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# Is Impaired Sleep Quality a Triggering Factor in Melasma Patients? A Cross-Sectional Study

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## Abstract

**Background:** Sleep disorders trigger the hormonal imbalance and the accumulation of reactive oxygen molecules which are involved in melasma pathogenesis. **Aims and Objectives:** This study aims to assess the potential relationship between melasma and sleep components. **Material and Methods:** One hundred patients with melasma and 100 sex- and age-matched healthy controls aged over 18 were included. The melasma area severity index (MASI) and melasma quality of life (MelasQoL) scores of the patients were calculated. The Pittsburg Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS) were applied to patients with melasma and healthy controls. **Results:** Compared with the controls, the median PSQI and ESS total scores were higher in the melasma patients. The patients with melasma reported impaired sleep components more frequently than the healthy controls. The rate of cases with excessive daytime sleepiness was similar between the patients and the controls. The analysis did not reveal any statistically significant correlation between MASI, MelasQoL, and the two questionnaires for melasma patients. In the multivariate analyses, the following factors were found to affect melasma: subjective sleep quality score (OR: 2.49, 95%CI: 1.26–4.89); sleep latency score (OR: 2.16, 95%CI: 1.34–3.49), sleep disturbances score (OR: 2.78, 95%CI: 1.17–6.57), Fitzpatrick skin type (OR: 1.88, 95% CI: 1.15–3.07), and total ESS score (OR: 1.13, 95% CI: 1.04–1.23). **Conclusion:** Our study's findings suggest impaired subjective sleep quality, prolonged sleep onset latency, and sleep disturbances may affect melasma. Dermatologists should consider the potential benefits of improving sleep hygiene and treating sleep disorders in melasma patients.

**Key Words:** *Daytime sleepiness, melasma, sleep disorders, sleep health, sleep quality*

## Introduction

Melasma is a chronic acquired hyperpigmentation disorder characterized by irregularly circumscribed, brown macules and plaques on sun-exposed areas, principally on the face. This skin disorder is frequently observed in dark-skinned women.[1] Its prevalence varies between 1% to 50% depending on the ethnicity, skin type, and intensity of ultraviolet (UV) exposure.[2] Although the underlying mechanism of melasma is not fully understood, many factors are blamed for its etiology. The most important factors are UV exposure, genetic predisposition, and hormonal effects (pregnancy, hormone replacement therapies, oral contraceptives, and corticosteroid use).[1,3]

Studies indicate that oxidative stress is associated with melasma pathogenesis.[4] Some showed an imbalance between the serum oxidant and antioxidant markers in melasma patients.[4-6] Kim and Lee[7] demonstrated that oxidative stress in melasma inhibits the ciliogenesis and hedgehog signaling pathway in lesional keratinocytes due to the downregulation of nuclear factor E2-related factor 2, a regulator of cellular antioxidant defences. This leads to keratinocyte differentiation, melanin synthesis, and melanosome transfer, causing skin hyperpigmentation. Prolonged sleep deprivation reduces the anti-oxidative mechanisms, leading to the accumulation of reactive oxygen molecules.[8] In addition, sleep deprivation disrupts the regulation of female sex hormones, such as gonadotropins, progesterone, luteinizing hormone, and estradiol, which play a role in melanogenesis.[9,10]

Although the available data suggest a potential link between sleep health and melasma, this issue has yet to be researched. If this hypothesis is true, advising sleep hygiene practices and treating sleep disorders

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may benefit patients with melasma. The study aimed to examine the potential link between melasma and different aspects of sleep health using the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS) in melasma patients.

## Materials and Methods

This cross-sectional study took place at the Dermatology Outpatient Department of a university hospital from December 2022 to October 2023. One hundred patients with melasma and 100 sex- and age-matched healthy volunteers aged over 18 were included in the study. Cases with other pigmentation disorders, taking medicine for systemic disease, and patients with skin disorders including psoriasis, atopic dermatitis, urticaria, alopecia and skin sensitivity leading to poor sleep quality were excluded from the study. Pregnant cases and melasma patients under melasma treatment for six months were also excluded.

