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Original Research Article

A Clinicoepidemiological Study of Melasma in a Tertiary Care Hospital in Assam

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Abstract

Background: Melasma is a common acquired disorder of hypermelanosis affecting sun-exposed areas, particularly the face. It predominantly affects individuals with Fitzpatrick skin types III–V and significantly impairs quality of life. There is a paucity of data on the clinico-epidemiological profile of melasma from the northeastern region of India.

Objectives: To evaluate clinical patterns of melasma and to estimate the prevalence among males and females and assess associated risk factors in a tertiary care hospital in Assam.

Methods: A hospital-based cross-sectional observational study was conducted over six months among 120 patients clinically diagnosed with melasma attending the dermatology outpatient department of Silchar Medical College and Hospital. Detailed history, clinical examination, Wood's lamp evaluation, and Melasma Area and Severity Index (MASI) scoring were performed.

Results: The mean age of the study population was 34.8 ± 8.6 years. There was a marked female predominance (female-to-male ratio 5:1). The centrofacial pattern was the most common clinical presentation (61.7%), followed by the malar (31.7%) and mandibular (6.6%) patterns. The epidermal type predominated on Wood's lamp examination (58.3%). Significant associations were observed with chronic sun exposure (78.3%), pregnancy (30%), family history (30%), use of oral contraceptive pills (18.3%), and topical steroid application (21.7%).

Conclusion: Melasma in Northeast India predominantly affects women of reproductive age with centrofacial distribution. Sun exposure remains the principal aggravating factor, and there is a notable prevalence of unsupervised topical steroid use in this population.

Keywords: Melasma; Epidemiology; Assam; Pigmentary disorder; MASI score; Clinico-epidemiological.

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Introduction

Melasma, derived from the Greek word melas meaning "black," is an acquired chronic hypermelanosis of sun-exposed skin characterized by symmetric grey-brown to dark-brown macules and patches on the face [1]. This condition has been recognized since antiquity and remains one of the most common pigmentary disorders encountered in dermatological practice across the world [2]. The condition predominantly affects individuals with darker phototypes, particularly Fitzpatrick skin types III to V, and demonstrates a marked predilection for women of reproductive age, although males are not immune to the condition [3]. The global prevalence of melasma varies significantly depending on ethnic composition, geographic location, intensity of ultraviolet radiation exposureand the phototype of the population under study. Melasma accounts for approximately 0.25% to 4% of patients presenting to dermatology clinics in Southeast Asia and is recognized as the most frequently encountered pigmentary disorder among Indians [4,5]. A

multicentric cross-sectional study from India evaluating 1,001 patients reported a mean age of 38.02 years with females constituting 85% of the study population [6]. Another multicentric Indian study involving 331 patients noted a mean age of 37.2 ± 9.3 years with a female-to-male ratio of approximately 4:1 [7]. Studies conducted in Latin American, Middle Eastern, and African populations have similarly documented high prevalence rates, underscoring the global burden of this disease [2,8].

The pathogenesis of melasma is complex and multifactorial. Contemporary understanding of the disease has moved beyond the simplistic view of isolated epidermal melanocyte overactivity to encompass a more holistic model involving intricate interactions between ultraviolet and visible light exposure, hormonal influences, genetic predisposition, dermal vascular changes, inflammatory mediators, and melanogenesis-related signalling pathways [9]. Ultraviolet radiation is considered the single most important precipitating and aggravating factor, stimulating melanogenesis by activating melanocytes and upregulating key transcription factors such as microphthalmia-associated transcription factor (MITF) and endothelin-1 [10]. Recent investigations have additionally highlighted the role of visible light, particularly blue light, in triggering pigmentation through the opsin-3 pathway [9]. Hormonal factors, including pregnancy, oral contraceptive use, and hormonal replacement therapy, have been consistently implicated in the development and exacerbation of melasma, with epidemiological surveys reporting pregnancy as a triggering factor in approximately 20% to 40% of affected women [6,7,11].

