INDONESIAN HEALTH JOURNAL

Volume 5 Number 3, September 2026
pp. 627-637
E-ISSN: 2963-3036
DOI: 10.58344/ihj.v5i3.922

The Relationship Between Sun Exposure Duration and the Clinical Severity of Melasma in Women of Childbearing Age in Kabun, Rokan Hulu, Riau Province

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Keywords:
Melasma; sun exposure; women of childbearing age; MMASI; hyperpigmentation.

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Abstract

Melasma is a chronic hyperpigmentation disorder that commonly affects women of childbearing age and is influenced by several factors, including sun exposure. This study aimed to analyze the relationship between the duration of sun exposure and the clinical severity of melasma among women of childbearing age in Kabun District, Rokan Hulu Regency, Riau Province. An analytical observational study with a cross-sectional design was conducted involving 50 women who met the inclusion and exclusion criteria using a total sampling technique. Sun exposure data were collected using the Sun Exposure Questionnaire (SEQ), while the clinical severity of melasma was assessed using the Modified Melasma Area and Severity Index (mMASI). Data were analyzed using univariate analysis and Spearman's correlation test with a significance level of 0.05. The results showed that most participants were aged 30–39 years (94%), had mild melasma (68%), and experienced low to moderate levels of sun exposure (84%). Spearman's correlation analysis demonstrated no significant relationship between the duration of sun exposure and the clinical severity of melasma ($r = -0.080$; $p = 0.580$). Age and a history of hormonal contraceptive use were also not significantly associated with melasma severity. It can be concluded that the duration of sun exposure was not significantly associated with the clinical severity of melasma among women of childbearing age in Kabun District. Further studies involving larger and more heterogeneous populations are recommended to investigate additional risk factors that may influence melasma severity.

INTRODUCTION

Melasma is a chronic hyperpigmentation disorder characterized by dark patches on areas of the face that are frequently exposed to ultraviolet (UV) radiation due to increased melanocyte activity (Honigman & Rodrigues, 2023; Miao et al., 2025; Wang et al., 2023). This condition is influenced by several factors, including ultraviolet radiation and sunlight exposure, which stimulate melanocytes (pigment-producing cells) and increase melanin production, thereby worsening the condition (Placidacki, 2024).

Women of childbearing age are more susceptible to melasma because hormonal factors, such as pregnancy and the use of hormonal contraceptives, can trigger its development (Espósito et al., 2022; Khalaf et al., 2025; Naznin et al., 2025; Primawati et al., 2026; Zhang et al., 2025). However, recent research suggests that regular sun exposure is one of the primary environmental factors associated with melasma risk. International studies indicate that longer

durations of sun exposure are associated with greater melasma severity (Zheng, 2024; Ghasemiyeh, 2024).

Case studies in Indonesia further confirm the importance of this issue. Observational studies and reports from dermatologists in Indonesia indicate that melasma is prevalent and associated with behaviors such as sunscreen use (Abd Hisham et al., 2024; I. N. Putri et al., 2024; Rahmawati et al., 2025; Sanjiwani & Aryadi, 2025). For example, studies among Indonesian populations have shown that melasma commonly occurs in adults and is associated with sun exposure and skincare practices (Du, 2022).

Another study conducted in Indonesia demonstrated an association between the duration of sun exposure and the occurrence or severity of melasma (Darmawan et al., 2026; Devi et al., 2022; Du et al., 2022; Nukana et al., 2022; Praharsini et al., 2024; I. A. Putri et al., 2022; Rahmawati et al., 2025). Research involving individuals with outdoor occupations, such as street sweepers in Batam, showed that prolonged exposure to sunlight may increase the risk of melasma (Batubara, 2021). A study conducted in Medan examined the relationship between sunscreen use, sun exposure, and the incidence of melasma. The findings confirmed that sun exposure is a modifiable risk factor that can potentially be reduced through preventive measures (Syahputra, 2024). School-based studies have also demonstrated an association between sun exposure behaviors and the incidence of melasma among female students (Minerva, 2022).

The importance of studying this condition in Kabun District, Rokan Hulu Regency, Riau Province, further strengthens the rationale for this research. Riau is a tropical region with high levels of UV radiation throughout the year. Outdoor activities, such as farming, may increase sun exposure among women during their reproductive years. However, specific studies in rural areas of Indonesia that assess sun exposure duration and its relationship with melasma severity remain limited. Therefore, contextual research in Kabun District is needed to generate local evidence that can serve as a basis for melasma prevention and management strategies (Du, 2022; Coal, 2021).

