

REVIEW ARTICLE

Insights from literature analysis : optimal sunscreen use decreases Melasma incidence in women living in tropical climates

Lina Damayanti^{1*}, Astri Pradini², Mitha Salsabila³

- 1) Department of Dermatology and Venereology, Faculty of Medicine, Universitas Jenderal Achmad Yani, Cimahi, Indonesia.
- 2) Department of Histology, Faculty of Medicine, Universitas Jenderal Achmad Yani, Cimahi, Indonesia.
- 3) Medicine Study Program, Faculty of Medicine, Universitas Jenderal Achmad Yani, Cimahi, Indonesia.

*Corresponding author. E-mail: Linad819@gmail.com

ABSTRACT

Melasma is a hyperpigmented patch that is generally found on the face, especially on the cheeks, chin, upper lip, and can extend to the neck. The color of hyperpigmentation in melasma varies, generally from light brown to black with an irregular shape. Melasma is often found in countries with tropical climates with skin types III-V. This happens because countries with these climates are exposed to more sunlight. To prevent melasma, it is recommended to use sunscreen to reduce excessive UV exposure to the skin. It is important to use sunscreen optimally in order to reduce the incidence of melasma. The effect of excessive UV exposure to skin, including melasma, can be reduced by applying sunscreen on the regular basis. This literature review used four databases (Google scholar, PUBMED, NCBI and PERDOSKI) and relevant keywords such as "melasma" and "sunscreen" to find the source of articles published in 2010 to 2022. A total of 142 articles in Indonesian and English were found. After selecting based on inclusion and exclusion criteria, 14 relevant articles were obtained and will be discussed in this literature review. The result of this literature review show a significant relationship between optimal use of sunscreen and the incidence of melasma in women from countries with tropical climates, especially in Asia. Melasma is most commonly found in women with Fitzpatrick skin types III-V and more likely to occur between ages 25-60 years. Patients with melasma who used sunscreen optimally, by applying it every 2 hours, showed a decrease in the degree of severity of melasma compared to those who did not repeat the use of sunscreen. The conclusion can be strengthened more straightforward. For example, applying sunscreen every 2h can significantly decrease the incidence of melasma.

Keyword: Melasma, hyperpigmented, sunscreen, tropical climate, woman

Received: 2024-02-15, Revised: 2024-02-23 Accepted: 2024-02-25, Published: 2024-02-29.

Copyright (c) 2024 Lina Damayanti, Astri Pradini, Mitha Salsabila

This is an Open Access (OA) article under the CC BY-SA 4.0 International License (<https://creativecommons.org/licenses/by-sa/4.0/>).

How to cite :

Damayanti, L., Pradini, A. and Salsabila, M. (2024) "Insights from literature analysis : optimal sunscreen use decreases Melasma incidence in women living in tropical climates", Acta Medical and Health Sciences, 2(3).p.148-156. doi: [10.35990/amhs.v2n3.p148-156](https://doi.org/10.35990/amhs.v2n3.p148-156)

INTRODUCTION

Melasma represents a prevalent form of hyperpigmentation typically localized on facial regions such as the bilateral malar areas, chin, and upper lip, occasionally extending to the cervical region.¹⁻³ Although it can manifest across all ethnicities, its incidence is notably higher among females inhabiting tropical climates or with skin types III-V on the Fitzpatrick scale.¹⁻⁴ Countries with tropical climates experience heightened solar exposure during dry seasons, coupled with elevated humidity levels. Southeast Asian countries, including Singapore, Malaysia, and Indonesia, have been focal points for numerous investigations on melasma. In Indonesia, the female-to-male incidence ratio stands at 21:1.⁵ This country's tropical setting, marked by increased solar irradiation relative to other regions, coupled with a predominantly skin type III-V demographic, underscores its susceptibility to melasma.⁴

Epidemiological data from the outpatient dermatology clinic of Cipto Mangunkusumo Hospital (RSCM) in 2004 recorded a prevalence rate of up to 2.39%, with an incidence rate of 2.49%, reflecting an incremental annual rise of 0.1%. Subsequent analysis of patient records from Dr. M. Djamil Padang General Hospital's dermatology and venereology departments observed a 9.4% surge in melasma cases between 2011 and 2014, totaling 1,622 consultations.⁶ Moreover, surveillance of melasma cases at Griya Geulis Clinic, Dustira Hospital Cimahi, during December 2017 and January 2018 highlighted this period's heightened incidence.⁷

Mitigating direct skin exposure to

ultraviolet (UV) radiation stands as a critical step in preventing the onset of melasma. Among these measures is the use of sunscreen, a paramount intervention. In accordance with FDA guidelines, optimal sunscreen efficacy necessitates formulations boasting a minimum Sun Protection Factor (SPF) of 15.^{6,8} The pervasive prevalence of melasma remains as a vexing cosmetic concern for afflicted individuals. The persistent high incidence rates of melasma in Indonesia indicate a plausible inadequacy in sunscreen utilization among the populace. Consequently, this study aims to look into the complexity of melasma and determine whether sunscreen is effective in preventing its onset, as elucidated by an exhaustive review of pertinent literature.