Sociodemographic data, drug usage (oral contraceptives, photosensitizing drugs, hormone replacement therapies, systemic corticosteroids), and family history of melasma were documented. Patients' skin types were assessed according to the Fitzpatrick classification (I–VI).

Clinical data were assessed after the approval of the Dokuz Eylül University Faculty Non-Interventional Research Ethics Committee (Date: 21.12.2021; Number: 2022/41-08). Informed consent was obtained from the involved patients and healthy controls in the study.

The severity of melasma in patients was measured using the Melasma Area Severity Index (MASI).[11] The Melasma Quality of Life Scale (MelasQol), validated by Dogramacı *et al.*,[12] was used to assess the quality of life of the melasma patients.

The Pittsburgh Sleep Quality Index (PSQI) is a questionnaire that assesses various aspects of sleep quality, such as how long it takes to fall asleep, how well you sleep, and whether you use sleep medication. Each aspect is scored from 0 to 3, with 3 indicating poorer sleep quality. The range of potential scores is 0-21, with scores greater than five indicating impaired sleep quality.[13,14]

To determine daytime sleepiness, the Epworth Sleepiness Scale (ESS), validated by Izci *et al.*, was used. The questionnaire includes eight carefully designed items to assess the likelihood of excessive daytime sleepiness. Each item is rated from 0 to 3 based on the probability of dozing off during an activity. A total score of 10 or higher indicates excessive daytime sleepiness, potentially indicating underlying health issues.[15,16]

### Statistical methods

The normality of variables was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The Mann–Whitney U test was used because all the quantitative independent data were distributed asymmetrically. The qualitative data were compared between the groups using Pearson's Chi-square test or Fisher's exact test. Logistic regression analysis was used to explore the factors that affect melasma. SPSS 28.0 program was used in the analyses. All tests were two-tailed, and *P* values less than 0.05 were considered statistically significant.

Because no previous studies were available on this topic to guide a simple size calculation, we performed a post-hoc power analysis using the observed differences between the melasma and control groups. The calculated statistical power for both the ESS total score and the global PSQI score comparisons was 99% ($\alpha$ = 0.05, two-tailed).

## Results

### Patient characteristics and risk factors of melasma

The study involved 100 patients with melasma, of whom 93% were female. The control group included 100 sex- and age-matched healthy volunteers. The mean age of the patients was 44.7 ± 9.3 years. The body mass index, education level distribution, residential location, and occupation were similar between patients with melasma and healthy controls. The detailed sociodemographic data of the patients with melasma and healthy controls are presented in Table 1.

The mean MASI score of the patients was 7.5 ± 5.5 (range: 0.8-29.4) and the mean MelasQoL score was 19.9 ± 9.7 (range: 10-58). There was a statistically significant positive correlation between the MASI and MelasQoL in patients with melasma (r: 0.25, p: 0.013).

When comparing the risk factors between the study groups, we found that the melasma group had a significantly higher frequency of smoking, alcohol consumption, history of corticosteroid use, and number of pregnancies compared to the healthy controls. The incidence of darker skin types and family history of melasma was also higher in melasma patients than in the healthy controls [Table 2].

### Differences in the sleep components and excessive daytime sleepiness between patients with and healthy controls

The scores of the four components of the PSQI were significantly higher in the melasma patients compared to the controls. Patients with melasma reported poor sleep quality more frequently (n: 60, 60%) than the healthy controls (*n*: 34, 34%) [Table 3]. No statistically significant correlation was observed between MASI, MelasQoL, and total PSQI scale in melasma patients (Spearman's analysis r: 0.023, *p*: 0.82; *r*: 0.04, p: 0.7; respectively).

