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Melasma and prolonged oral contraceptive use: a community-based retrospective cohort study

Melasma dan Penggunaan Kontrasepsi Oral Jangka Panjang: Suatu Studi Kohort Retrospektif Berbasis Komunitas

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ABSTRACT

Background: *Melasma is a common skin disorder often influenced by hormonal factors such as estrogen and progesterone. Combined oral contraceptives (COCs), which contain both hormones, are widely used in Indonesia and may contribute to melasma, especially among long-term users.*
Objective: *This study aimed to examine the association between prolonged COC use and melasma among women in Lamongan Regency, Indonesia.*
Methods: *Using a retrospective cohort design, 20 reproductive-aged women were selected through purposive sampling. Data were collected via structured interviews and clinical observation, and analyzed using the Chi-square test.*
Results: *Results showed that 55% of participants developed melasma, with a significant association between COC use duration and melasma occurrence (p = 0.024). Women who used combined oral contraceptives for ≥3 years showed a trend toward higher odds of developing melasma compared to those who used COCs for <3 years (OR = 8.0; p= 0.024.*
Conclusion: *These findings underscore the need for integrating dermatological considerations into contraceptive counseling, particularly in primary healthcare facilities.*

Keywords: *melasma, combined oral contraceptives (COCs), hormonal factors, reproductive-age women*

ABSTRAK

Latar belakang: Melasma merupakan kelainan kulit yang umum terjadi dan sering dipengaruhi oleh faktor hormonal seperti estrogen dan progesteron. Kontrasepsi oral kombinasi (KOK), yang mengandung kedua hormon tersebut, banyak digunakan di Indonesia dan dapat berkontribusi terhadap timbulnya melasma, terutama pada pengguna jangka panjang.
Tujuan: Penelitian ini bertujuan untuk menelaah hubungan antara penggunaan KOK jangka panjang dengan kejadian melasma pada wanita di Kabupaten Lamongan, Indonesia.
Metode: Dengan menggunakan desain kohort retrospektif, sebanyak 20 wanita usia reproduktif dipilih melalui purposive sampling. Data dikumpulkan melalui wawancara terstruktur dan observasi klinis, kemudian dianalisis menggunakan uji Chi-square.
Hasil: Hasil penelitian menunjukkan bahwa 55% partisipan mengalami melasma, dengan hubungan yang signifikan antara lama penggunaan KOK dan kejadian melasma (p = 0,024). Wanita yang menggunakan kontrasepsi oral kombinasi (KOK) selama ≥3 tahun menunjukkan kecenderungan kemungkinan lebih tinggi terkena melasma dibandingkan dengan wanita yang menggunakan KOK selama <3 tahun (OR = 8,0; p = 0,024).
Kesimpulan: Temuan ini menegaskan pentingnya integrasi aspek dermatologis dalam konseling kontrasepsi, khususnya di fasilitas kesehatan tingkat I.

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Kata kunci: melasma, hormonal, Kontrasepsi Oral Kombinasi (KOK), usia produktif

INTRODUCTION

Family planning (FP) programs are recognized globally as essential interventions that significantly reduce maternal mortality and enhance the health and economic status of women. By enabling women to control the timing and spacing of pregnancies, FP programs contribute to safer motherhood, healthier families, and stronger communities.[1] Hormonal contraceptives, including combined oral contraceptives (COCs), are indeed among the most widely used contraceptive methods globally. Their popularity is driven by their effectiveness, accessibility, and versatility in meeting diverse reproductive health needs.[2] According to the World Health Organization (WHO) and recent market analyses, oral contraceptives remain one of the most widely used forms of modern contraception worldwide, with over 150 million women estimated to be users globally. Southeast Asia, in particular, is experiencing a notable and steady increase in the uptake of hormonal contraceptives, including oral contraceptive pills.[3]

In Indonesia, combined oral contraceptives (COCs) are the second most preferred contraceptive method after injectable contraception, particularly among women of reproductive age. Injectable contraception remains the leading choice, but COCs continue to be widely used and are a significant component of the country's modern contraceptive method mix.[4] Regional data from East Java indicate that 23.5% of contraceptive users opt for oral pills, while injectable methods dominate at 60.1%.[5] Combined oral contraceptives (COCs) are widely used for their effectiveness and convenience, but discontinuation rates remain high, largely due to side effects. According to the U.S. National Survey of Family Growth (NSFG), approximately 33% of oral contraceptive users discontinued use within 12 months for method-related reasons, which include side effects and switching to other methods. This figure is consistent with other studies, which have found that side effects such as weight change, headaches, mood changes, and changes in sexual satisfaction are commonly reported and are associated with higher rates of discontinuation.[6]

