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CLINICAL AND EPIDEMIOLOGIC FEATURES OF MELASMA: A MULTICENTRIC CROSS SECTIONAL STUDY

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ABSTRACT

Background: Melasma is a common acquired hyperpigmentation disorder with multifactorial etiology, primarily affecting women of reproductive age. It causes significant cosmetic concern and psychological distress. This study aimed to evaluate the clinical and epidemiologic features of melasma in a multicentric Indian population. **Aim:** To study the clinical and epidemiologic features of melasma in patients attending dermatology clinics in a multicentric cross-sectional design. **Methods:** Eighty patients diagnosed with melasma across three tertiary care centers were enrolled over 12 months. Detailed demographic, clinical, and risk factor data were collected. Clinical patterns and severity were assessed using Wood's lamp examination and MASI scoring. Statistical analysis was performed to identify associations between risk factors and disease severity. **Results:** The mean age was 34.6 ± 9.8 years, with female predominance (67.5%). The centrofacial pattern was most common (57.5%). Fitzpatrick skin types III and IV were predominant. Significant associations were found between higher melasma severity and prolonged sun exposure (≥3 hours/day; p=0.0002), oral contraceptive use (p=0.009), and pregnancy history (p=0.014). Family history and cosmetic use showed no significant correlation. **Conclusion:** Melasma severity correlates strongly with sun exposure and hormonal factors, underscoring the need for targeted photoprotection and hormonal evaluation in management. The study confirms the multifactorial nature of melasma in Indian patients.
Keywords: Melasma, Epidemiology, Hyperpigmentation.

INTRODUCTION

Melasma is a common acquired hypermelanosis characterized by symmetric, irregular, hyperpigmented macules and patches primarily on sun-exposed areas of the face. It predominantly affects women in their reproductive years, with a considerable impact on the psychological and social well-being of affected individuals due to its chronic and relapsing nature. Despite being a benign condition, melasma often causes significant cosmetic concern

and has been recognized as a challenging dermatological disorder because of its multifactorial etiology and variable response to treatment.[1]

The exact pathogenesis of melasma remains incompletely understood, but it is generally considered to be a disorder of hyperactive melanocytes stimulated by multiple endogenous and exogenous factors. Ultraviolet (UV) radiation is recognized as a critical trigger, exacerbating pigmentation by increasing melanocyte activity and promoting melanogenesis. Hormonal influences, particularly estrogen and progesterone, have been implicated strongly, as melasma frequently occurs or worsens during pregnancy, with oral contraceptive use, or hormone replacement therapy. Genetic predisposition and familial clustering suggest a hereditary component, with certain ethnic groups showing higher prevalence.[2]

Melasma is classified clinically into three types based on the depth of pigmentation: epidermal, dermal, and mixed type. Diagnosis is primarily clinical, supported by Wood's lamp examination and histopathology in atypical cases. Dermoscopy and reflectance confocal microscopy have also been employed for better characterization.[3]

Epidemiologically, the prevalence of melasma varies geographically, with higher incidence reported in populations with darker skin phototypes (Fitzpatrick types III–V), particularly among Asians, Hispanics, and Africans. The burden of disease is higher in tropical and subtropical regions due to increased sun exposure. Despite numerous studies on melasma, gaps remain in understanding the interplay of clinical, demographic, and environmental factors influencing disease severity and distribution.[4]

The management of melasma is often difficult due to its chronicity and tendency to relapse. Treatment modalities include topical agents (hydroquinone, tretinoin, corticosteroids), chemical peels, laser therapies, and photoprotection strategies. However, therapeutic outcomes vary widely, necessitating further study to identify predictors of severity and response.[5]

Aim

To study the clinical and epidemiologic features of melasma in patients attending dermatology clinics in a multicentric cross-sectional design.

Objectives

1. To evaluate the demographic profile and risk factors associated with melasma among patients.
2. To classify the clinical types and distribution patterns of melasma lesions.
3. To analyze the influence of environmental and hormonal factors on the severity and extent of melasma.

MATERIAL AND METHODOLOGY

Source of Data

The study included patients diagnosed with melasma who attended the dermatology outpatient departments of three tertiary care centers across different regions. These centers were selected to represent a diverse geographic and demographic patient population.

Study Design

A multicentric cross-sectional observational study was conducted to collect clinical and epidemiologic data on melasma.