A genetic component is also well-established. Studies have documented a positive family history in 20% to 70% of melasma patients, suggesting an underlying hereditary susceptibility that may influence melanocyte biology and response to environmental stimuli [2,7]. Additionally, recent mechanistic reviews have emphasized the contributions of dermal changes, including increased vascularity, mast cell infiltration, solar elastosis, and impaired epidermal barrier function, to the persistence and recurrence of the condition [9,10]. Clinically, melasma is classified according to the distribution of facial pigmentation into three patterns: centrofacial (involving the forehead, cheeks, upper lip, nose, and chin), malar (restricted primarily to the cheeks and nose), and mandibular (affecting the jawline area) [1]. Wood's lamp examination further classifies melasma based on the depth of melanin deposition into epidermal, dermal, and mixed types, although the reliability of this classification in darker skin types remains a subject of ongoing debate [3,4]. Disease severity is quantitatively assessed using validated scoring systems, the most widely employed being the Melasma Area and Severity Index (MASI), which considers the area involved, darkness of pigmentation, and homogeneity of lesions across four facial regions [12].

The psychosocial impact of melasma is substantial and often underestimated. Multiple studies have demonstrated that melasma significantly impairs quality of life, self-esteem, emotional well-being, and occupational and social functioning, with some investigators reporting the psychological burden to be comparable to that of other chronic dermatological conditions [13]. This makes comprehensive assessment, patient counselling, and long-term management essential components of clinical care.

The management of melasma remains challenging, primarily due to the chronic and relapsing nature of the disease. Current therapeutic strategies employ a multimodal approach combining rigorous broad-spectrum photoprotection, including protection against visible light using tinted sunscreens containing iron oxide; topical depigmenting agents such as hydroquinone, azelaic acid, kojic acid, arbutin, and retinoids; combination regimens such as the modified Kligman's formula; procedural modalities including chemical peels, microneedling, and selective laser therapy; and emerging systemic treatments including oral tranexamic acid [14]. Despite these advances, recurrence remains common, and an understanding of the local epidemiological profile and risk factors is crucial for tailoring preventive and therapeutic strategies. While extensive data exist from western, southern, and northern regions of India, there is a notable paucity of published literature on the clinico-epidemiological profile of melasma from the northeastern states, which constitute a geographically, climatically, and ethnically distinct population [6,7]. The subtropical climate of Assam, with its high humidity and significant sun exposure, combined with the predominantly Mongoloid and Indo-Aryan ethnic mix and Fitzpatrick skin types III to V, creates a unique dermatological milieu. Furthermore, the prevalent practice of unsupervised topical steroid use in this region may modify the clinical presentation and aggravation of melasma. The present study was therefore designed to fill this gap by investigating the clinical patterns, epidemiological features, and risk factors associated with melasma in patients attending a tertiary care hospital in Assam, thereby contributing regional data to the broader understanding of this condition in the Indian context.

Aims and Objectives

1. To evaluate the clinical patterns of melasma in patients attending a tertiary care hospital in Assam.
2. To estimate the prevalence of melasma and assess the associated risk factors.

Materials and Methods

Study Design and Setting: This was a hospital-based cross-sectional observational study conducted in the Department of Dermatology, Venereology, and Leprosy, Silchar Medical College and Hospital, Silchar, Assam, over a period of six months.

Study Population and Sample Size: A total of 120 consecutive patients clinically diagnosed with melasma who attended the dermatology outpatient department during the study period were enrolled.Sample size was calculated by using the following Danial sample size formula:

$$N= \{Z2 \text{ X } p(1-p)/d2\}$$

Where N=Sample size,
Z=Statistics for a level of confidence (For the level of confidence of 95%, which is convention, Z Value is 1.96)
p= expected prevalence or proportion
q = 100-p
d = absolute error

According to a study by Dr. Arun Achar et al5 prevalence is considered to be 4%.

Taking the prevalence as 4% with absolute error 3.5% in the formula, we get sample size (N) = 120

Inclusion Criteria: Patients aged 18 years and above of both sexeswith a clinical diagnosis of melasma presenting as symmetrical hyperpigmented macules and patches on the face, who provided written informed consent for participation, were included in the study.