This study aims to determine the relationship between sun exposure duration and the clinical severity of melasma among women of childbearing age in Kabun District, Rokan Hulu Regency, Riau Province. Specifically, this study describes sun exposure duration and the clinical severity of melasma among respondents and analyzes the relationship between these two variables. The research problem focuses on whether sun exposure duration is associated with the clinical severity of melasma, accompanied by an assessment of sun exposure characteristics and melasma severity among women of childbearing age in the study area. The findings of this study are expected to contribute to scientific development, particularly in dermatology and public health, provide references for future research, increase public awareness regarding the importance of sun protection as an effort to prevent melasma, and support healthcare professionals in developing educational, counseling, and promotive-preventive interventions for women of childbearing age who are at risk of developing melasma.

METHOD

Research design

This study employed an analytical observational research design with a cross-sectional approach. Data were collected through questionnaires and clinical observations to determine

the relationship between sun exposure duration and the clinical severity of melasma among women of childbearing age in Kabun District, Rokan Hulu Regency, Riau Province. The study was conducted in Kabun District, Rokan Hulu Regency, Riau Province, over a two-month period, including research preparation, data collection, and data analysis.

Population and sample

A total of 50 women of childbearing age (15–49 years) who were domiciled and active in Kabun District during the study period. For melasma-specific analysis, samples were taken from women of childbearing age who were clinically diagnosed with melasma on screening examinations.

1. Inclusion criteria: Women aged 15–49 years; domiciled ≥6 months in Kabun; be willing to give written consent; have melasma lesions on clinical examination.
2. Exclusion criteria: Women with other skin conditions that may cause similar hyperpigmentation, are undergoing depigmentation therapy in the last 3 months, or have a history of laser/peeling procedures in the last 6 months, women who use *sunscreen*, and who are unwilling to give their consent to follow the entire research procedure.

The sampling technique used in this study is the total sampling method, which is a sampling method that involves the entire population that meets the inclusion and exclusion criteria set by the researcher. This method was chosen because the population that suits the needs of the research is small so that the entire population can be used as a sample to better understand the relationship between independent and dependent variables. Based on this method, the respondents in this study amounted to 50 people, all women of childbearing age living in Kabun District, Rokan Hulu Regency, Riau Province.

Data analysis

In this study, data analysis was carried out in two stages: univariate analysis and bivariate analysis. The purpose of univariate analysis is to describe the characteristics of respondents and the distribution of all variables studied. Categorical variables, such as age, occupation, duration of sun exposure, and severity of melasma according to MMASI scores, are expressed as frequency and percentage distributions. Quantitative variables, such as duration of sun exposure (hours per day) and MMASI scores, are expressed as mean and standard deviation if not normally distributed, or median and minimum-maximum range if not normally distributed.

Bivariate analysis was then performed to determine the relationship between the duration of sun exposure and the severity of melasma based on the MMASI score. The relationship between variables was tested using the chi-square test with a significance level (α) of 0.05. The relationship between the two variables is considered statistically significant if the p-value < 0.05.

RESULTS AND DISCUSSION

This research has received ethical approval from the Health Sciences Ethics Committee of Universitas Prima Indonesia with license number 073/KEPK/UNPRI/I/2026. This study used an observational analytical design with a cross-sectional approach, with the aim of analyzing the relationship between the duration of sun exposure and the clinical severity of melasma in women of childbearing age in Kabun District, Rokan Hulu Regency, Riau Province.

Data was collected through interviews using the Sun Burn Questionnaire (SEQ) to measure the duration and extent of the sunburn experienced by respondents. In addition, a clinical examination was conducted using the Modified Melasma Severity Extent Index and Severity (MMASI) to determine the severity or clinical severity of melasma.