One of the notable dermatological side effects of prolonged COC use is melasma—a chronic, relapsing hyperpigmentation disorder commonly affecting sun-exposed areas of the face.[7] Melasma has been linked to elevated levels of estrogen and progesterone, making COC users particularly vulnerable. Several studies suggest a significant correlation between long-term hormonal contraceptive use and melasma incidence, though risk varies by population, region, and contraceptive type. Studies report that 17–25% of COC users develop melasma, with some populations showing up to 46% incidence among hormonal contraceptive users. The risk is up to eight times higher for COC users compared to non-users,[8] estrogen and progesterone directly influence melanin production by binding to receptors in the skin,[9] however melasma rarely occurs in those using hormonal contraceptives for under six months.[10]

In rural and underserved communities, limited access to contraceptive counseling and dermatological care can exacerbate these adverse effects.[11] Despite the high use of COCs in Indonesia, few studies have examined their dermatological impact in rural populations such as those in Lamongan Regency. Kemlagi Gede Village was selected as the study site because it represents a typical rural area with high contraceptive use, limited dermatological services, and a strong reliance on community-level primary healthcare, making it an appropriate setting to assess real-world risks associated with prolonged COC use. Understanding this association is crucial not only for public health planning but also for improving the quality of life of women in these communities.

Recent global developments emphasize the importance of safe and patient-centered contraceptive services, including more comprehensive pre-contraceptive screening and

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counseling. However, most international guidelines and screening protocols primarily focus on life-threatening or systemic risks such as thromboembolic events, cardiovascular complications, or metabolic effects, while dermatological outcomes such as melasma are rarely addressed. In many settings, particularly in low- and middle-income countries, counseling regarding potential skin changes is not routinely included, despite its psychological and cosmetic implications for women. Furthermore, evidence on the association between long-term COC use and melasma remains limited, especially from community-based studies in developing countries. Therefore, this study aimed to investigate the association between long-term use of combined oral contraceptive pills and the occurrence of melasma among reproductive-age women in Kemlagi Gede Village, Lamongan Regency, Indonesia.

METHODS

Study design

This study employed an analytical observational design using a retrospective cohort approach to investigate the association between prolonged use of combined oral contraceptive pills (COCs) and the incidence of melasma among reproductive-aged women in Kemlagi Gede Village, Lamongan Regency, Indonesia. The research was conducted from February to April 2025.

Data source and sampling procedures

The population consisted of women of reproductive age (18–45 years) who had used COCs and were registered at the local public health center (Puskesmas) in Turi Subdistrict. Participants were selected using a purposive sampling technique, being between 18 and 45 years old, having used COCs continuously for at least 12 months, having no history of other dermatological conditions that may affect skin pigmentation, such as lupus erythematosus, and providing informed consent to participate in the study. The population of this study consisted of reproductive-age women who were registered as users of combined oral contraceptive pills at primary healthcare facilities in Lamongan Regency. Based on the known population size and calculation using the Slovin formula with an acceptable margin of error, and considering field feasibility, a total of 20 eligible respondents were included in this study.

Variable of study

The independent variable in this study was the duration of combined oral contraceptive (COC) use. Although initially recorded as a continuous variable, it was categorized into two groups: <3 years and ≥3 years. The 3-year cut-off was selected to distinguish short-to-moderate use from long-term hormonal exposure, which has been reported to increase the likelihood of hormonal adverse effects, including melasma. The dependent variable was the presence of melasma, which was clinically assessed using the Melasma Area and Severity Index (MASI) and subsequently confirmed by a licensed dermatologist.

Measurement and instrument

Data were collected using a structured questionnaire, direct clinical observation, and skin examination, as well as medical record review to verify the duration and consistency of COC use. The presence and severity of melasma were assessed using the Melasma Area and Severity Index (MASI).

Data collection

Eligible women were recruited from the target village community. Interviews and clinical skin assessments were conducted by trained personnel. All collected data were systematically recorded and anonymized to maintain participant confidentiality.

Ethical Considerations

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Informed consent was obtained from all participants prior to data collection. Confidentiality of personal data was strictly maintained, and participation was entirely voluntary, with the option to withdraw at any time. This study received ethical approval from the Health Research Ethics Institute, Institute of Health Science Nahdlatul Ulama Tuban, under approval number No. 12/0084223523/LEPK.IIKNU/I/2025. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Data analysis

Data were analyzed using descriptive statistics. The duration of COC use, originally recorded as a continuous variable (in years), was categorized into two groups (<3 years and ≥3 years) based on clinical and literature considerations related to hormonal exposure duration. Since both the independent variable (duration category) and dependent variable (melasma: present/absent) were categorical, the association between them was tested using the Chi-square test. A p-value of <0.05 was considered statistically significant. Data analysis was performed using SPSS for Windows version 16.0.

In addition to the Chi-square test, the strength of association between duration of COC use and melasma was estimated using the odds ratio (OR) with a 95% confidence interval. Odds ratio (OR) and 95% confidence intervals were calculated to estimate the strength and precision of the association.