Exclusion Criteria: Patients with other pigmentary disorders such as lichen planus pigmentosus, post-inflammatory hyperpigmentation, or drug-induced hyperpigmentation; patients with concomitant inflammatory dermatoses of the face; patients on active treatment for melasma within the preceding four weeks; and patients who did not provide informed consent were excluded from the study.

Data Collection and Clinical Assessment: After obtaining written informed consent, a detailed history was elicited from each participant using a pre-designed structured proforma.

The following information was recorded: demographic data including age, sex and occupation; age of onset and duration of melasma; pattern and distribution of facial pigmentation; history of sun exposure and nature of outdoor activity; history of oral contraceptive pill use; cosmetic use; history of topical corticosteroid application on the face; family history of melasma in first-degree relatives; history of thyroid disorders; and details of any previous treatment received.

Clinical Examination: A thorough clinical examination was performed under adequate natural and artificial lighting. Melasma was classified into three clinical patterns based on the distribution of hyperpigmented lesions: centrofacial (involving the forehead, cheeks, upper lip, nose, and chin), malar (involving the cheeks and nose), and mandibular (involving the jawline and ramus of the mandible).

Wood's Lamp Examination: All patients underwent Wood's lamp examination in a darkened room to classify the depth of melanin deposition. Lesions showing enhancement of pigmentation under Wood's lamp were classified as epidermal type; those showing no significant enhancement were classified as dermal type; and those demonstrating partial enhancement were classified as mixed type.

Severity Assessment: Disease severity was assessed using the Melasma Area and Severity Index (MASI). The MASI score was calculated by evaluating the area of involvement, darkness of pigmentation, and homogeneity of lesions across four facial regions (forehead, right malar, left malar, and chin), using a standardized scoring formula. MASI scores were graded as mild (<12), moderate (12–24), and severe (>24).

Ethical Considerations: The study protocol was approved by the Institutional Ethics Committee of Silchar Medical College and Hospital prior to commencement of the study. Written informed consent was obtained from all participants. Confidentiality of patient data was maintained throughout the study.

Statistical Analysis: All data were recorded on a pre-designed proforma and entered into Microsoft Excel spreadsheet. Statistical analysis was performed using descriptive statistics. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were expressed as frequencies and percentages. Data were tabulated and analysed using appropriate statistical methods.

Results

A total of 120 patients with clinically diagnosed melasma were enrolled in this study. The results are presented in detail below.

Age Distribution: The age of the patients ranged from 18 to 55 years, with a mean age of 34.8 ± 8.6 years. The majority of the patients (n = 48, 40.0%) belonged to the 31–40 years age group, followed by the 21–30 years age group with 34 patients

(28.3%). Patients in the 41–50 years group constituted 22 cases (18.3%), while 8 patients (6.7%) each were observed in the 11–20 years and above 50 years age groups respectively. These findings indicated that melasma predominantly affected individuals in the reproductive and middle-aged population, with the peak incidence observed between 31 and 40 years of age (Table 1).

Table 1: Age Distribution of Patients (n = 120)

Age Group (years)	Number of Patients (n)	Percentage (%)
11–20	8	6.7
21–30	34	28.3
31–40	48	40.0
41–50	22	18.3
>50	8	6.7
Total	120	100.0

Gender Distribution: Among the 120 patients, 100 were females (83.3%) and 20 were males (16.7%), demonstrating a marked female predominance with a female-to-male ratio of approximately 5:1. This observation was consistent with the well-established predilection of melasma for the female sex. The higher female preponderance was likely attributable to the influence of hormonal factors such as pregnancy, use of oral contraceptives, and other endocrine influences, as well as heightened cosmetic concern and health-seeking behaviour among women in the study population (Table 2).

Table 2: Gender Distribution (n = 120)

Gender	Number of Patients (n)	Percentage (%)
Female	100	83.3
Male	20	16.7
Total	120	100.0

Clinical Pattern of Melasma: Based on the distribution of facial pigmentation, melasma was classified into three clinical patterns. The centrofacial pattern was the most common, observed in 74 patients (61.7%), involving pigmentation over the forehead, cheeks, upper lip, nose, and chin. The malar pattern was the second most common, seen in 38 patients (31.7%), characterized by pigmentation predominantly over the cheeks and nose. The mandibular pattern was the least common, observed in only 8 patients (6.6%), with pigmentation confined along the mandibular area. Thus, the centrofacial type emerged as the predominant clinical pattern in this study population, followed by the malar and mandibular types in decreasing order of frequency (Table 3).

