Acta Dermatovenerol APA

Acta Dermatovenerologica
Alpina, Pannonica et Adriatica

2024;33:1-5
doi: 10.15570/actaapa.2024.5

Photoaging assessment by Glogau classification: correlation of dermoscopy findings in the coastal population of Indonesia

Putu Martha Gerynda Sukma[1], Sri Linuwih SW Menaldi[1]✉, Larisa Paramitha Wibawa[1], Shannaz Nadia Yusharyahya[1], Marsen Isbayuputra[2]

[1]*Department of Dermatology and Venereology, Faculty of Medicine, University of Indonesia, Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia.*
[2]*Department of Community Medicine, Faculty of Medicine, University of Indonesia, Jakarta, Indonesia.*

Abstract

Introduction: To date, there is no gold standard for identifying photoaging. This study investigates the correlation of photoaging profiles based on the Glogau scale and the dermoscopy photoaging scale (DPAS) in a coastal population.
Methods: An analytical cross-sectional study was conducted at Cilincing Municipal Health Center in Jakarta in October 2022. Individuals living in the coastal area, 20 years and older, with Fitzpatrick skin types III–V, and with a mean daily sun exposure of ≥ 3 hours were included. The Glogau scale and DPAS were assessed through history taking, physical examination, and dermoscopic examination. A Spearman correlation test was used to assess the correlation between the Glogau scale and DPAS.
Results: Thirty individuals with a mean age of 41.5 ± 11.5 years participated in the study. The median Glogau score was 3 (range: 2–4). The mean DPAS score was 28.5 ± 5.6. Lentigo, hypo-hyperpigmented macules, telangiectasia, deep wrinkles, and superficial wrinkles were observed in all subjects. There was a moderate positive correlation between the Glogau scale and DPAS (r = 0.536, p = 0.002).
Conclusions: The Glogau scale has a significant correlation with DPAS. DPAS can serve as a reliable, easy, practical, and fast diagnostic tool to assess the severity of aging.

Keywords: correlation, dermoscopy photoaging scale, Glogau scale, aging profile, coastal area

Received: 15 August 2023 | **Returned for modification:** 6 January 2024 | **Accepted:** 31 January 2024

Introduction

Photoaging, a form of extrinsic aging, is influenced by environmental, nutritional, and behavioral factors (1). Cumulative sun exposure notably plays a pivotal role because the severity of photoaging correlates with both cumulative sun exposure and skin type. Moreover, advancing age is associated with a slower regeneration process and diminished skin protection, thereby increasing the susceptibility of older individuals to photoaging compared to their younger counterparts (2).

Despite the development of various methods for identifying photoaging, none have achieved the status of a gold standard. Most assessment tools focus on evaluating wrinkles, pigmentary changes, and vascular alterations, particularly on the facial skin (3). The first photoaging assessment by Glogau in 1996 categorized the severity of photoaging based on age, clinical skin appearance, and habitual foundation use (4). Although initially designed for Caucasian individuals, the practicality and efficiency of the Glogau scale have led to its widespread adoption among Asian populations (1, 4).

Dermoscopic examination has emerged as a preferred diagnostic method for assessing photoaging due to its simplicity, rapidity, and objectivity. The dermoscopy photoaging scale (DPAS) offers a quantitative evaluation of early aging signs, encompassing pigmentary changes, vascular irregularities, telangiectasia, wrinkles, actinic keratosis, and senile comedones (5, 6). Dermoscopy allows visualization of skin morphologies that may not be discernible to the naked eye.

Despite limited research on photoaging in coastal populations, particularly with DPAS assessments, no studies have explored the correlation between the Glogau scale and DPAS in coastal communities. Therefore, this study investigates the correlation between the Glogau scale and DPAS among a coastal population in Indonesia.

Methods

This analytic cross-sectional study took place at Cilincing Municipal Health Center, North Jakarta, in November 2022. It was conducted concurrently with another study led by Natalia Rania Sutanto and colleagues, which focused on a different research question and involved a distinct participant cohort.