RESULTS

Respondent Characteristics

The descriptive characteristics related to the duration, adherence, and reported complaints among respondents who used combined oral contraceptives (COCs). These variables provide an overview of contraceptive use patterns and user experiences within the study population.

Table 1. Duration, Adherence, and Complaints During Combined Oral Contraceptive Use

Variable	Category	n	%
Duration of COC Use	< 3 years	5	25
	≥ 3 years	15	75
Adherence to COC Use	Regular	10	50
	Irregular	10	50
Reported Complaints	Yes	16	80
	No	4	20

The majority of respondents had used COCs for ≥3 years (75%). Regarding adherence, 50% of the participants consistently took COCs as prescribed, while the other 50% reported irregular use. Moreover, 16 respondents (80% of the total) experienced one or more complaints related to COC use, which may influence both efficacy and the likelihood of side effects. These findings suggest a need for improved counseling and follow-up regarding consistent contraceptive use and potential adverse outcomes.

Prevalence of Melasma

The prevalence of melasma among participants was assessed to determine its potential association with long-term COC use. Table 2 outlines the distribution of melasma occurrence within the study population.

Table 2. Prevalence of Melasma Among COC Users

Melasma Occurrence	n	%
Present	11	55
Absent	9	45

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Melasma was present in 55% of the study population, suggesting a notable prevalence among long-term COC users. Although nearly half of the participants did not exhibit clinical signs of melasma, the relatively high proportion of affected individuals raises concern regarding the potential dermatological impact of hormonal contraceptives. This finding supports the need for further investigation into hormone-related skin changes among women using COCs, particularly in primary care and community settings.

Association Between Duration of COC Use and Melasma

To assess the association between the duration of COC use and melasma, a Chi-square test was conducted. The results are presented in Table 3. Women who used combined oral contraceptives for ≥3 years showed a trend toward higher odds of developing melasma compared with those who used COCs for <3 years (OR = 8.0; 95% CI: 0.7–92.3; p = 0.024).

Table 3. Association Between COC Use Duration and Melasma Incidence

Duration of Use	Melasma (n)	No Melasma (n)	Total	OR (95% CI)	*p-value*
< 3 years	1	4	5	Reference	0.024
≥ 3 years	10	5	15	8.0	
Total	11	9	20	(0.7 – 92,3)	

OR = odds ratio; reference group: <3 years of COC use; p-value obtained from Chi-square test.

DISCUSSION

While the small sample size and lack of multivariate control are acknowledged, the observed statistical significance (p = 0.024) and estimated odds ratio (OR = 8.0) support the hypothesis that prolonged hormonal exposure via COCs may be associated with increased melasma risk. Given the lack of similar data from rural Indonesia, this pilot study provides important preliminary insights and highlights the need for more robust, prospective cohort studies in this area.

This study found that 55% of women using combined oral contraceptives (COCs) experienced melasma, with a statistically significant association between long-term COC use (≥3 years) and melasma incidence (p = 0.014). This supports findings from international and regional research highlighting hormonal contraceptives as a major risk factor for melasma.

Although the estimated odds ratio suggests a possible increased likelihood of melasma among long-term COC users, the wide confidence interval (0.7–92.3) indicates substantial uncertainty in the estimate. This imprecision may be attributed to the relatively small sample size used in this preliminary study. Therefore, the findings should be interpreted with caution, and further studies with larger sample sizes are needed to obtain more precise estimates.

Prolonged Use of COCs and Melasma Risk

Our analysis showed that respondents with ≥3 years of COC use had a markedly higher prevalence of melasma (10 out of 15, or 66.7%) compared to those using it for less than 3 years (1 out of 5, or 20%). The melasma prevalence increases significantly with extended hormonal exposure, especially beyond 36 months of use. The prevalence observed in this study was higher than that reported in several previous studies, which may be related to differences in population characteristics, including tropical climate and higher sun exposure, darker skin phototypes, prolonged hormonal exposure, and limited sunscreen use among women in this community setting[12]. The cumulative effect of estrogen and progesterone on melanogenesis over time likely underpins this relationship, supporting the observation that prolonged COC use may be a potential risk factor for melasma development.[13] Hormonal contraceptives, especially those containing

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estrogen, promote melanogenesis by stimulating estrogen receptors on melanocytes. This leads to increased melanin synthesis and pigment deposition, particularly in sun-exposed areas like the face. The mechanism involves estrogen and progesterone binding to their respective receptors, which are expressed in various tissues, including the skin.[14] This trend aligns with previous findings indicating that longer durations of hormonal contraceptive use are associated with a higher risk of pigmentary disorders. Moreover, the interaction between cumulative hormone exposure and environmental factors such as ultraviolet radiation may further exacerbate melanocyte activity, contributing to the persistence and severity of melasma.[15]