Table 3: Clinical Pattern of Melasma (n = 120)

Clinical Pattern	Number of Patients (n)	Percentage (%)
Centrofacial	74	61.7
Malar	38	31.7
Mandibular	8	6.6
Total	120	100.0

Wood's Lamp Classification: Wood's lamp examination was performed in all 120 patients to classify the depth of melanin deposition. The epidermal type was the most common, identified in 70 patients (58.3%), where pigmentation became more prominent under Wood's lamp illumination, suggesting predominant epidermal melanin deposition. The dermal type was identified in 30 patients (25.0%), where no significant enhancement of pigmentation was noted under Wood's lamp, suggesting deeper dermal melanin deposition. The mixed type was observed in 20 patients (16.7%), demonstrating features of both epidermal and dermal pigmentation with partial enhancement under Wood's lamp. These results indicated that epidermal melasma was the predominant type in the study population, which has therapeutic implications as epidermal type generally responds better to topical depigmenting agents (Table 4).

Table 4: Wood's Lamp Classification (n = 120)

Type	Number of Patients (n)	Percentage (%)
Epidermal	70	58.3
Dermal	30	25.0
Mixed	20	16.7
Total	120	100.0

Associated Risk Factors: Several predisposing and aggravating factors were identified in the study population. Multiple risk factors were recorded in some patients. The most common risk factor was chronic sun exposure, reported in 94 patients (78.3%), underscoring the pivotal role of ultraviolet radiation in the pathogenesis and exacerbation of melasma. A history of pregnancy was noted in 36 female patients (30.0%), suggesting a significant contribution of hormonal changes to the development of melasma. A family history of melasma was present in 36 patients (30.0%), indicating a possible genetic predisposition. Use of topical corticosteroids on the face was reported in 26 patients (21.7%), reflecting the widespread and often unsupervised use of topical medications in this population.

A history of oral contraceptive pill use was elicited in 22 patients (18.3%), further implicating hormonal factors in the aetiopathogenesis of melasma in this region (Table 5).

Table 5: Associated Risk Factors (n = 120)

Risk Factor	Number of Patients (n)	Percentage (%)
Sun exposure	94	78.3
Pregnancy	36	30.0
Family history	36	30.0
Topical steroid use	26	21.7
Oral contraceptive pills	22	18.3

*Multiple responses were recorded in some patients; percentages do not total 100%

Discussion

The present study evaluated 120 patients with melasma attending a tertiary care dermatology centre in Assam to characterize the clinico-epidemiological profile and identify the associated risk factors in this relatively understudied population of Northeast India. The findings of this study are discussed in the context of existing literature from India and other parts of the world.

Age Distribution: In the present study, the majority of patients belonged to the 31–40 years age group (40.0%), with a mean age of 34.8 ± 8.6 years. This finding is consistent with the observations of Achar and Rathi, who reported a mean age of 33.45 years among 312 melasma patients from Eastern India [4]. Krupa Shankar et al., in their multicentric study across nine Indian centres involving 331 patients, reported a mean age of 37.2 ± 9.3 years [7]. Kumar et al., in their study of 200 patients from North India, documented a mean age of 32.9 years [15]. The large multicentric study by Sarkar et al. involving 1,001 patients from 10 centres across India reported a mean age of 38.02 years [6]. Additionally, Handel et al., in their comprehensive review of melasma epidemiology from Brazil, noted the mean age of onset to be approximately 28 years [2]. These findings collectively establish that melasma predominantly affects individuals in the third and fourth decades of life, which corresponds to the reproductive and economically active years when hormonal influences, ultraviolet radiation exposure, and occupational factors converge to predispose to the development of this condition.