METHODS

This study adopts a literature review approach to collate data from diverse scholarly sources, including books, peer-reviewed journals, theses, and dissertations, concerning the prevalence of melasma in tropical climate regions characterized by skin types III-V, within a temporal window spanning 5-10 years. The literature search strategy entails employing internet search methodologies with targeted keywords such as melasma, sunscreen, skin types III-V, and tropical climate to ensure comprehensive coverage of relevant literature.

RESULTS AND DISCUSSION

Literature Search Tracking

The table below presents the results of the literature search using keywords, search years, and databases.

Tabel 1. Literature Search Tracking

Date	Database	Years	Keywords	The tally of articles reviewed.
September 2 th , 2020	Google Scholar	2010 – 2020	Melasma	30
September 3 rd , 2020	Pubmed NCBI	2014 - 2020	Melasma in Asian Patients	15
September 5 th , 2020	Google Scholar	2017 – 2020	<i>Hubungan antara pemakaian tabir surya dengan kejadian melisma</i>	17
September 8 th , 2020	Google Scholar	2017 – 2020	<i>Pajanan sinar matahari dengan kejadian melisma</i>	24
December 23 rd , 2020	Pubmed	2016 – 2020	Darker skin on melisma	15
December 23 rd , 2020	PERDOSKI	2017	<i>Dermatologi kosmetik</i>	1
December 25 th , 2020	Google Scholar	2014 – 2020	Application sunscreen	2
December 28 th , 2020	Google Scholar	2014 – 2020	<i>Tabir surya dan iklim tropis</i>	37
Januari 2 nd , 2021	Pubmed	2011 – 2020	Melasma update	5
Januari 2 nd , 2021	Google scholar	2017 – 2022	<i>Tabir surya yang optimal</i>	10
October 25 th , 2022	Google scholar	2017 – 2022	Melasma in Asia'n patient	10
October 31 st , 2022	Google scholar	2017 – 2022	Melasma in Asian skin	12
November 23 rd , 2022	NCBI	2016 – 2022	Melasma in Singapore	5

Literature Analysis

Table 2. Characteristics of literature on melasma and the effects of sunscreen use on melasma prevention in countries with tropical climates.

Researcher & Years	Title	Research methods	Results	Samples	Research Similarities
Krupa Shankar , <i>et al</i> (2014)	A Cross- Section al, Multic entric Clinico -Epidemiolog ical Study Of Melasma in India	A multicentric cross-sectional study	A certain correlation has been established between solar irradiance and the incidence of melasma. It is noteworthy that within the confines of this study, a mere 10% of subjects employed sunscreen with a Sun Protection Factor (SPF) of 50.	331	There is a convergence of evidence supporting the assertion that solar radiation serves as a precipitating factor in the development of melasma, exacerbated by a lack of societal awareness regarding the optimal application of sunscreens.
Lahida, dkk.(2017)	<i>Hubungan Riwayat Pemakaian Tabir Surya Dengan Kejadian Melasma Pada Wanita Usia 25-45 Tahun.</i>	Analytical observational study with a cross-sectional design	A statistically significant association was observed between the application of sunscreen and the incidence of melasma. Nonetheless, this investigation failed to detect a statistically significant relationship between the duration of solar exposure and the onset of melasma.	70	This study observed a congruence between the application of sunscreen and the incidence of melasma.
Umborowati , dkk. (2014)	<i>Studi Retrospektif: Diagnosis dan Terapi Pasien Melasma</i>	A retrospective Study	The incidence of melasma demonstrates a predilection for females over males, with sunlight exposure identified as the predominant etiological factor based on anamnestic data.	1.313	The congruence with the conducted research lies in the predominance of melasma occurrence among women, with sunlight exposure identified as the primary causative factor in this study.