Mechanism: Estrogen and Progesterone in Hyperpigmentation

Estrogen is known to influence the melanogenic pathway by upregulating tyrosinase and activating melanocyte-stimulating hormone (MSH) receptors.[16] Progesterone, though less studied, may also contribute indirectly by modulating dermal vasculature and skin thickness.[17] Sex hormones can influence dermal vasculature; the increase in skin thickness and potential changes in dermal structure could indirectly affect the skin's response to environmental factors and pigmentation processes.[18] The synergistic effect of both hormones may lead to persistent hyperpigmentation, particularly in genetically susceptible individuals or those with darker skin types (Fitzpatrick types III–V), which are common among Indonesian women.[19] Studies show that estrogen directly enhances melanogenesis by increasing the expression of melanogenic enzymes and growth factors, while progesterone may also stimulate melanocyte activity, although its effects are more complex and sometimes contradictory in vitro.[20]

Local and Global Context

In Indonesia, oral contraceptives remain a widely preferred method of family planning, particularly in rural areas where access to alternative contraceptive methods or dermatologic care is limited. A study analyzing data from the Indonesia Demographic and Health Survey found that the prevalence of modern contraceptive use among poor women in rural areas was 58.7%, with oral contraceptives being a common choice due to their accessibility and ease of use. Factors such as limited healthcare infrastructure, lower socioeconomic status, and fewer available family planning options contribute to the continued reliance on oral contraceptives in these communities.[21] Despite this, Melasma is often underreported or normalized in Indonesia, with many patients continuing to use oral contraceptives or other hormonal treatments despite experiencing pigmentation disorders. This underreporting is partly due to a lack of counseling on dermatological side effects, limited access to dermatologic care, and the perception that melasma is a benign or inevitable condition, especially among women in reproductive age groups.[22] The psychological and aesthetic impacts of melasma are significant, affecting self-esteem and quality of life, yet these consequences are frequently overlooked in routine healthcare interactions.[23] Studies highlight that the severity of melasma can negatively influence self-esteem, but without adequate education and counseling, patients may not recognize the link between their contraceptive use and skin changes, leading to continued use despite the distress caused by persistent pigmentation.[24]

Internationally, recent reviews stress the importance of pre-contraceptive screening and follow-up for women at risk of pigmentary changes.[25] The rationale is that early identification of women with personal or family histories of pigmentary disorders, or those with risk factors like darker skin types, allows for informed counseling about the potential dermatological side effects of hormonal contraceptives. This proactive approach helps women make informed choices and facilitates early intervention if pigmentary changes occur.[26] However, such practices are rarely implemented in primary health centers in

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low-resource settings. Our study highlights this gap in public health implementation at the community level.

The implications of this research extend to public health and clinical practice, particularly in rural settings. The findings highlight the need for improved contraceptive counseling that includes information on potential dermatological effects, as well as enhanced access to dermatological care for women using long-term hormonal contraception. Additionally, the study underscores the importance of integrating skin health screening into primary healthcare services, especially in communities with high contraceptive use but limited specialist availability.

Due to resource limitations and the exploratory nature of this research, the study was designed as a preliminary community-based investigation. Findings from this study may provide the groundwork for future large-scale epidemiological research in similar populations.

This study has several limitations. First, the sample size was small (n=20), limiting the generalizability of the findings. Second, potential confounding factors such as skin phototype, cumulative sun exposure, sunscreen use, and family history of melasma were not controlled or quantified. Third, the analysis was limited to a bivariate approach using a Chi-square test without multivariate adjustment. Despite these limitations, the statistically significant association observed suggests a need for further studies with larger and more diverse populations.

CONCLUSION

This retrospective cohort study demonstrated a significant association between prolonged use of combined oral contraceptive pills (COCs), particularly use for ≥3 years, and the occurrence of melasma among women in Kemlagi Gede Village. Women who used COCs for ≥3 years showed a tendency toward higher odds of developing melasma compared with those who used COCs for a shorter duration. However, the wide confidence interval indicates uncertainty in the estimate, likely related to the limited sample size. These findings should therefore be interpreted cautiously. These findings support existing evidence regarding the role of hormonal exposure in melasma and highlight the importance of incorporating information on potential dermatological effects into contraceptive counseling, especially in rural or resource-limited settings.

Healthcare providers, particularly those in primary and community-based services, should enhance contraceptive counseling by incorporating education on the dermatological implications of long-term COC use. Counseling should address not only the contraceptive efficacy and benefits, but also potential side effects such as melasma, alongside practical strategies for monitoring and managing skin changes. Integrating routine skin assessments and follow-up protocols may improve patient satisfaction and long-term adherence to family planning programs. Further multicenter studies with larger sample sizes and more robust dermatological evaluation are recommended to strengthen the external validity of these findings.

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