Gender Distribution: In our study, females constituted 83.3% of the study population, with a female-to-male ratio of 5:1. This marked female predominance is a consistent finding across the global melasma literature. Krupa Shankar et al. observed a female-to-male ratio of approximately 4:1 in their multicentric Indian study [7]. Sarkar et al. reported that 85% of their 1,001 patients were female [6]. Kumar et al. documented a female-to-male ratio of 6.14:1 in their North Indian cohort [15]. Achar and Rathi similarly noted a female-to-male ratio of approximately 4:1 [4]. However, the proportion of males with melasma is not insignificant, as Indian studies have reported male involvement ranging from 10% to 25% of cases [5,6].

Sarkar et al. in their dedicated study on melasma in Indian males have described the clinical, aetiological, and histological features of this condition in men, emphasizing that male melasma may be underreported due to lower health-seeking behaviour [5]. The predominance of females in the present study may be attributed to the well-known influence of hormonal factors including pregnancy, oral contraceptive use, and endocrine changes during the reproductive years, as well as the higher cosmetic awareness and healthcare utilization among women.

Clinical Pattern: The centrofacial pattern was the most common clinical presentation in our study, observed in 61.7% of patients, followed by the malar pattern in 31.7% and the mandibular pattern in 6.6%. These findings align closely with the observations of Krupa Shankar et al., who reported centrofacial involvement in 42% and malar involvement in 39% of patients [7]. Sarkar et al. similarly noted that the centrofacial and malar patterns together constituted the vast majority of cases in the Indian population [6]. Achar and Rathi reported the centrofacial pattern as the most common type (55.44%) in their study from Eastern India [4]. Yalamanchili et al. also documented centrofacial predominance in their epidemiological

assessment of melasma [13]. However, some studies have reported contrasting findings. The centrofacial pattern may be more prominently represented in populations from the eastern and northern regions of India, while some southern studies have reported a higher prevalence of the malar pattern [7]. These geographic variations in distribution patterns may reflect differences in genetic background, sun exposure patterns, occupational practices, and regional climatic conditions that influence ultraviolet radiation exposure to specific facial regions.

Wood's Lamp Classification: The epidermal type was the most common Wood's lamp finding in our study, identified in 58.3% of patients, followed by the dermal type (25.0%) and the mixed type (16.7%). This predominance of the epidermal type is consistent with findings from multiple Indian studies [4,7,13]. The epidermal subtype is characterized by enhancement of pigmentation under Wood's lamp due to increased melanin in the epidermis and is generally considered more amenable to topical depigmenting therapy [1]. However, it is important to note that the reliability of Wood's lamp classification has been questioned, particularly in individuals with darker skin phototypes (Fitzpatrick types V and VI), in whom the high baseline cutaneous pigmentation may obscure the distinction between epidermal and dermal types [3]. Histopathological correlation has been recommended for more accurate classification in such populations. Nevertheless, in the clinical setting, Wood's lamp examination remains a practical and widely utilized tool for preliminary assessment of the depth of pigmentation and for guiding initial therapeutic decisions.

Risk Factors: Sun exposure was identified as the most prevalent associated risk factor in the present study, reported in 78.3% of patients. This is in agreement with the observations of multiple investigators. Krupa Shankar et al. identified sun exposure as a major precipitating factor in their multicentric study, noting that only 10% of patients were using sunscreen with SPF greater than 50 [7]. Sarkar et al. reported sun exposure as a significant aggravating factor in their large multicentric Indian cohort, further noting that the duration of occupational heat exposure may be linked to disease severity [6]. Kumar et al. reported that 48.84% of female patients and 78.57% of male patients experienced exacerbation with sun exposure in their North Indian study [15]. The high proportion of patients with sun exposure-related melasma in the present study may be attributable to the subtropical climate of Assam, characterized by high temperatures, intense solar radiation, and significant outdoor occupational activities in the predominantly agrarian population.

Pregnancy was documented as a risk factor in 30.0% of the female patients in our study. This is comparable to the findings of Kumar et al., who reported onset of melasma during pregnancy in 36.4% of female patients [15]. The multicentric study by Krupa Shankar et al. also documented pregnancy as a significant precipitating factor [7]. Hormonal changes during pregnancy, particularly elevated levels of oestrogen, progesterone, and melanocyte-stimulating hormone, are known to stimulate melanocyte activity and increase melanin synthesis, thus predisposing to the development of melasma [11].