**Table 1: Characteristics of melasma patients and the healthy control group**

| Variables | | Melasma Group | | | | Control Group | | | | *P* | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean±SD/*n*% | | | Median | Mean±SD/*n*% | | | Median | | |
| Age | | 43.1 | ± | 0.185 | 43.0 | 45.7 | ± | 11.1 | 45 | 0.185 | m |
| Gender | Male | 7 | 1.000 | 7.0% | | 7 | | 7% | | 1.000 | $X^2$ |
| | Female | 93 | | 93.0% | | 93 | | 93% | | | |
| BMI | | 24.8 | ± | 0.225 | 24.2 | 25.4 | ± | 3.7 | 24.6 | 0.225 | m |
| Education | Primary school | 12 | 0.595 | 12.0% | | 13 | | 13% | | 0.595 | $X^2$ |
| | Middle school | 4 | | 4.0% | | 6 | | 6% | | | |
| | High school | 30 | | 30.0% | | 22 | | 22% | | | |
| | University | 54 | | 54.0% | | 59 | | 59% | | | |
| Occupation | Housewife | 25 | 0.402 | 25.0% | | 32 | | 32% | | 0.402 | $X^2$ |
| | Public Servant | 47 | | 47.0% | | 34 | | 34% | | | |
| | Laborer | 4 | | 4.0% | | 3 | | 3% | | | |
| | Retiree | 10 | | 10.0% | | 12 | | 12% | | | |
| | Freelance | 14 | | 14.0% | | 19 | | 19% | | | |
| Working Actively? | No | 34 | 0.658 | 34.0% | | 37 | | 37% | | 0.658 | $X^2$ |
| | Yes | 66 | | 66.0% | | 63 | | 63% | | | |
| Residential location | Urban (city) | 91 | | 91% | | 94 | | 94% | | 0.421 | $X^2$ |
| | Rural | 9 | | 9% | | 6 | | 6% | | | |

[m]Mann–Whitney U test/$X^2$ Chi Squared test. BMI, body mass index; SD, standard deviation

The rate of cases with excessive daytime sleepiness according to the cut-off value of >10 points was higher in the melasma patients (n: 20, 20%) than in the controls (*N*: 12; 12%). However, the difference was not statistically significant [Table 3]. The study findings showed no connection between MASI, MelasQoL, and ESS total score in melasma patients (Spearman's analysis r: 0.045, *p*: 0.65; r: 0.042, *p*: 0.68, respectively). The frequency of excessive daytime sleepiness was statistically higher in melasma patients with overweight or obesity (*n*: 13/45; 28.9%) than in melasma patients with a healthy weight (28.9% vs 12.7%; *p*: 0.044).

### *Univariate and multivariate analysis of the factors affecting melasma*

In the univariate analyses of the melasma risk factors in Table 2, smoking, history of corticosteroid use, Fitzpatrick skin type, total ESS scores, and the scores of the three sub-components of the PSQI (subjective sleep quality, sleep latency, and sleep disturbances) were the significant factors affecting melasma. The odds ratios and their corresponding 95% confidence intervals are displayed in Table 4.

In the multivariate analyses, subjective sleep quality score (OR: 2.49, 95%CI: 1.26–4.89); sleep latency score (OR: 2.16, 95%CI: 1.34–3.49), sleep disturbances score (OR: 2.78, 95%CI: 1.17–6.57), Fitzpatrick skin type (OR: 1.88, 95% CI: 1.15–3.07), and total ESS score (OR: 1.13, 95% CI: 1.04–1.23) were the significant independent factors that affecting melasma [Table 4].

In the control group family history of melasma was reported in 23% (OR: 1.93, 95% CI: 1.03–3.6, *P* = 0.038). Eighteen percent of the healthy control group did not respond to the question, so this variable was excluded from the multivariate analysis.

## Discussion

Melasma is a chronic multifactorial disease whose etiopathogenesis is not fully understood.[1,3] An imbalance between serum oxidant and antioxidant markers has been observed in patients with melasma, which disrupts the formation of primary cilia in keratinocytes. Primary cilia play an inhibitory role in melanogenesis; therefore, their inhibition can potentially lead to increased melanin synthesis, melanosome transfer, and skin hyperpigmentation.[7] Poor sleep quality may disrupt antioxidant systems, leading to increased accumulation of oxygen radicals and subsequent skin inflammation. Furthermore, sleep deprivation can disturb the hormonal balance of progesterone, estradiol, luteinizing hormone, and prolactin. Research has shown that the levels of these hormones, which are involved in melanogenesis, vary between individuals with melasma and healthy controls.[8-10] However, to our knowledge, it has not been evaluated whether patients with melasma have impaired sleep quality. Our study demonstrated that more than half of patients with melasma (66%) reported poor sleep quality. Recent studies have shown the association of poor sleep quality with various chronic inflammatory skin disorders, including psoriasis, chronic spontaneous urticaria, and atopic dermatitis.[17,18] In a retrospective study, patients with rosacea reported poor sleep quality more frequently than the healthy controls. In addition, there was a positive correlation between the rosacea severity score and the PSQI score.[19] In our study,