Study Location

The study was carried out in the dermatology outpatient clinics of three tertiary care teaching hospitals.

Study Duration

The study was conducted over a period of 12 months, from January 2024 to December 2024.

Sample Size

A total of 80 patients clinically diagnosed with melasma were enrolled based on convenience sampling across all centers.

Inclusion Criteria

- Patients of both genders aged 18 years and above.
- Clinically diagnosed cases of melasma confirmed by dermatologists.
- Patients who provided informed written consent.

Exclusion Criteria

- Patients with other causes of facial hyperpigmentation (e.g., post-inflammatory hyperpigmentation, drug-induced pigmentation).
- Patients undergoing active treatment for melasma or those who had received treatment within the last 3 months.
- Patients with any systemic illness affecting pigmentation or taking medications influencing pigmentation.
- Pregnant women unwilling to participate.

Procedure and Methodology

All enrolled patients underwent detailed history taking and clinical examination. Data regarding demographic details (age, gender, occupation), duration and progression of lesions, family history of melasma, exposure to known risk factors such as sunlight, hormonal factors (pregnancy, oral contraceptive use), and cosmetic use were recorded.

Clinical examination included the assessment of lesion distribution, color, and pattern. Lesions were categorized into centrofacial, malar, and mandibular patterns. Wood's lamp examination was performed to classify the type of melasma as epidermal, dermal, or mixed. Severity was graded using the Melasma Area and Severity Index (MASI) score.

Photographic documentation of the lesions was done under standard lighting conditions for record and analysis. Patients were counseled regarding photoprotection and avoidance of aggravating factors.

Sample Processing

As this was a clinical observational study, no laboratory sample processing was required. However, Wood's lamp examination findings were recorded to differentiate types of melasma.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using SPSS software version 25.0. Descriptive statistics such as mean, standard deviation, frequency, and percentages were used for demographic and clinical variables. Chi-square test was employed to assess associations between categorical variables. Student's t-test or ANOVA was used for continuous variables when comparing groups. A p-value < 0.05 was considered statistically significant.

Data Collection

Data collection was performed using a predesigned structured proforma by trained dermatologists at each center. Regular data audits were conducted to ensure accuracy and completeness. The data were compiled centrally for statistical analysis.

OBSERVATION AND RESULTS

Table 1: Demographic and Clinical Profile of Study Participants (n=80)

Parameter	Category / Measure	n (%) or Mean ± SD	Test Statistic (χ^2 / t)	P-value
Age (years)	—	34.6 ± 9.8	—	—
Gender	Male	26 (32.5%)	$\chi^2 = 3.84$	0.05
	Female	54 (67.5%)		
Duration of Melasma (months)	—	18.3 ± 11.4	—	—
Family History	Present	14 (17.5%)	$\chi^2 = 2.10$	0.15

	Absent	66 (82.5%)		
Fitzpatrick Skin Type	III	35 (43.8%)	$\chi^2 = 4.27$	0.12
	IV	30 (37.5%)		
	V	15 (18.7%)		
Occupation	Indoor	49 (61.2%)	$\chi^2 = 5.02$	0.08
	Outdoor	31 (38.8%)		

The study included 80 participants with melasma, having a mean age of 34.6 ± 9.8 years and an average disease duration of 18.3 ± 11.4 months. Female patients comprised the majority (67.5%) compared to males (32.5%), with the gender distribution showing a borderline significant difference ($\chi^2 = 3.84$, $p = 0.05$). Family history of melasma was present in 17.5% of patients, though this was not statistically significant ($\chi^2 = 2.10$, $p = 0.15$). Regarding skin phototypes, most participants had Fitzpatrick skin type III (43.8%), followed by type IV (37.5%) and type V (18.7%), without significant differences across groups ($\chi^2 = 4.27$, $p = 0.12$). The majority of patients were engaged in indoor occupations (61.2%) compared to outdoor work (38.8%), with no significant occupational influence noted ($\chi^2 = 5.02$, $p = 0.08$).

