics

No.	Variable	Mild aging		Heavy aging		Total	
		N	%	N	%	N	%
1	Age						
	<36	33	86.8%	3	4.8%	36	36%
	>=36	5	13.2%	59	95.2%	64	64%
	Total					100	100%
2	Glogau Scale						
	1	38	100%	0	0%	38	38%
	2	0	0	35	56.5%	35	35%
	3	0	0	27	43.5%	27	27%
	Total					100	100%
3	Worker						
	yes	25	64.1%	27	44.3%	52	52%
	no	14	35.9%	34	55.7%	48	48%
	Total					100	100%

Table 2. Results of simple logistic regression bivariate analysis on independent variables

No.	Variable	Sig.	Adj.OR	95.0% C.I for EXP(B)	
				Lower	Upper
1	UV Exposure (40 minutes)	.001	4.767	1.838	12.364
2	UV Exposure (1 hr)	.025	.380	.163	.887
3	Vehicle emission	.185	2.015	.716	5.673
4	Smoking exposure	.687	1.266	.251	2.484
5	Smoking	.536	1.686	.322	8.813
6	Alcohol consumption	.999	.00	.00	.00
7	Sunscreen	.053	.430	.183	1.011
8	Anti-aging	.092	.488	.212	1.124
9	Exercise	.101	1.988	.874	4.521
10	Calories	1.064	.899	.409	2.768
11	Fat	.538	1.346	.523	3.467
12	Protein	.967	.983	.436	2.214
13	Carbohydrate	.763	.800	.188	3.406
14	Vitamin A	.380	.683	.291	1.601
15	Vitamin C	.643	.412	.224	1.848
16	Vitamin D	.073	.471	.207	1.073
17	Vitamin E	.074	.370	.125	1.100

Adj. OR = Adjusted Odd Ratio; C.I = Confidence Interval; Exp(B) = Exponentiation of the B coefficient;

The characteristics of the respondents based on the Glogau scale in this study were found to be women with a Glogau scale range of 1-3 with a Glogau scale 1 mode. Characteristics of respondents based on occupation in this study found that 48 respondents did not work or as housewives and 52 respondents worked. The majority of respondents who work spend most of their time indoors.

In the results of the bivariate analysis, the results of statistical tests using logistic regression on UV light exposure variables with a cut-off value of 40 minutes obtained a p-value of 0.001.

Meanwhile, at the cut-off limit for 1 hour of exposure to UV light, the p-value was 0.025. Because the p-value <0.05, it can be concluded that UV exposure has a significant effect on skin aging.

In Table 3, a multivariate analysis was done by changing the cut-off of UV light exposure based on considering Indonesia's geographical conditions, which is on the equator, and the characteristics of the respondents.

The analysis of the influence of the variable UV exposure, p-value = 0.017 (p <0.05) was obtained, which means that the results of these variables were statistically significant

Table 3. Results of multivariate analysis

No.	Variable	Sig.	Adj.OR	95.0% C.I for EXP(B)	
				Lower	Upper
1	UV exposure	.276	1.930	.591	6.299
2	Vehicle emission	.902	.914	.218	3.830
3	Sunscreen	.002	.122	.033	.459
4	Anti-aging	.029	.272	.084	.876
5	Exercise	.101	2.361	.845	6.595
6	Vitamin D	.022	.310	.113	.846
7	Vitamin E	.082	.349	.106	1.144

Adj. OR = Adjusted Odd Ratio

C.I = Confidence Interval

Exp(B) = Exponentiation of the B coefficient

Table 4. Results of multivariate analysis 2

No.	Variable	Sig.	Adj.OR	95.0% C.I for EXP(B)	
				Lower	Upper
1	UV exposure	.017	4.163	1.292	13.412
2	Vehicle emission	.911	.933	.274	3.175
3	Sunscreen	.002	.121	.031	.474
4	Anti-aging	.036	.279	.085	.919
5	Exercise	.093	2.470	.860	7.093
6	Vitamin D	.040	.342	.123	.950
7	Vitamin E	.064	.305	.087	1.072

Adj. OR = Adjusted Odd Ratio

C.I = Confidence Interval

Exp(B) = exponentiation of the B coefficient

DISCUSSION

Based on multivariate logistic regression analysis, the value of UV exposure p = 0.276 (p > 0.05), which means that the variable was not significant. Therefore, it can be concluded that there was no significant difference between the incidence of skin aging and the frequency of exposure to ultraviolet light.

The results of this study were not in line with research conducted by Chung in 2001 where he explained that UV exposure for more than 1–2 hours/day increases the risk of wrinkles formation.