**Table 2: Comparison of risk factors of melasma between the study groups**

| Variables | | Melasma Group | | | | Control Group | | | | *P* | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean±SD/*n*% | | | Median | Mean±SD/*n*% | | | Median | | |
| Smoking | Non-smoker | 45 | | 45% | | 66 | | 66% | | 0.011$X^2$ | |
| | Ex-smoker | 17 | | 17% | | 12 | | 12% | | | |
| | Smoker | 38 | | 38% | | 22 | | 22% | | | |
| Smoking (pack/year) | | 14.3 | ± | 12 | 13 | 11.9 | ± | 19.1 | 5 | 0.1 | m |
| Alcohol consumption | (–) | 50 | | 50% | | 65 | | 65% | | 0.032 | $X^2$ |
| | (+) | 50 | | 50% | | 35 | | 35% | | | |
| Coffee intake | (–) | 12 | | 12% | | 21 | | 21% | | 0.086 | $X^2$ |
| | (+) | 88 | | 88% | | 79 | | 79% | | | |
| Coffee intake (cups/day) | | 2.1 | ± | 1.4 | 2 | 1.9 | ± | 1.2 | 1 | 0.262 | m |
| Previous Pregnancy | (–) | 17 | | 18.3% | | 24 | | 25.8% | | 0.216 | $X^2$ |
| | (+) | 76 | | 81.7% | | 69 | | 74.2% | | | |
| Pregnancy Count | | 2.4 | ± | 0.9 | 2.0 | 2.1 | ± | 1.0 | 2.0 | 0.034 | m |
| History of OCP use | (–) | 53 | | 57.0% | | 53 | | 57.0% | | 1.000 | $X^2$ |
| | (+) | 40 | | 43.0% | | 40 | | 43.0% | | | |
| Hormone Replacement Therapy | (–) | 83 | | 88.3% | | 83 | | 88.3% | | 1.000 | $X^2$ |
| | (+) | 11 | | 11.7% | | 11 | | 11.7% | | | |
| Systemic corticosteroid | (–) | 82 | | 82.0% | | 94 | | 94.0% | | 0.009 | $X^2$ |
| | (+) | 18 | | 18.0% | | 6 | | 6.0% | | | |
| History of infertility | (–) | 92 | | 92.0% | | 97 | | 97.0% | | 0.121 | $X^2$ |
| | (+) | 8 | | 8.0% | | 3 | | 3.0% | | | |
| History of photosensitive medication use | (–) | 89 | | 89.0% | | 95 | | 95.0% | | 0.118 | $X^2$ |
| | (+) | 11 | | 11.0% | | 5 | | 5.0% | | | |
| Fitzpatrick skin type | II | 8 | | 8.0% | | 17 | | 17.0% | | 0.016 | $X^2$ |
| | III | 30 | | 30.0% | | 36 | | 36.0% | | | |
| | IV | 51 | | 51.0% | | 45 | | 45.0% | | | |
| | V | 11 | | 11.0% | | 2 | | 2.0% | | | |
| Family history of melasma ( first degree)* | (–) | 59 | | 59% | | 57 | | 57% | | 0.037 | $X^2$ |
| | (+) | 23 | | 23% | | 43 | | 43% | | | |

[m]Mann–Whitney U test/$X^2$ Chi Squared test–missing data: 18 in the healthy control group. OCP, oral contraceptive pill; SD, standard deviation

although melasma patients had higher PSQI scores than the healthy controls, no correlation was found between the PSQI and MASI scores. This result suggests that there may be a nonlinear relationship between poor sleep quality and the severity of melasma. Impaired sleep quality may maintain the chronic hypermelanocytic conditions rather than affecting the disease severity.