Researcher & Years	Title	Research methods	Results	Samples	Research Similarities
Waskita (2018)	<i>Hubungan Antara Riwayat Pemakaian Tabir Surya Dengan Derajat Keparahan Melasma</i>	The research used an observational methodology, employing a comparative analytical framework within a cross-sectional approach.	The incidence of melasma in Indonesia demonstrates a notable prevalence among women aged 25 to 40 years. Moreover, an observed pattern reveals that a considerable proportion of patients with moderate-grade melasma exhibit persistent manifestations, attributed to inadequate adherence to proper sunscreen application, typically limited to once daily without subsequent reapplication.	60	This study highlights sunlight exposure is a key element in causing melasma and emphasized the importance of using sunscreen to reduce the incidence of it.
Setyawati, dkk (2019)	<i>Profil Melasma Di Rumah Sakit Umum Pusat Sanglah Denpasar Periode Januari 2014 Sampai Desember 2014.</i>	A Retrospective Study	Our current investigation shows a clear predilection for melasma among females compared to males, typically starting between the ages of 25 and 65 years. Additionally, occupational scrutiny indicates a notable prevalence of melasma among individuals in administrative positions, ostensibly due to the heightened sunlight exposure inherent to their job roles.	54	Melasma causes a significant predilection in females, with sunlight exposure being the primary etiological determinant.
Rattanamukrom, dkk (2022)	A Comparative Study of Dermatoscopic Features of Melasma and Hori's Nevus in Asian Patients	A Cross-sectional Study	We identified a cohort of 29 patients with melasma classified as skin type III and 21 patients categorized as skin type IV in this study.	50	This study observed the incidence of melasma in Asian patients exhibiting skin types III and IV was observed in this study. Nevertheless, the investigation did not ascertain sunlight exposure as a contributing factor to the onset of melasma.
Prabawaningrum (2015)	<i>Hubungan Riwayat Pemakaian Tabir Surya Dengan Kejadian Melasma</i>	"Observational analytical study"	The results of this investigation demonstrate a lower prevalence of melasma among respondents who utilize sunscreen compared to those who do not employ sunscreen.	45	An analogous finding from this study is the observation that optimal sunscreen utilization correlates with a decreased occurrence of melasma compared to individuals who do not employ sunscreen.
Fatima sakeena et al. (2020)	The Role of Sunscreen in Melasma and Postinflammatory Hyperpigmentation	A Literature Review	The utilization of sunscreen incorporating UV + VL protection serves as an essential adjunctive measure in the prevention of hyperpigmentation and the management of melasma. Furthermore, advice on optimal sunscreen application practices has an impact on the severity gradient of melasma.	600	In this study, the use of sunscreen is solely employed as an adjunctive therapy.
Bhattarai, et al (2017)	Clinical patterns and epidemiological characteristics of melasma in a tertiary care hospital of Nepal	Statistical research	This study suggests that the occurrence of melasma is predominantly observed among females with a history of excessive sunlight exposure. Additionally, skin types III and IV were identified as the most prevalent phenotypes associated with melasma in this investigation.	138	A parallelism evident in this study is the prevalence of melasma attributed to solar radiation exposure, exhibiting a higher incidence among females, particularly in individuals with skin types III and IV.
Xu, dkk. (2021)	Melasma: condition of Asian Skin	A Literature Review	Ultraviolet (UV) radiation stands out as a pivotal catalyst in the progression of melasma. Researchers notably observed the highest prevalence of melasma in Southeast Asian territories and India.	135	This research elucidates that melasma incidence can be attributed to UV radiation exposure, with a pronounced predilection observed among individuals of Asian descent.

Researcher & Years	Title	Research methods	Results	Samples	Research Similarities
K Jha, dkk. (2015)	Vitiligo and Melasma: A Psychosocio-Cosmetic Challenge in Context of South Asian Countries	A Retrospective Study	There is a correlation between melasma incidence and skin types III and IV.	3.224	This study illustrates concordance with previous research, revealing a predominant incidence of melasma among individuals categorized with skin types III–IV.
Sarkar, dkk (2019)	Role of broad – spectrum sunscreen alone in the improvement of melasma area severity index (MASI) and melasma Quality of Life Index in melasma.	A Cross-sectional (study)	The significant use of sunscreen can notably alleviate the severity of melasma occurrence.	100	The significant use of sunscreen can effectively reduce the severity of melasma.
Mayra, dkk. (2017)	Sun-protective behaviors in patients with cutaneous hyperpigmentation : A cross-sectional study	A Cross-sectional Study	The use of sunscreen with suboptimal application for patients is associated with an exacerbation in the severity of melasma incidence.	404	The optimal application of sunscreen has been shown to decrease the severity of melasma.
Harumi O, Goh CL (2016)	The effect of melasma on the quality of life in a sample of women living in Singapore	A Cross-sectional Study	Forty-seven patients of Chinese descent were identified with melasma affecting the facial skin, typically within the age range of 56 to 60 years. The predominant contributing factor to this condition was identified as sunlight exposure.	49	In this research, individuals of Asian descent, including those of Chinese ethnicity, demonstrated a heightened occurrence of melasma. Additionally, sunlight exposure emerged as another significant contributing factor.