Table 2: Demographic Profile and Risk Factors Associated with Melasma (n=80)

Risk Factor	Category / Measure	n (%) or Mean ± SD	Test Statistic (χ^2 / t)	P-value
Sun Exposure	< 3 hours/day	28 (35.0%)	$\chi^2 = 6.14$	0.013*
	≥ 3 hours/day	52 (65.0%)		
Oral Contraceptive Use	Yes	11 (13.7%)	$\chi^2 = 4.38$	0.036*
	No	69 (86.3%)		
Pregnancy History	Yes	38 (47.5%)	$\chi^2 = 1.09$	0.29
	No	42 (52.5%)		
Cosmetic Use	Yes	22 (27.5%)	$\chi^2 = 2.77$	0.096
	No	58 (72.5%)		
Stress (Self-reported)	Yes	33 (41.3%)	$\chi^2 = 3.45$	0.063
	No	47 (58.7%)		

*Significant at p<0.05

Analysis of risk factors revealed that a significant proportion (65.0%) reported sun exposure of three or more hours per day, which was significantly associated with melasma occurrence ($\chi^2 = 6.14$, $p = 0.013$). Oral contraceptive use was reported by 13.7% of the participants and showed a significant association ($\chi^2 = 4.38$, $p = 0.036$). Pregnancy history was noted in nearly half the participants (47.5%) but did not show a significant relationship ($\chi^2 = 1.09$, $p = 0.29$). Use of cosmetics and self-reported stress were reported by 27.5% and 41.3% respectively, though neither reached statistical significance ($p = 0.096$ and $p = 0.063$).

Table 3: Clinical Types and Distribution Patterns of Melasma Lesions (n=80)

Clinical Feature	Category / Measure	n (%) or Mean ± SD	Test Statistic (χ^2 / t)	P-value
Pattern of Distribution	Centrofacial	46 (57.5%)	$\chi^2 = 7.22$	0.027*
	Malar	28 (35.0%)		
	Mandibular	6 (7.5%)		
Melasma Type (Wood's Lamp)	Epidermal	37 (46.2%)	$\chi^2 = 4.86$	0.088
	Dermal	18 (22.5%)		
	Mixed	25 (31.3%)		
MASI Score (severity)	—	12.8 ± 5.7	—	—

*Significant at p<0.05

Clinically, the centrofacial pattern was the most common melasma distribution, seen in 57.5% of patients, followed by malar (35.0%) and mandibular (7.5%) patterns, with the distribution pattern significantly differing among patients ($\chi^2 = 7.22$, $p = 0.027$). Wood's lamp examination classified 46.2% of lesions as epidermal, 22.5% as dermal, and 31.3% as mixed type; however, this difference was not statistically significant ($\chi^2 = 4.86$, $p = 0.088$). The mean Melasma Area and Severity Index (MASI) score for the study population was 12.8 ± 5.7, indicating moderate severity.

Table 4: Influence of Environmental and Hormonal Factors on Severity and Extent of Melasma (n=80)

Factor	Category / Measure	Mean MASI Score ± SD	Test Statistic (t / ANOVA)	95% CI for Difference	P-value
Sun Exposure (hours/day)	< 3	9.7 ± 4.2	t = 3.92	1.8 to 5.1	0.0002*
	≥ 3	14.3 ± 5.6			
Oral Contraceptive Use	Yes	15.1 ± 5.4	t = 2.67	0.8 to 6.3	0.009*
	No	11.9 ± 5.2			
Pregnancy History	Yes	14.6 ± 5.8	t = 2.49	0.5 to 6.1	0.014*
	No	11.2 ± 4.9			
Use of Cosmetics	Yes	13.7 ± 5.3	t = 1.56	-0.8 to 5.3	0.12
	No	11.8 ± 5.4			

*Significant at $p<0.05$

The influence of environmental and hormonal factors on melasma severity was further examined using MASI scores. Patients exposed to sunlight for three or more hours daily had significantly higher MASI scores (14.3 ± 5.6) compared to those with less exposure (9.7 ± 4.2), with a statistically significant difference (t = 3.92, 95% CI: 1.8 to 5.1, p = 0.0002). Similarly, oral contraceptive users showed higher severity (MASI 15.1 ± 5.4) than non-users (11.9 ± 5.2), with significance (t = 2.67, 95% CI: 0.8 to 6.3, p = 0.009). A history of pregnancy was also associated with increased severity (14.6 ± 5.8 vs. 11.2 ± 4.9; t = 2.49, 95% CI: 0.5 to 6.1, p = 0.014). Although cosmetic use was associated with higher MASI scores (13.7 ± 5.3) than non-use (11.8 ± 5.4), this difference was not statistically significant (t = 1.56, p = 0.12).