The variables studied were sun exposure as an environmental risk factor, measured by the duration of sun exposure and the position of the sun on the skin. The study participants were women of reproductive age aged 15–49 years who were clinically diagnosed with melasma, domiciled in Kabun District and met the predetermined inclusion and exclusion criteria. This survey was conducted using a common sampling technique and the entire population that met the criteria was included as respondents. Based on this technique, the sample size produced was 50 respondents. Prior to the study, all respondents were informed about the study's objectives, procedures, benefits, and potential risks. Participation is voluntary and is demonstrated by signing an consent form prior to the start of data collection. The collected data is then processed and analyzed using the Statistical Package for the Social Sciences (SPSS) software. Univariate analysis was performed to assess the characteristics of respondents and the distribution of each study variable, and bivariate analysis was used to examine the relationship between the duration of sun exposure and the clinical severity of melasma with statistical tests corresponding to the type and distribution of data. All research was conducted in accordance with the ethical principles of health research, including respecting respondents' autonomy, protecting data confidentiality, and ensuring the safety, comfort, and well-being of respondents during the study.

Data analysis

Univariate test

Table 1 Respondent data

Variabel	Category	Quantity	Percentage
Age	15-19 years old	0	0%
	20-29 years old	3	6%
	30-39 years old	47	94%
	40-49 years old	0	0%
Jobs	Indoors	50	100%
	Outdoors	0	0%
Family planning use history	Ya	25	50%
	No	25	50%
History of the disease	Ya	0	0%
	No	50	100%
History of sunscreen use	Ya	0	0%
	No	50	100%
History of aesthetic actions < last 6 months	Ya	0	0%
	No	50	100%
Degree of severity of melasma	Mild degree	34	68%
	Medium degree	15	30%
	Degree of weight	1	2%
Levels of sun exposure	Low display	23	46%
	Medium display	19	38%
	High display	8	16%

The demographic distribution showed that most of the study subjects were in the age range of 30–39 years (47 people; 94%), while the age group of 20–29 years included only 3

people (6%). All participants (100%) worked in a closed (indoor) environment and were confirmed to be free of a history of specific diseases. The same pattern was also found in the variables of sunscreen use as well as facial aesthetic actions in the last 6 months, where none of the respondents (100%) had them. Meanwhile, exposure to hormonal contraceptives was evenly divided among 25 respondents (50%) for each group.

Regarding the clinical variables of melasma, mild manifestations were identified in 34 respondents (68%), moderate in 15 respondents (30%), and severe in 1 respondent (2%). Finally, the level of sun exposure in this population included the low category of 23 respondents (46%), the medium category of 19 respondents (38%), and the high level of 8 respondents (16%).

Table 2. Univariate test table of respondent data

		Degree of severity of melasma	**Levels of sun exposure**	**Jobs**	**Age**	**Family planning use history**	**History of sunscreen use**	**History of the disease**	**History of facial aesthetic action < last 6 months**
N	*Valid*	50	50	50	50	50	50	50	50
	Missing	0	0	0	0	0	0	0	0
Mean		1.34	1.70	1.00	2.94	.50	.00	.00	.00
Std. Error of Mean		.073	.104	.000	.034	.071	.000	.000	.000
Median		1.00	2.00	1.00	3.00	.50	.00	.00	.00
Mode		1	1	1	3	0	0	0	0
Std. Deviation		.519	.735	.000	.240	.505	.000	.000	.000
Variance		.270	.541	.000	.058	.255	.000	.000	.000
Range		2	2	0	1	1	0	0	0
Minimum		1	1	1	2	0	0	0	0
Maximum		3	3	1	3	1	0	0	0
Sum		67	85	50	147	25	0	0	0

Referring to Table 2 regarding statistical descriptions, the clinical degree of melasma in this study population was dominated by mildness, with an average score of 1.34, a median score of 1.0, and a mode of 1. On the other hand, the sun exposure index showed a distribution that varied between the low to high category with a moderate tendency (*mean* = 1.70; *median* = 2; *mode* = 1). For the age variable, the majority of the study subjects were in the age group of 30–39 years (*mean* = 2.94; *median* = 3; *mode* = 3). Furthermore, data on the history of hormonal contraceptive use showed an even distribution of 50% (*mean* = 0.50; *median* = 0.5; variance = 0.255).

Interestingly, there are several variables that show absolute homogeneity (100% similar) so that they have a standard *deviation* value of 0. These variables included the type of work in which all respondents worked indoors (data centering value = 1), as well as sunscreen use history, medical history, and facial aesthetic actions in the last 6 months where the entire sample did not have one (data centering value = 0).