This certainly raises the question of why the results of this study were inconsistent with the theory.⁷

In 2009, Newman simulated the year 2020, and he reported that 17% of global ozone would have been destroyed. Furthermore, one ozone hole is formed every year over the North Pole and Antarctica.⁸ This certainly massively increases the UV radiation on the earth due to depletion or changes in the ozone layer that the results of this study were different from the previous theory. Therefore, this study proves 40

minutes of sun exposure results in a significant effect on skin aging.

Also, Indonesia's geographical conditions should be taken into account. Chung's research was conducted in South Korea, and Indonesia is a country located on the equator. Humans are at a higher risk of being exposed to the sun's harmful ultraviolet (UV) rays when traveling near the equator, during the summer months, at high altitude, and between 10 a.m. and 4 p.m.⁹ Therefore, this geographical difference factor can also play a role in the research results.

The characteristics of the respondents can also influence the results of the study as more than 50% of the study participants have occupations. Although though the majority of respondents work indoors, their daily commute exposes them to UV rays as most of them use motorbikes. Unemployed participants and housewives are also at risk of being exposed to UV rays as most of them go to the market or pick up their children at schools. Therefore, we adjusted the cut-off limit of UV exposure.

As result, at 40 minutes of exposure, the multivariate analysis found significant results between UV exposure and the incidence of skin aging with a value of $p = 0.017$ ($p < 0.05$) and AOR = 4.163. This means that people exposed to UV rays for at least 40 minutes/day are at risk of experiencing skin aging compared to those with shorter exposure.

The bivariate analysis of the effect of vehicle smoke exposure resulted in p -value = 0.185 ($p > 0.05$), which means that this variable was not significant. In multiple or multivariate logistic regression analysis, the obtained value of $p = 0.902$ ($p > 0.05$), which means exposure to transportation pollution did not affect skin aging. The results of this study are not in line with research conducted by Krzyzanowski, in which his research explained that in general, people seem to spend 1–1.5 hours traveling daily, although this varies according to the occupation, age, gender, and socioeconomic status.¹⁰ In this study, the taking of respondents did not use certain living criteria, so it could not be determined whether the respondents received high or low levels of exposure to particulate matter (PM) in their daily lives. It means that exposure to transportation pollution does not necessarily cause skin aging. This can be due to the fact that the data collection process is only based on anamnesis without measuring the air quality that the respondent passes through, considering that not all respondents live or work in areas with the same level of air cleanliness.

The bivariate analysis result of the effect of cigarette smoke exposure on skin aging was $p = 0.687$ ($p > 0.05$). This study found that cigarette smoking did not affect skin aging. This certainly contrasts an

epidemiological study that reported a direct relationship between exposure to airborne particles (PM) and the occurrence of prominent signs of skin aging, especially pigment spots and wrinkles. One of the main mechanisms by which ambient PM exerts its adverse effects is through the formation of ROS.¹¹

In this study, some respondents confirmed that they have family members or friends who smoke. Those smokers usually smoke outside or in a separate room, and only some of them share the same room. Average daily housing exposures are estimated following the (modified) approach by Nazaroff and Singer in 2004. Children exposed to parents can have one or two parents who smoke. A large national survey in the UK estimated that among smoking parents in two parent households, 35% lived with adults who also smoked.¹²

Cigarette smoke produces small most dangerous elements of air pollution. Indoor levels can far exceed those outdoors, as new engine models and lead-free fuels have reduced levels of particulate emissions from car exhaust.¹³ Therefore, indoor workers might be exposed to poorer air quality than outdoor workers, and further intervention regarding indoor and outdoor air quality is needed.

In the bivariate analysis result on the effect of smoking on skin aging was p -value = 0.536 ($p > 0.05$). This result contrasts with research conducted by Morita in 2007. His research analysis indicates that subjects with a history of smoking for at least 35 packs/year or the equivalent of 2 cigarettes/day have a deep wrinkle depth, greater and variance than non-smokers ($p < 0.05$). However, the number of grooves was significantly lower in subjects with a history of smoking compared to non-smokers ($p < 0.05$).¹⁴

The contradictory result between this study and the reference study could be due to the inadequate sample size and Indonesian culture where female smokers are considered taboo that out of 100 samples obtained, only 6 people admitted that they were smokers.

No data on the influence of alcoholic drinking habits on skin aging were found as general Indonesian populations do not drink alcoholic beverages. Therefore, this variable cannot be analyzed.