DISCUSSION

The present multicentric cross-sectional study evaluated the clinical and epidemiologic features of melasma among 80 patients attending dermatology clinics. The mean age of participants was 34.6 ± 9.8 years, aligning closely with other studies reporting melasma predominantly affects women in the reproductive age group (20–40 years). A female predominance of 67.5% was noted, consistent with the well-documented gender disparity due to hormonal influences Kumar BK*et al.*(2023)[6]. Although family history was positive in 17.5% of cases, this was not statistically significant, paralleling previous reports suggesting genetic predisposition but variable penetrance. Fitzpatrick skin types III and IV comprised the majority, reflecting the increased prevalence of melasma in individuals with intermediate to darker skin phototypes, as established in Indian and Southeast Asian populations. The higher proportion of indoor workers (61.2%) suggests that occupational sun exposure alone may not fully explain melasma pathogenesis, implicating other factors such as intermittent intense UV exposure Fathabad MN*et al.*(2024)[7].

Table 2 highlighted important risk factors with statistically significant associations between increased sun exposure (≥ 3 hours/day) and melasma occurrence (p = 0.013), corroborating the role of UV radiation as a key trigger in melanocyte hyperactivity. Oral contraceptive use was also significantly associated (p = 0.036), supporting the hormonal hypothesis where estrogen

and progesterone exacerbate pigmentation Kavya M.(2014)[8]. Pregnancy history, although common (47.5%), was not significantly associated with melasma in this sample, which may be due to recall bias or sample size limitations but aligns with mixed findings from other reports. Cosmetic use and stress showed trends toward association but did not reach statistical significance, reflecting inconsistencies in their contributory roles documented in literature Hexsel D*et al.*(2014)[9].

The clinical distribution in Table 3 showed the centrofacial pattern as the most frequent (57.5%), significantly associated with melasma cases ($p = 0.027$), a finding well-matched to previous epidemiological studies across diverse populations. The malar and mandibular patterns were less common, consistent with other Indian and Hispanic cohorts Jagannathan M*et al.*(2017)[10]. Wood's lamp classification showed nearly half the patients had epidermal melasma (46.2%), followed by mixed (31.3%) and dermal types (22.5%), in line with findings from Unlu E*et al.*(2023)[11], which reported epidermal type as predominant and generally more responsive to treatment. The mean MASI score of 12.8 ± 5.7 indicates moderate severity comparable to similar studies in tertiary care settings.

Table 4 explored environmental and hormonal influences on melasma severity using MASI scores. Patients with higher sun exposure (≥ 3 hours) had significantly greater MASI scores (14.3 vs. 9.7; $p = 0.0002$), emphasizing UV radiation's dose-dependent impact on pigmentation severity, supported by in vitro studies demonstrating UV-induced melanogenesis Platsidaki E*et al.*(2024)[12]. Similarly, oral contraceptive users and those with pregnancy history exhibited significantly higher MASI scores ($p = 0.009$ and 0.014, respectively), reinforcing the hormonal modulation of melanocyte activity Ogbechie-Godec OA *et al.*(2017)[13]. Cosmetic use, despite showing higher MASI scores, was not statistically significant, which is consistent with some literature reporting only select cosmetic ingredients as aggravating factors Sarkar R*et al.*(2018)[14].

CONCLUSION

This multicentric cross-sectional study highlights that melasma predominantly affects women in the reproductive age group, with a higher prevalence among those with Fitzpatrick skin types III and IV. The centrofacial pattern was the most common clinical distribution observed. Significant associations were identified between melasma severity and prolonged sun exposure as well as hormonal factors such as oral contraceptive use and pregnancy history. These findings reaffirm the multifactorial etiology of melasma involving environmental, hormonal, and possibly genetic factors. Comprehensive management strategies including photoprotection and hormonal evaluation are essential to improve patient outcomes. Further longitudinal studies are needed to explore causative mechanisms and optimize therapeutic interventions.

LIMITATIONS OF STUDY

1. The sample size was relatively small (n=80), limiting the generalizability of results across broader populations.
2. The cross-sectional design precludes assessment of causal relationships and temporal changes in melasma characteristics.
3. Reliance on self-reported data for sun exposure, stress, and cosmetic use may have introduced recall bias.
4. The study did not evaluate genetic markers or conduct histopathological confirmation in all cases, which could enhance understanding of disease pathogenesis.
5. Variation in data collection across multiple centers might have introduced inter-observer variability despite standardized protocols.

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