In 2014, a multicentric cross-sectional study focused on melasma, encompassed a sample size of 331 individuals. Findings revealed a higher prevalence of melasma among women, with a gender ratio of 4:1. Patients diagnosed with melasma had a mean age of 37 years. Notably, only 10% of patients reported the use of sunscreen with SPF 50.⁹ Concurrently, a retrospective study conducted in Indonesia in 2014, investigating the diagnosis and treatment of melasma, involved 1,313 participants. The majority of newly diagnosed melasma cases, predominantly comprising females (99.2%), were observed at the Cosmetic Division of the Department of Dermatology and Venereology at Dr. Soetomo Hospital in Surabaya between 2009 and 2011. Conversely, male patients accounted for a mere 0.8% of the total new melasma cases. The mean age ranged between 36 and 45 years, followed by 46 and 55 years. Anamnesis-based evaluations identified sunlight exposure (85.5%) as the primary contributing factor, followed by cosmetics, contraception, familial

predisposition, pregnancy, and medication.⁸

A subsequent study conducted in 2022 focused on Asian patients, utilizing a cross-sectional approach to investigate melasma and Hori's nevus. This research comprised a sample of 50 individuals, with an average age of 43 years. Among the participants, and 29 were categorized as having skin types III and 21 were categorized as having skin types IV. Notably, in this investigation, sunlight exposure did not emerge as a discernible cause of melasma.¹⁰ Conversely, a statistical inquiry in Nepal in 2017 regarding the clinical patterns and epidemiology of melasma within a Nepalese hospital involved a sample size of 138 individuals. The findings revealed a higher prevalence of melasma among women, accounting for 113 cases (81.9%) compared to men with 25 cases (18.1%). A majority of patients (45.7%) reported a melasma occurrence lasting less than one year. Continuous and prolonged exposure to sunlight (83.3%) was the primary

precipitating factor for melasma was, followed by stress (34.8%), pregnancy (30.4%), and contraceptive pills (5.8%). Among patients with melasma, 91 (65.9%) were classified as skin type III, while 42 (30.4%) and 5 (3.6%) were categorized as skin types IV and V, respectively.^{11,12}

A literature review conducted in the United States in 2021, focusing on Asian patients and comprising a sample size of 135, identified UV radiation as a primary triggering factor in melasma development. The study noted the highest incidence of melasma in the Southeast Asian and Indian regions. Consequently, it concluded that melasma occurrence can be attributed to UV radiation, particularly prevalent among individuals with Asian skin types. Subsequently, a retrospective study in Nepal in 2015, involving a sample of 3,224 participants, revealed a correlation between melasma occurrence and skin types III–IV. In Southeast Asia, melasma prevalence was notably higher among women (40%) compared to men (20%). The Nepalese study also emphasized sunscreen as the predominant treatment modality for melasma, while noting its predilection for affecting women with darker skin tones. These findings underscore the congruence with prior research, indicating a heightened incidence of melasma among individuals classified as having skin types III–IV.¹³

In 2016, researchers in Singapore conducted a subsequent investigation to evaluate the impact of melasma on the quality of life among female residents. Of the 49 diagnosed melasma patients, 47 were of Asian ethnicity, specifically Chinese, predominantly aged between 56 and 60 years. Sunlight exposure emerged as the primary risk factor, accounting for 67.3% of cases. The mean age was reported as 56.6 ± 9.1 years. These findings corroborate prior research indicating a heightened prevalence of melasma among women with skin types III and IV, with sunlight exposure being a significant risk determinant.¹⁴ Furthermore, a 2019 study

conducted in Indonesia revealed a markedly higher incidence of melasma among females compared to males, with 98.1% of cases occurring in women and 1.9% in men. This trend aligns with data extracted from the seventh edition of Fitzpatrick's *Dermatology in General Medicine*, which underscores the predominance of melasma among women relative to men.¹⁵