Normality test

Table 3. Normality test

	Shapiro-Wilk		
	Statistic	***df***	***Say.***
Degree of severity of melasma	.627	50	.000
Jobs	.	50	.
Age	.255	50	.000
Family planning use history	.637	50	.000
History of sunscreen use	.	50	.
History of the disease	.	50	.
History of facial aesthetic action < last 6 months	.	50	.
Levels of sun exposure	.774	50	.000

The analysis of the distribution of data using the Shapiro-Wilk method (Table 3) was only intended for non-categorical variables, so nominal factors such as occupation, sunscreen habits, disease history, and facial aesthetic treatments in the last 6 months were excluded. From the results of testing the remaining variables, it was found that the data was not distributed normally because the total significance value was less than 0.05 (p = 0.000). The Shapiro-Wilk statistical values obtained consecutively were 0.627 for the severity of melasma, 0.255 for the age factor, 0.637 for the history of hormonal birth control, and 0.774 for the level of sun exposure.

Bivariate test

Table 4. Test results *Spearman's rho* between the severity of melasma and the level of sun exposure

			Degree of severity of melasma	**Levels of sun exposure**
Spearman's rho	Degree of severity of melasma	*Correlation Coefficient*	1.000	-.080
		Sig. (2-tailed)	.	.580
		N	50	50
	Levels of sun exposure	*Correlation Coefficient*	-.080	1.000
		Sig. (2-tailed)	.580	.
		N	50	50

Referring to the data in Table 4, the clinical manifestations or severity of melasma in the subjects were not directly affected by the duration and intensity of sun exposure. This is strengthened by the acquisition of the Spearman correlation coefficient which is only 0.080 and the value p = 0.580. Since the significance value was above the threshold of 0.05, the hypothesis of a direct relationship between sun radiation exposure and the severity of the melasma condition in this sample was statistically rejected.

Table 5 The results of the Spearman's rho test between the severity of melasma against other independent variables

Variabel	Subvariables	Information	Melasma severity	Jobs	Age	Birth control history	History of sunscreen use	History of illness	History of facial aesthetic procedures <last 6 months
Spearman's rho	Melasma severity	Correlation Coefficient	1.000	.	-.180	.070	.	.	.
		Sig. (2-tailed)	.	.	.212	.629	.	.	.
	Occupation	N	50	50	50	50	50	50	50
		Correlation Coefficient	.	1,000	.	.	.	.	.
	Age	Sig. (2-tailed)	.	.	.	.	.	.	.
		N	50	50	50	50	50	50	50
	History of birth control use	Correlation Coefficient	-.180	.	1,000	-.084	.	.	.
		Sig. (2-tailed)	.212	.	.	.561	.	.	.
	History of sunscreen use	N	50	50	50	50	50	50	50
		Correlation Coefficient	.070	.	-.084	1,000	.	.	.
	Medical history	Sig. (2-tailed)	.629	50	.561	.	.	.	.
		N	50	.	50	50	50	50	50
	History of facial aesthetic procedures in the last <6 months	Correlation Coefficient	.	.	.	.	1,000	.	.
	Subvariables	Sig. (2-tailed)	.	50	.	.	.	.	.
	Melasma severity	N	50	.	50	50	50	50	50

Variabel	Subvariables	Information	Melasma severity	Jobs	Age	Birth control history	History of sunscreen use	History of illness	History of facial aesthetic procedures <last 6 months
		Correlation Coefficient	.	.	.	.	.	1,000	.
	Occupation	Sig. (2-tailed)	.	50	50	.	.	.	.
		N	50	.	.	50	50	50	50
	Age	Correlation Coefficient	.	.	.	.	.	.	1,000
		Sig. (2-tailed)	.	50	50	.	.	.	.
	History of birth control use	N	50	Jobs	Age	50	50	50	50

This study concluded that there was no statistically significant association between all the factors tested and the severity of melasma in respondents. This conclusion is based on the results of the Spearman test in Table 7, where the age relationship with melasma was negative and weak (r = -0.180; p = 0.212), while the relationship between hormonal contraceptives was positive but very insignificant (r = 0.070; p = 0.629). Moreover, correlation analysis cannot be applied to occupational variables, sunscreen habits, disease history, and facial care in the last 6 months due to respondent data that is 100% constant or homogeneous. .

Based on the results of the study, most of the respondents were between 30 and 39 years old, and most had mild melasma. These results are consistent with previous research that melasma is more common in women of reproductive age, especially in the third and fourth decades of life. Hormonal activity is still at its peak in this age group, and sun exposure begins to affect skin pigmentation (Placidaki, 2024). However, age is more of a factor associated with melasma symptoms than a determinant of disease severity.