Notably, the majority of individuals in this coastal area are engaged in occupations such as fishing and drying salted fish, which are considered high-risk activities for photoaging (7). The study's inclusion criteria encompassed individuals residing and working in coastal areas (e.g., fishermen and salted fish dryers), 20 years and older, with Fitzpatrick skin types III–V and a mean daily sun exposure of ≥ 3 hours. The exclusion criteria were a history of another skin disorder on the skin of the face, use of drugs that influence skin aging and dyschromia, medical aesthetic procedures (botulinum toxin injection, dermal filler injection, rejuvenation laser procedure, electrosurgery, etc.) performed in the previous 6 months, and undergoing chemical peeling in the previous month. Subjects were recruited consecutively. Using a sample size formula for the correlation study with consideration of a 95% confidence interval and 80% study power, the estimation of the sample size was 30 subjects.

History taking, physical examination, and dermoscopic examination were performed by the main investigator. Data obtained

✉ **Corresponding author: susetyo_mr@yahoo.com**

from history taking included patient demographics (sex, age, and occupation) and Fitzpatrick skin type. The duration of sun exposure per week was also documented. Before the physical examination, subjects that used makeup were asked to clean their faces with makeup remover. If the skin was oily or there were leftover makeup products, it was then cleaned with alcohol swabs. The subjects' faces were inspected and photographed in three positions (front view, 45° lateral right view, and 45° lateral left view) during relaxation and smiling. The face was divided into four regions (forehead, right cheek, left cheek, and chin). Each region was assessed with a Heine DELTAone dermoscope (Heine Optotechnik GmbH & Co, Herrsching, Germany). When there was telangiectasia, gel was applied to make the view clearer. Each region was photographed. The Glogau scale was assessed based on the results of clinical examination. The Glogau scale was determined by assessing wrinkles, pigmentation, keratosis, and use of foundation. Figure 1 shows the graphic presentation of the Glogau classification scale. DPAS was assessed based on the clinical and dermoscopic findings. DPAS assessed yellowish discoloration, yellow papules, white linear areas of scarring (skin atrophy), lentigo, hypo-hyperpigmented macules, telangiectases, actinic keratosis, senile comedones, deep wrinkles, superficial wrinkles, and criss-cross wrinkles with a score range of 0 to 44. We also add a grouping of DPAS for wrinkles as a sum of the score for deep wrinkles, superficial wrinkles, and criss-cross wrinkles. DPAS for pigmentation was the sum of the score of yellowish discoloration, yellow papules, white linear areas of scarring (skin atrophy), lentigo, and hypo-hyperpigmented macules.

This study was approved by the Health Research Ethics Committee at the Faculty of Medicine at the University of Indonesia (approval number KET-1084/UN2.F1/ETIK/PPM.00.02/2022). Prior to participation, all subjects were provided with both oral and written explanations detailing the study's objectives, benefits, and procedures, as well as the potential advantages and drawbacks of participation. Each subject provided informed consent by signing a consent form before enrollment in the study.

Data analysis was conducted using Statistical Package for the Social Sciences (SPSS) version 20.0. The Spearman correlation test was employed to evaluate the correlation between the Glogau scale and DPAS. A significance level of $p < 0.05$ was considered statistically significant. Correlation coefficients were categorized as strong, moderate, or weak based on established criteria.

Glogau I Mild Aging	Glogau II Moderate Aging	Glogau III Advanced Aging	Glogau IV Severe Aging
Mild pigmentary changes	Early lentigo signs	Clear signs of dyschromia	Grayish-yellow skin
No keratosis	Palpable but no visible keratosis	Visible keratosis	History of skin malignancy
Scarce wrinkles	Presence of smile lines	Always use foundation	Wrinkles all over the face
No or minimal use of foundation	Occasional use of foundation		Cannot use foundation (cakes and cracks)

Figure 1 | Graphic representation of the Glogau scale (4). Modified from https://quizlet.com/230181160/the-glogau-scale-diagram/.

Results

A total of 30 subjects were recruited into the study. The subjects' sociodemographic characteristics are shown in Table 1.

The majority of subjects exhibited Glogau scale III (80%), with a median of 3 (range: 2–4). Table 2 outlines the Glogau scale characteristics, indicating predominantly Glogau III for wrinkle and pigmentation components, with no subjects falling under Glogau I for actinic keratosis. The median range for wrinkles did not significantly differ across various facial regions (forehead, nasolabial folds, and around the eyes; $p = 0.264$).

The mean DPAS score of all subjects was 28.5 ± 5.6. Lentigo, hypo-hyperpigmented macules, telangiectasia, deep wrinkles, and superficial wrinkles were identified in all subjects (Table 3). The median DPAS for wrinkle components was 7 (range: 5–12), and the mean DPAS for pigmentation components was 14.8 ± 3.0. All dermoscopic findings of the subjects were documented (Fig. 2). Total median DPAS scores differed significantly between the forehead

Table 1 | Sociodemographic characteristics of subjects (*N* = 30).