A 2017 analytical study conducted in Indonesia investigated the relationship between sunscreen usage history and melasma incidence among 70 female participants. The findings revealed that 44.3% of women without a history of using sunscreen developed melasma. Utilizing Chi-square analysis, a significant association was observed between sunscreen usage history and melasma occurrence among women aged 25–45 years ($p=0.000$). The prevalence of melasma in this study was highest among women aged 25–45 years, comprising 52.9% of the sample.¹⁶ Subsequently, an observational study conducted in Indonesia in 2018 examined the correlation between the history of sunscreen use and melasma severity. This study, involving 60 participants, identified the highest melasma incidence among women aged 40–50 years (55.0%) and the lowest among those aged >51 years (3.3%). Moreover, respondents who regularly used sunscreen predominantly exhibited mild melasma severity (96.7%), while those who did not regularly use sunscreen showed a higher prevalence of moderate melasma severity (70.0%). The study's findings suggested that despite regular sunscreen use, respondents with moderate melasma severity may have engaged in suboptimal sunscreen application practices, as indicated by the lack of sunscreen reapplication throughout the day, based on respondent anamnesis data.⁷

In 2015, a subsequent observational analytical study was undertaken in Indonesia to explore the relationship between sunscreen usage history and melasma incidence. With a sample size of 45 participants, the investigation revealed a statistically significant association between

the two variables, as evidenced by a Chi-square test yielding a p-value of 0.003 ($p < 0.05$).¹⁷ In contrast, in 2020, a literature review conducted in India examined the role of sunscreen in managing melasma and post-inflammatory hyperpigmentation, drawing upon 600 sources. The findings underscored the importance of sunscreen containing UV + VL protection as an adjunctive therapy to mitigate hyperpigmentation and ameliorate melasma conditions. Furthermore, counseling on optimal sunscreen application was shown to impact the severity of melasma. Thus, the literature review concurs with the notion that sunscreen primarily serves as an adjunctive therapeutic measure.¹⁸

In 2019, a cross-sectional study in India investigated the impact of sunscreen use on the quality of life in melasma patients, involving a sample size of 100 individuals. The study's findings suggested that a significant reduction in melasma severity was associated with the optimal application of sunscreen. The mean MASI scores within the study groups were reported as 12.38 ± 14.7 and 9.15 ± 4.7 , respectively. Moreover, mean HI-MELASQOL values demonstrated a decrease from 47.2 ± 14 to 38.1 ± 14.2 at the beginning and end of the study, respectively. Spearman correlation analysis revealed a positive, albeit nonsignificant, correlation between MASI and HI-MELASQOL before and after the study. Thus, the study findings corroborate ongoing research indicating that optimal sunscreen use may mitigate the severity of melasma.¹⁹ In a subsequent cross-sectional study conducted in the United States in 2017, focusing on sunscreen cream application habits among patients with hyperpigmentation, the sample consisted of 404 individuals. The study highlighted that suboptimal sunscreen application exacerbated melasma incidence. Notably, approximately 67.5% of patients used

sunscreen-containing products, with 91% applying sunscreen products with SPF 21 or higher. However, a significant proportion (48.5%) expressed uncertainty about the broad-spectrum protection provided by their sunscreen, and only a small fraction (7.6%) adhered to reapplication every 2 hours. Additional factors associated with sunscreen application included female gender (OR = 3.8, $P = 0.0004$) and disease duration > 1 year (OR = 2.1, $P = 0.003$). Multivariate analysis revealed an odds ratio of sunscreen use among African-American individuals compared to Caucasians of 0.31 ($P = 0.0008$). Thus, this study aligns with ongoing research suggesting that optimal sunscreen use may mitigate the severity of melasma.²⁰

CONCLUSION

The findings gleaned from this literature review indicate a predominant prevalence of melasma among female individuals exhibiting skin types III-V, typically within the age bracket of 25-60 years. This phenomenon can be attributed to the heightened solar radiation exposure prevalent in locales where individuals with such skin types predominantly reside, notably in regions across Asia. Furthermore, this literature study demonstrates a statistically significant correlation between optimal use of sunscreen and the incidence of melasma.

ACKNOWLEDGEMENTS

The author would like to other parties who assisted with this research.

DECLARATION OF INTEREST

The authors declare that they have no conflict of interest'

FUNDING

There is no funding from any party.