Statistical analysis of this study showed that the level of sun exposure was not significantly related to the severity of melasma. These results may have been influenced by the similarity of the characteristics of the respondents, who all worked indoors, resulting in slight differences in the intensity and duration of exposure to ultraviolet light. This situation may reflect limited differences in sun exposure between individuals, making it difficult to demonstrate a statistical association with melasma risk. Previous research has shown that exposure to ultraviolet radiation is associated with a higher risk of melasma in individuals who work in the field or outdoors (Fadhilah & Rahmawati, 2023). Pathophysiologically, ultraviolet

light is an important factor in the development of melasma. Ultraviolet light activates melanocytes, promotes the formation of reactive oxygen species (ROS), and stimulates the expression of tyrosinase, an enzyme that plays a key role in melanogenesis. The activation of this mechanism leads to an increase in melanin synthesis, which promotes melasma hyperpigmentation (Passeron & Picardo, 2021). However, if the level of exposure to ultraviolet radiation was low and similar among all respondents, these biological impacts were not necessarily reflected in the statistically significant difference in melasma risk. The study also found no significant association between a history of hormonal contraceptive use and the severity of melasma. These results are somewhat consistent with previous research that showed that hormonal contraceptives play a greater role in melasma symptoms than lesion severity (Phinari & Darmaputra, 2022). Biologically, estrogen and progesterone increase melanocyte activity by binding to hormone receptors on melanocytes and keratinocytes, thereby promoting melanogenesis (Zhang et al., 2025). However, the effects of hormones on melasma can be affected by a variety of factors, including the type of contraception, hormone dosage, duration of use, genetic predisposition, and environmental factors. Therefore, the use of hormonal contraceptives is not necessarily associated with an increased risk of melasma.

In this study, the association between age and the severity of melasma also showed a weak negative correlation, which was not statistically significant. These findings support previous research that age is most closely associated with an increased risk of melasma, while the severity of lesions is more influenced by other factors such as cumulative ultraviolet light exposure, hormonal status, genetic predisposition, and an individual's biological response to melanogenic stimuli. Therefore, increasing age does not necessarily mean an increased risk of melasma.

Miscellaneous variables, such as occupation, history of sunscreen use, medical history, and history of facial aesthetic procedures in the past six months, could not be further analyzed because all respondents had the same characteristics. The homogeneity of this sample is a limitation of the study, reducing the variability of the data needed to assess the relationship between these factors and the severity of melasma. However, some studies have shown that regular use of sunscreen and various aesthetic procedures can influence the clinical course of melasma, particularly in preventing the development of hyperpigmentation and reducing the risk of recurrence (Rodrigues et al., 2022). Overall, the results of this study show that age, level of sun exposure, and history of hormonal contraceptive use were not significantly associated with the risk of melasma in women of reproductive age in Kabun Regency.

CONCLUSION

In general, this study confirmed differences in the characteristics of each observed variable related to the clinical severity of melasma, with most respondents being women aged 30–39 years who presented with mild melasma. The Spearman correlation test showed that independent variables, including age, sun exposure duration, and history of hormonal contraceptive use, were not statistically significant ($p > 0.05$). Conversely, several respondent characteristics showed no variation (100% identical), including a closed work environment, healthy physical condition, and the absence of sunscreen use or facial care practices within the previous six months, which prevented statistical analysis of these variables. The findings

indicated that the absence of significant associations in this study may have been influenced by limited variability among the measured variables and uniform characteristics among respondents. Therefore, the severity of melasma in this sample may have been influenced by other factors beyond the variables examined in this study.

Future research is recommended to involve larger samples with more heterogeneous respondent characteristics, particularly regarding occupational exposure, sunscreen use, and a history of aesthetic procedures, to enable more comprehensive analysis of factors associated with melasma severity. Further studies should also investigate other potential risk factors that may influence melasma severity, including family history, Fitzpatrick skin type, duration and type of hormonal contraceptive use, and regular sunscreen use habits. The use of more objective assessment instruments, such as the Melasma Area and Severity Index (MASI), is recommended to improve the accuracy and objectivity of clinical severity evaluations. For healthcare professionals, particularly those in dermatology, the findings of this study highlight that melasma severity is multifactorial; therefore, prevention and management strategies should be implemented through individualized and comprehensive approaches. Patient education regarding melasma risk factors and the importance of sun protection remains essential, even though no significant association was identified in this study.

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