Characteristics	Results
Sex, *n* (%)	
Male	7 (23.3)
Female	23 (76.7)
Age in years, mean ± *SD*	41.5 ± 11.5
Age category in years, *n* (%)	
20–29	4 (13.3)
30–39	11 (36.7)
40–49	9 (30.0)
50–59	2 (6.7)
≥ 60	4 (13.3)
Occupation, *n* (%)	
Salted fish dryers	22 (73.3)
Fishermen	1 (3.3)
Merchants	5 (16.7)
Other outdoor workers	2 (6.7)
Fitzpatrick skin type, *n* (%)	
III	6 (20.0)
IV	15 (50.0)
V	9 (30.0)
Duration of sun exposure in hours/week, mean ± *SD*	52.8 ± 12.5

SD = standard deviation.

Table 2 | Photoaging characteristics of subjects based on the Glogau scale (*N* = 30).

Glogau scale photoaging assessment	Results (*n*, %)
Glogau II	3 (10.0)
Glogau III	24 (80.0)
Glogau IV	3 (10.0)
Glogau scale median	3 (range: 2–4)

Table 3 | Photoaging characteristics of subjects based on the dermoscopy photoaging scale (*N* = 30).

DPAS criteria	*n*	%
Yellowish discoloration	26	96.7
Yellowish papules	27	90.0
White line/skin atrophy	24	80.0
Lentigo	30	100.0
Hypo-hyperpigmented macule	30	100.0
Telangiectasia	30	100.0
Actinic keratosis	2	6.7
Senile comedones	23	76.7
Deep wrinkles	30	100.0
Superficial wrinkles	30	100.0
Criss-cross wrinkles	12	40.0

DPAS = dermoscopy photoaging scale.