The bivariate analysis of the effect of using sunscreen on skin aging $p = 0.053$ ($p > 0.05$) was obtained, which means that the effect of using sunscreen does not necessarily cause skin aging. However, analysis of the use of sunscreen on aging with multivariate analysis using multiple logistic regression methods showed $p = 0.004$ ($p < 0.05$), which means that the use of sunscreen has a significant effect on the occurrence of skin aging. The results of the

multivariate analysis are considered more valid because this analysis eliminates collinearity on other variables. So it can be concluded that regular use of sunscreen can delay skin aging.

Mizuno reported that the recommended amount of sunscreen use is 2 mg/cm², which is much more than the amount of cosmetic cream or milk emulsion commonly used.¹⁵ However, due to research limitations, the measurement of sunscreen use is measured by the number of times used (re-apply) sunscreen in a day. According to Diffey, experts generally suggest re-applying sunscreen every 2-3 hours.¹⁶ However, Diffey's research was conducted in the United Kingdom (Caucasian race), whereas as we know aging is an accumulative process caused by intrinsic and extrinsic factors. According to Ling, the skin's response to UV radiation depends on the epidermal melanin content as well as the distribution of the melanosomes. Melanin provides photoprotection to the skin and this affects the rate of skin aging and changes between different racial groups. As a result of the higher melanin content in Asian skin than in white (Caucasian) skin, Asian skin generally manifests the classic signs of photoaging later in life, usually after the fifth decade. This could be the reason why in the respondents of this study, the average use of sunscreen was around 4.48 hours but showed significant results as a protector against aging of the skin.¹⁷

The bivariate analysis of the effect of using anti-aging cream on aging was $p = 0.092$ ($p > 0.05$). This means that the effect of anti-aging creams use was not significant in slowing down skin aging. However, the analysis of anti-aging cream use on skin aging showed $p = 0.029$ ($p < 0.05$). This means that the use of anti-aging creams has a significant effect on the occurrence of skin aging. Therefore, it can be concluded that routine use of anti-aging creams can delay the occurrence of skin aging.

The study results are in line with research conducted by Baumann. Photo-aging preventive measures include avoiding direct exposure to sunlight, use of sunscreen to block or reduce the amount of UV exposure, use of retinoids to inhibit collagenase synthesis and to promote collagen production, and use of anti-oxidants, especially in combination, to reduce and neutralize free radicals.

Although the types of night creams or anti-aging creams used by respondents were varied, in general, to prevent the formation of wrinkles, it is necessary to stop the degradation of the three primary structural constituents of the skin, namely collagen, elastin, and hyaluronic acid because the components are known to

decrease with age.¹⁸

The analysis result of the effect of exercise on skin aging was $p = 0.101$ ($p > 0.05$). This means that exercise did not cause skin aging. Therefore, it can be concluded that exercise did not have a significant effect on skin aging.

This does not in line with previous research conducted by Dr. Mark Tarnopolsky. He reported that after the age of 40, men and women who exercise frequently had a thinner, healthier corneal stratum and a thicker dermis layer on their skin. The composition of their skin was much closer to that of humans aged 20 and 30 years old than their peers, who were aged 65 years.

However, the researchers were aware that other factors, including diet, genes, and lifestyle, may have influenced differences in skin conditions between the exercising and non-exercising groups. It was impossible to know whether exercise has affected people's skin or by chance, they have good genetics and lived a healthy life.¹⁹

The bivariate analysis results of the effect of nutrition on skin aging showed no significant result with a p value > 0.05 . Therefore, the analysis was continued with a multivariate analysis between variables with other variables, and the result was p -value < 0.2 . The result for the vitamin D variable was $p = 0.022$ ($p < 0.05$). This means that vitamin D affected skin aging.

The nutritional analysis result showed that only vitamin D had significant results. The result matches with the previous theory, stating that vitamin D can reduce DNA damage, inflammation, and photocarcinogenesis caused by ultraviolet light, and thus, protect the skin.²⁰

Frequently studied antioxidants such as carotenoids, tocopherols, flavonoids, vitamins (A, C, D, and E), essential omega-3 fatty acids, some proteins, and lactobacilli have been cited as agents that can improve skin health and beauty.²¹ This study concluded that UV light, use of sunscreen, use of anti-aging creams, and adequate nutrition are factors that affect skin aging. Some analyses on variables showed results that were not in accordance with the theory because the data collection was based on anamnesis. Therefore, elements of subjectivity, differences in culture and geography were present. Furthermore, the COVID-19 pandemic has delayed the sampling, increasing the probability of a bigger error.

We suggest that future research be carried out in a more specific perspective to avoid and minimize biases and subjectivity.