A positive family history was observed in 30.0% of patients in our study, which closely correlates with the findings of Krupa Shankar et al., who reported a family history in 31.1% of their patients [7]. Kumar et al. documented a positive family history in 29.07% of female patients [15]. Handel et al., in their epidemiological review, reported that over 40% of patients globally had a family history of melasma [2]. These findings consistently support a genetic predisposition to melasma, although the specific genetic loci and inheritance patterns remain to be fully elucidated. Topical corticosteroid use was identified in 21.7% of patients in the present study, reflecting the widespread and largely unsupervised use of topical steroid-containing creams in the northeastern region of India. The large multicentric study by Sarkar et al. similarly noted that the use of steroid-containing medications was common among Indian melasma patients [6]. Indiscriminate topical steroid application is a well-known exacerbating factor for melasma and can lead to steroid-dependent facial dermatitis, further complicating the clinical picture and management. Oral contraceptive pill use was reported in 18.3% of our patients, which aligns with the well-established hormonal aetiology of melasma. Krupa Shankar et al. documented oral contraceptive use as a precipitating factor in their multicentric cohort [7]. Exogenous oestrogen and progestogen administration is known to stimulate melanocyte proliferation and melanin production, thereby contributing to the onset or exacerbation of melasma in susceptible individuals [11].

Comparison with Studies from the Broader Literature: The findings of the present study are broadly consistent with the existing body of evidence from India and other Asian populations [2,4,6,7,15]. However, certain regional differences merit attention. The higher female-to-male ratio of 5:1 observed in our study, compared to the 4:1 ratio reported by most multicentric studies, may reflect both the genuine hormonal susceptibility of the predominantly female population in the Northeast and the relatively lower health-seeking behaviour among males in this region. The high prevalence of topical steroid use (21.7%) is a concerning finding

that distinguishes this population from many urban-based study cohorts and highlights the need for targeted public health education regarding the hazards of unsupervised topical steroid application.

Limitations of the Study: The present study has certain limitations that should be acknowledged. Being a hospital-based cross-sectional study with a relatively modest sample size of 120 patients, the findings may not be fully generalizable to the entire population of Northeast India. The classification of melasma type by Wood's lamp without histopathological correlation may have introduced some misclassification, particularly in patients with darker skin types.

Additionally, MASI scoring, although validated, is subject to inter-observer variability. Future studies with larger sample sizes, community-based designs, dermoscopic and histopathological correlation, and quality-of-life assessments would further strengthen the evidence base from this region.

Conclusion

The present study provides valuable clinico-epidemiological data on melasma from a tertiary care centre in Assam, Northeast India. Melasma predominantly affected young to middle-aged women in the reproductive age group, with the centrofacial pattern being the most common clinical presentation and the epidermal type being the most frequent Wood's lamp classification. Sun exposure emerged as the principal aggravating factor, followed by pregnancy and family history, underscoring the multifactorial aetiology of the disease involving environmental, hormonal, and genetic determinants. The notable prevalence of topical corticosteroid misuse in this population highlights a significant public health concern requiring targeted educational interventions. These findings are largely concordant with data from other Indian and Asian populations, while also highlighting region-specific features pertinent to the northeastern demographic. Comprehensive patient counselling emphasizing rigorous photoprotection, avoidance of unsupervised topical steroid use, and awareness of hormonal triggers should form the cornerstone of preventive strategies in this population. Further community-based studies with larger sample sizes and histopathological correlation are recommended to provide a more complete understanding of melasma epidemiology in the northeastern region of India.

Figure 1: Clinical photographs of melasma patients. (a) Malar pattern melasma in a male patient showing brown hyperpigmented macules over the cheek. (b) Centrofacial melasma in a female patient with diffuse hyperpigmentation over the forehead, nose, and malar regions. (c) Malar melasma in a female patient demonstrating bilateral symmetrical patches over the malar prominences. (d) Centrofacial melasma with prominent malar involvement in a female patient showing dark brown confluent patches over both cheeks and nose

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