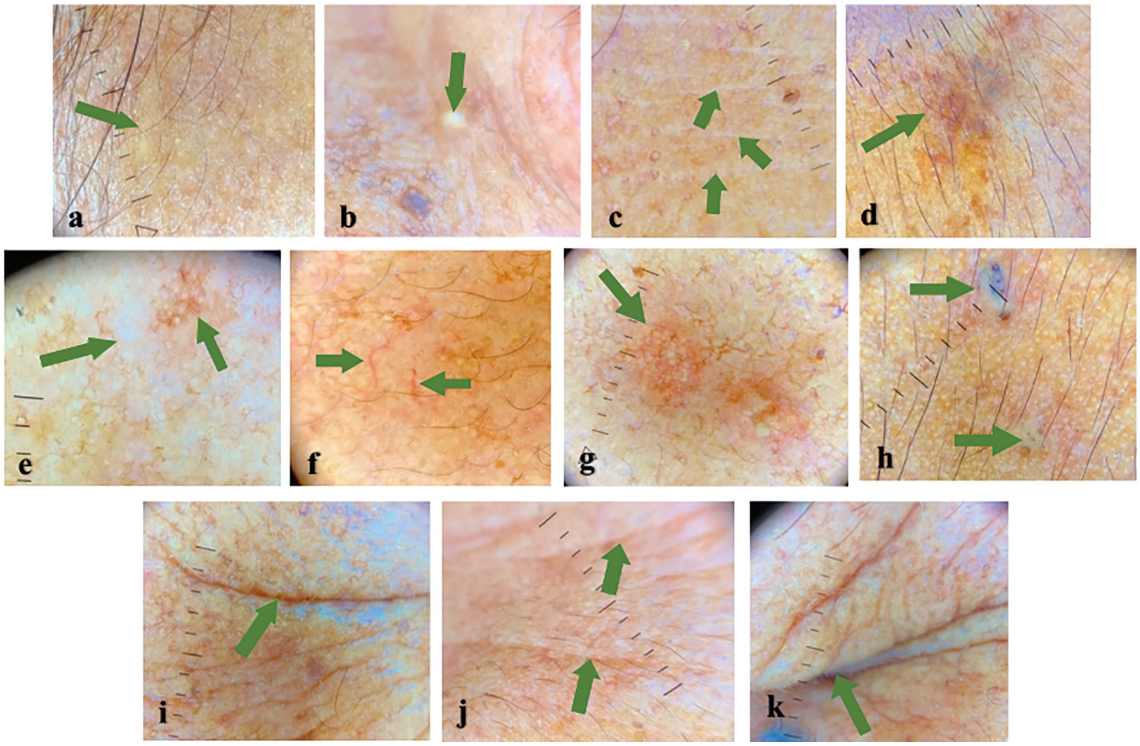

Figure 2 | Dermoscopic findings of subjects based on the dermoscopy photoaging scale (green arrows): (a) yellowish discoloration, (b) yellowish papules, (c) white lines / skin atrophy, (d) lentigo, (e) hypo-hyperpigmented macules, (f) telangiectasia, (g) actinic keratosis, (h) senile comedones, (i) deep wrinkles, (j) superficial wrinkles, (k) criss-cross wrinkles.

(6, range: 4–10), right cheek (9, range: 6–10), left cheek (9, range: 6–10), and chin (5, range: 2–9; $p < 0.001$).

There was an increase in the DPAS score as the Glogau scale increased. The mean DPAS scores were 23 ± 3, 28.2 ± 5.2, and 36 ± 1 in subjects with Glogau II, III, and IV, respectively. There was a significant correlation between the Glogau scale and DPAS ($r = 0.536$, $p = 0.002$). There was a moderate positive correlation between age and the Glogau scale ($r = 0.673$, $p < 0.001$) as well as DPAS ($r = 0.608$, $p < 0.001$). There was no significant correlation between the duration of sun exposure and the Glogau scale ($r = 0.129$, $p = 0.496$) as well as DPAS ($r = 0.235$, $p = 0.211$).

Discussion

The predominance of female subjects in our study can be attributed to its timing because it was conducted in the morning. During this time, women were primarily engaged in fish cultivation, processing, and marketing activities, whereas men typically pursued fishing activities at night and returned to the mainland in the morning to rest (8).

The mean age of the subjects was 41.5 ± 11.5 years, ranging from 22 to 67 years old. The largest proportion of subjects fell within the 30–39-year age group, consistent with findings from a previous study in the same area of Jakarta, which also reported a high representation of participants in the 30–39-year age bracket (23%) (9). This demographic profile suggests that the majority of subjects were of productive working age.

In this study, most subjects had Fitzpatrick skin type IV (50%). We excluded Fitzpatrick skin types I, II, and VI during recruitment because these types are rarely observed in the Indonesian population. A study in Turkey reported Fitzpatrick skin type III as most common due to differences in ethnicity and geographical area compared to our study (6).

This study recruited a coastal population among which 73.3% of subjects work as salted fish dryers. Salted fish dryers perform their job by rubbing fresh fish with salt and drying them under the sun for 1 to 2 days. This occupation is highly correlated with photoaging. The higher the cumulative sun exposure, the more severe photoaging occurs (9). The mean duration of sun exposure was 52.8 ± 12.5 hours/week or 7.5 hours/day. This duration is higher compared to other studies. A study from Guangzhou, China, reported that the mean duration of sun exposure in female subjects was 19.62 hours/week (10). In Malaysia, sun exposure durations were reported as 2.92 hours per week in urban areas and 7.83 hours per week in rural areas (11). Notably, the majority of our subjects commenced work at 7:30 am and concluded their tasks between 3 to 4 pm throughout the year because the equatorial region experiences only two seasons.

The majority of subjects (80%) had Glogau III, with a median Glogau scale of III (range II–IV). Another study in Egypt also reported Glogau III as the most dominant finding in its subjects (12). The findings for wrinkle and pigmentation components were in line with the Glogau scale. There were also two subjects with actinic keratosis according to DPAS and there was no actinic keratosis finding according to the Glogau scale. These results are in line with previous literature, which reported one subject with actinic keratosis in the coastal Jakarta area (9). Skin type plays an important role in this matter. A study in Turkey reported that the prevalence of actinic keratosis was higher in individuals with Fitzpatrick skin types I and II but it decreased significantly in individuals with Fitzpatrick skin types IV and V. This is in line with previous literature, which stated that actinic keratosis, a precancerous lesion, is highly correlated with Fitzpatrick skin type, particularly lighter skin (13).

The mean DPAS score was 28.5 ± 5.6, higher than the median DPAS score in the study previously carried out in the same Jakarta coastal area (9). A study regarding various ethnicities in Medan reported lower median DPAS scores with a range of 12.5 to 16 (14).

This study found a higher DPAS score compared to previous studies because of the older age and higher duration of sun exposure. A study in Jakarta reported a younger median age of subjects, 40 years old (range: 21–76 years old), with a lower median duration of sun exposure (50.75 hours/week) (9).