REFERENCES

- Rodrigues M, Pandya AG. Hypermelanoses. In: Kang S, Amagai M, Bruckner AL, Enk AH, Margolis DJ, McMichael AJ, et al, editor. Fitzpatrick's dermatology. 9th ed. New York: McGraw Hill Incorporation; 2019. p.1379-81.
- Handel AC, Miot LDB, Miot HA. Melasma: a clinical and epidemiological review. *An Bras Dermatol* 2014;5:772.
- Sarkar R, Arora P, Garg VK, Sonthalia S, Gokhale N. Melasma Update. *Indian Dermatology Online Journal* 2014; 5(4): 426.
- Apriliyani PY . Hubungan Antara Pemakaian Tabir Surya Dengan Derajat Keparahan Melasma (*Skor MASI*) Pada Wanita di Kec. Grogol-Sukoharjo. Surakarta: Fakultas Kedokteran Universitas Muhammadiyah Surakarta. 2017.
- Shankar KDSR, Somani VK, Kohli M, Sharad J, Ganjoo A, Kandhari S, et al. A cross-sectional, multicentric clinico-epidemiological study of melasma in India. *Dermatologic Therapy*. 2014; 3: 71-81.
- Purba RA. Gambaran Faktor-Faktor Risiko Timbulnya Melasma di Poliklinik Kulit dan Kelamin RSU Royal Prima dan Murni Teguh Memorial Hospital Kota Medan Pada Bulan Desember 2018-Januari 2019. Medan: Fakultas Kedokteran Universitas HKBP Nommesen Medan. 2019.
- Waskita TW. Hubungan antara riwayat pemakaian tabir surya dengan derajat keparahan melasma. Cimahi: Fakultas Kedokteran Universitas Jenderal Achmad Yani. 2018.
- Umborowati MA, Rahmadewi. Studi Retrospektif: Diagnosis dan Terapi Pasien Melasma. *Berkala Ilmu Kesehatan Kulit & Kelamin* 2014; 26: 56- 61.
- Krupa S, Devasthanam S R, et al. A cross-sectional, multicentric clinico-epidemiological study of melasma in India. 2014; 4.1: 71-81.
- Rattananukrom T, Suchonwanit P, Thadanipon K, Vachiramon V. A Comparative Study of Dermatoscopic Features of Melasma and Hori's Nevus in Asian Patients. *J Clin Aesthet Dermatol* 2022; 15(3):16-20.
- Bhattarai S, Pradhan K., Sharma S, & Rajouria E A. . Clinical patterns and epidemiological characteristics of melasma in a tertiary care hospital of Nepal. *Pigment International* 2017; 4(1): 35.
- Wu M X., Antony R., & Mayrovitz H N. Melasma: A Condition of Asian Skin. *Cureus* 2021; 13(4).
- Jha A K., & Karki S. Vitiligo and melasma: a psychosocio-cosmetic challenge in context of south asian countries. *J Pigment Disord* 2015.
- Harumi O, Goh CL. The effect of melasma on the quality of life in a sample of women living in Singapore. *The Journal of clinical and aesthetic dermatology*. 2016 Jan;9(1):21.
- Setyawati NK. Insiden dan Profil Melasma di Rumah Sakit Umum Pusat Sanglah Denpasar Periode Januari 2014 Sampai Desember 2014. *E-Jurnal Medika Udayana*. 2019 Apr 18;8(2).
- Lahida SP. Hubungan riwayat pemakaian tabir surya dengan kejadian melasma pada wanita usia 25-45 tahun. Jakarta: Trisakti. 2018.
- Prabawaningrum CD. Hubungan Riwayat Pemakaian Tabir Surya dengan Kejadian Melasma. Surakarta: Fakultas Kedokteran Universitas Negeri Surakarta. 2015
- Fatima S, Braunberger T, Mohammad TF, Kohli I & Hamzavi IH. The Role of Sunscreen in Melasma and Postinflammatory Hyperpigmentation. *Indian journal of dermatology* 2020; 65(1): 5–10.
- Sarkar R., Ghunawat S., Narang, I., Verma S., Garg V K., & Dua R. Role of broad-spectrum sunscreen alone in the improvement of melasma area severity index (MASI) and Melasma

- Quality of Life Index in melasma. *Journal of cosmetic dermatology* 2019; 18(4): 1066-1073.
20. Maymone M B, Neamah H H., Wirya S A., Patzelt N M., Zancanaro P Q, & Vashi N A. Sun-protective behaviors in patients with cutaneous hyperpigmentation: A cross-sectional study. *Journal of the American Academy of Dermatology* 2017; 76(5): 841-846.