REFERENCES

1. Zhang S, Duan E. Fighting against skin aging: the way from bench to bedside. *Cell Transplant* 2018; 27(5):729-38.
2. Zahruddin A, Damayanti D. Penuaan kulit: patofisiologi dan manifestasi klinis. *Berkala Ilmu Kesehatan Kulit dan Kelamin* 2018;30(3):208-15.
3. Hasan A. *Kamus Besar Bahasa Indonesia*. Jakarta: Balai Pustaka; 2008.
4. Luthfianto D, Suprihhadi H. Pengaruh Kualitas Layanan dan Gaya Hidup Terhadap Keputusan Pembelian Café Jalan Korea. *J Ilmu dan Ris Manaj* 2017; 6(2):1-18.
5. Dewiastruti M, Hasanah IF. Pengaruh Faktor-Faktor Risiko Penuaan Dini di kulit Pada Remaja Wanita Usia 18-21 Tahun. *Jurnal Profesi Medika: Jurnal Kedokteran dan Kesehatan* 2017;10(1):21-5.
6. Salvestrini V, Sell C, Lorenzini A. Obesity may accelerate the aging process. *Front Endocrinol* 2019;10:266.
7. Chung JH, Lee SH, Youn CS, Park BJ, Kim KH, Park KC, et al. Cutaneous photodamage in Koreans: influence of sex, sun exposure, smoking, and skin color. *Arch Dermatol* 2001;137(8):1043-51.
8. Newman PA, Oman LD, Douglass AR, Fleming EL, Frith SM, Hurwitz MM, Kawa SR, Jackman CH, Krotkov NA, Nash ER, Nielsen JE. What would have happened to the ozone layer if chlorofluorocarbons (CFCs) had not been regulated?. *Atmos Chem Phys* 2009; 9(6):2113-28.
9. Wacker M, Holick MF. Sunlight and Vitamin D: A global perspective for health. *Dermatoendocrinol* 2013; 5(1):51-108.
10. Zulauf N, Dröge J, Klingelhöfer D, Braun M, Oremek GM, Groneberg DA. Indoor air pollution in cars: an update on novel insights. *Int J Environ Res Public Health* 2019; 16(13):2441.
11. Vierkötter A, Krutmann J. Environmental influences on skin aging and ethnic-specific manifestations. *Dermatoendocrinol* 2012; 4(3):227-31.
12. Belvin C, Britton J, Holmes J, Langley T. Parental smoking and child poverty in the UK: an analysis of national survey data. *BMC Public Health* 2015; 15(1):1-8.
13. Morita A. Tobacco smoke causes premature skin aging. *J Dermatol Sci* 2007; 48(3):169-75.
14. Tantisuwat A, Thaveerathittham P. Effects of smoking on chest expansion, lung function, and respiratory muscle strength of youths. *J Phys Ther Sci* 2014; 26(2):167-70.
15. Mizuno M, Kunimoto K, Naru E, Kameyama K, Furukawa F, Yamamoto Y. The effects of continuous application of sunscreen on photoaged skin in Japanese elderly people—the relationship with the usage. *Clin Cosmet Investig Dermatol* 2016; 9:95-105.
16. Diffey BL. When should sunscreen be reapplied? *J Am Acad Dermatol* 2001; 45(6):882-5.
17. Ling LC. Aging in Asian Skin. In: Farage MA, Miller KW, Maibach HI, editors. *Textbook of Aging Skin*. 2nd ed. Berlin: Springer; 2017. p.1019–24.
18. Shin JW, Kwon SH, Choi JY, Na JI, Huh CH, Choi HR, Park KC. Molecular mechanisms of dermal aging and antiaging approaches. *Int J Mol Sci* 2019; 20(9):2126.
19. Safdar A, Bourgeois JM, Ogborn DI, Little JP, Hettinga BP, Akhtar M, et al. Endurance exercise rescues progeroid aging and induces systemic mitochondrial rejuvenation in mtDNA mutator mice. *Proc Natl Acad Sci U S A* 2011; 108(10):4135-40.
20. Gordon-Thomson C, Tongkao-on W, Song EJ, Carter SE, Dixon KM, Mason RS. Protection from ultraviolet damage and photocarcinogenesis by vitamin D compounds. In: Jörg Reichrath, editor. *Sunlight, Vitamin D and Skin Cancer*. 2nd ed. New York: Springer; 2014. p.303-28.
21. Schagen SK, Zampeli VA, Makrantonaki E, Zouboulis CC. Discovering the link between nutrition and skin aging. *Dermatoendocrinol* 2012; 4(3):298-307.