Our study subjects belong to a darker-skinned Indonesian population, characterized by larger melanosome size and higher melanin levels compared to individuals with lighter skin tones. Melanocytes in darker skin produce melanin, which serves to reduce UV penetration into the dermis and connective tissue. This photoprotective mechanism is more robust in darker-skinned populations. Consequently, pigmentary changes often manifest as the initial signs of photoaging (15). Notably, yellowish discoloration was the most common finding in individuals classified as Glogau IV in our study (12). This yellowish change arises from the accumulation of reactive oxygen species (ROS) and lipid peroxidation induced by sun exposure. These processes in the dermal layer lead to the degradation of various proteins, ultimately resulting in the yellowish discoloration of the skin (16).

In our study, all subjects exhibited lentigo, hypo-hyperpigmented macules, telangiectasia, deep wrinkles, and superficial wrinkles. This observation aligns with the findings by El-Sayed et al., who similarly reported solar lentigines as the most prevalent sign of photoaging in their subjects, followed by hypo-hyperpigmented macules and telangiectasia (5). This consistency is consistent with previous literature, which indicates that coastal populations with skin of color (Fitzpatrick skin types III–V) are prone to experiencing pigmentary changes at a faster rate. Dyschromia, manifested as lentigo and mottled pigmentation, is recognized as the most common sign of photoaging among darker-skinned populations (17, 18).

The mean DPAS score increased as the Glogau scale increased. El-Sayed et al. reported a similar finding (12). This study showed that the DPAS score has a parallel relation to the Glogau scale in assessing photoaging. DPAS has been validated by comparing sun-exposed areas to non-sun-exposed areas (axilla and gluteal regions). DPAS is proven to be practical and fast, similar to the Glogau scale. However, DPAS is more detailed and accurate because it utilizes dermoscopy (12). The implication of the positive correlation between DPAS and the Glogau scale is that DPAS can aid the Glogau scale in determining the signs of photoaging. With early detection of photoaging, the prevention and treatment can be delivered faster. Few studies have explored the correlation between the Glogau scale and DPAS. Isik et al. reported a positive strong correlation between the Glogau scale and DPAS (r = 0.773, p < 0.001), with a larger sample size compared to the present study. The Fitzpatrick skin type in their study included types I–IV (6). Apart from the number of subjects, Fitzpatrick skin type and age can also affect the correlation coefficient. Melanin content is closely linked to skin type and serves as a natural defense against UV irradiation, commonly referred to as the sun protection factor (SPF). Darker-skinned individuals typically possess a higher natural SPF, approximately 13.4, compared to lighter-skinned individuals, whose natural SPF is less than 4. UV irradiation can penetrate the dermis of individuals of Caucasian ethnicity more deeply than those with darker skin tones. As a result, there is a higher propensity for photoaging in light-skinned populations (19).

Our study, like a previous one conducted in the same area, did not find any correlation between the duration of sun exposure and both the Glogau scale and DPAS. In the earlier study, it was reported that there was no significant correlation between the duration of sun exposure and DPAS (r = −0.095; p = 0.345) (9). It is worth noting that the duration of sun exposure obtained through history taking may be subject to recall bias. In addition, this method may not fully capture the cumulative sun exposure accumulated over a subject's lifetime, despite photoaging being a process closely linked to cumulative sun exposure (20).

Another plausible explanation could be that DPAS is capable of assessing both intrinsic and extrinsic aging profiles, suggesting that factors beyond sun exposure alone may influence the DPAS findings in our study. This underscores the multifactorial nature of photoaging.

We found a moderate positive correlation between age and the Glogau scale as well as DPAS. The older the subjects, the more severe their photoaging profiles. The study from Medan also reported the tendency of increased median Glogau scale and DPAS scores as the age increased, although correlation analysis was not performed (14). Previous studies in Jakarta reported a strong positive correlation between age and DPAS (r = 0.780, p < 0.001) (9). El-Sayed et al. also stated that older individuals had a higher DPAS score compared to individuals of younger age (5). This finding implicates that Glogau and DPAS are good predictors of assessing aging severity based on age.

The limitation of this study was the use of consecutive sampling, which may have resulted in a less diverse sample, limiting the variability of subjects. In addition, we did not record data on the use of sun protection by the subjects during the study, which could have influenced the severity of photoaging observed. Therefore, further studies should be conducted in other populations to validate and generalize our findings.

Conclusions

The higher the DPAS score, the higher the Glogau scale. There is a moderate positive correlation between photoaging profiles based on the Glogau scale and DPAS in coastal populations.

Acknowledgement

This research would not have been possible without the support of Cilincing Municipal Health Center, Jakarta. We would also like to thank Natalia Rania Sutanto for collaboration during data collection.

Funding

This research received a grant with approval number KET-1084/UN2.F1/ETIK/PPM.00.02/2022 from the University of Indonesia (*Publikasi Terindeks Internasional 2022*).

References

1. Durai PC, Thappa DM, Kumari R, Malathi M. Aging in elderly: chronological versus photoaging. Indian J Dermatol. 2012;57:343–52.
2. Yusharyahya SN. Mekanisme penuaan kulit sebagai dasar pencegahan dan pengobatan kulit menua: Mechanism of skin aging. eJournal Kedokteran Indonesia. 2021;9:150. Indonesian.
3. Yu SH, Baron ED. Evaluation and assessment of photoaging. Photonics Lasers Med. 2013;2:305–14.
4. Glogau RG. Aesthetic and anatomic analysis of the aging skin. Semin Cutan Med Surg. 1996;15:134–8.
5. El-Sayed MH, Saleh HM, El Zawahry KMA, Mostafa AE. The dermoscopic features of facial aging among Egyptians: a comparative study between males and females. J Cosmet Dermatol. 2019;18:1803–13.
6. Isik B, Gurel MS, Erdemir AT, Kesmezacar O. Development of skin aging scale by using dermoscopy. Skin Res Technol. 2013;19:69–74.
7. Data penduduk DKI Jakarta [Internet]. 2019 [cited 2024 Jan 10]. Available from: https://jakutkota.bps.go.id.
8. Nurlaili N, Muhartono R. Peran perempuan nelayan dalam usaha perikanan tangkap dan peningkatan ekonomi rumah tangga pesisir Teluk Jakarta. J Sosek KP. 2017;12:203. Indonesian.
9. Respati RA, Yusharyahya SN, Wibawa LP, Widaty S. The dermoscopic features of photoaging and its association with sun index score in the coastal population at Cilincing, Jakarta: a cross-sectional study. Clin Cosmet Investig Dermatol. 2022;15:939–46.
10. Flament F, Bazin R, Qiu H, Ye C, Laquieze S, Rubert V, et al. Solar exposure(s) and facial clinical signs of aging in Chinese women: impacts upon age perception. Clin Cosmet Investig Dermatol. 2015;8:75–84.
11. Nurbazlin M, Chee WS, Rokiah P, Tan AT, Chew YY, Nusaibah AR, et al. Effects of sun exposure on 25(OH) vitamin D concentration in urban and rural women in Malaysia. Asia Pac J Clin Nutr. 2013;22:391–9.
12. Magdy R, Sadek A. Dermoscopic findings of photo-ageing in Egyptian patients. Egypt Dermatol Online J. 2015;11:6.
13. Yaldiz M. Prevalence of actinic keratosis in patients attending the dermatology outpatient clinic. Medicine. 2019;98:e16465.
14. Jusuf NK, Putra IB, Muslim M. Evaluation of dermoscopic photoaging score among multiethnic in Medan, Indonesia. Bali Med J. 2022;11:1919–23.
15. Ling LC. Aging in Asian skin. In: Farage MA, Miller KW, Maibach HI, editors. Textbook of aging skin. Berlin: Springer; 2017. p. 1757–64.
16. Zucchi H, Pageon H, Asselineau D, Ghibaudo M, Sequeira I, Girardeau-Hubert S. Assessing the role of carbonyl adducts, particularly malondialdehyde adducts, in the development of dermis yellowing occurring during skin photoaging. Life. 2022;12:403.
17. Pandel R, Poljšak B, Godic A, Dahmane R. Skin photoaging and the role of antioxidants in its prevention. ISRN Dermatol. 2013;2013:930164.
18. Lym CI. Characteristics of Asian skin—revision. Journal Dermat Cosmetol. 2018; 2:127–33.
19. Chaudhary M, Khan A, Gupta M. Skin ageing: pathophysiology and current market treatment approaches. Curr Aging Sci. 2020;13:22–30.
20. Han A, Chien AL, Kang S. Photoaging. Dermatol Clin. 2014;32:291–9.