In the multivariate analysis of the components of the PSQI, it was found that for each unit increase in the scores of subjective sleep quality, sleep latency, and sleep disturbances, the odds of melasma were approximately doubled. Supporting our results, a study evaluating two groups of healthy women aged 30–50 with good and poor sleep quality determined that chronically poor sleep quality was associated with irregular pigmentation, fine wrinkles, loose skin, and loss of subcutaneous fat tissue, signs of accelerated ageing.[20] In addition, in a preliminary study, topical and systemic forms of melatonin treatment, an endogenous hormone negatively affected by sleep deprivation, were reported to be effective in melasma patients.[21] Further research is necessary to verify the impact of melatonin treatment on melasma patients with sleep disturbances. Advising patients with melasma on fundamental sleep hygiene practices may enhance melasma treatment outcomes. Avoiding napping, caffeine and alcohol intake, regular exercise, keeping regular sleep timing, having a quiet and dark sleep area, and having an appropriate temperature can improve sleep in patients with poor sleep quality.[22]

In our study, we found that the total ESS scores were notably greater in melasma patients than in healthy controls. Although the incidence of Epworth sleep disorder, according to the cut-off point of 10, is higher in melasma patients, the difference did not achieve significance. ESS evaluates the self-reported daytime sleepiness in various everyday situations, the primary cause of which is obstructive sleep apnea (OSA).[23] A retrospective study found that patients with rosacea had a 3.4-times higher relative risk of OSA than those without rosacea.[24] Psoriasis, atopic dermatitis, and

**Table 3: Differences in the sleep components and sleepiness scale between the study groups**

| | Control Group | | | | Melasma Group | | | | *P* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean±SD/*n*% | | | Median | Mean.±SD/*n*% | | | Median | | |
| Epworth Sleepiness Scale Total Score | 4.8 | ± | 3.9 | 4.0 | 7.3 | ± | 4.3 | 7.0 | <0.001 | m |
| Pathological sleepiness | | | | | | | | | | |
| (ESS ≤10) | 88 | | 88.0% | | 80 | | 80.0% | | 0.123 | $X^2$ |
| (ESS >10) | 12 | | 12.0% | | 20 | | 20.0% | | | |
| Pittsburgh Sleep Quality Index | | | | | | | | | | |
| Subjective sleep quality | 0.78 | ± | 0.56 | 1.00 | 1.34 | ± | 0.71 | 1.00 | <0.001 | m |
| Sleep latency | 0.76 | ± | 0.67 | 1.00 | 1.50 | ± | 1.03 | 1.00 | <0.001 | m |
| Sleep duration | 0.83 | ± | 0.89 | 1.00 | 0.97 | ± | 0.99 | 1.00 | 0.377 | m |
| Habitual sleep efficiency | 0.07 | ± | 0.41 | 0.00 | 0.03 | ± | 0.30 | 0.00 | 0.319 | m |
| Sleep disturbances | 0.96 | ± | 0.45 | 1.00 | 1.40 | ± | 0.55 | 1.00 | <0.001 | m |
| Use of sleeping medication | 0.01 | ± | 0.10 | 0.00 | 0.19 | ± | 0.69 | 0.00 | 0.016 | m |
| Daytime dysfunction | 0.36 | ± | 0.63 | 0.00 | 0.50 | ± | 0.82 | 0.00 | 0.485 | m |
| Global PSQI score | 3.77 | ± | 2.05 | 3.00 | 5.93 | ± | 2.85 | 5.00 | <0.001 | m |
| Sleep quality | | | | | | | | | | |
| Bad | 66 | | 66.0% | | 40 | | 40.0% | | <0.001 | $X^2$ |
| Good | 34 | | 34.0% | | 60 | | 60.0% | | | |

[m]Mann–Whitney U test/$X^2$ Chi Squared test. Bad, (Global PSQI score, >5); Good, (global PSQI score, ≤5); ESS, Epworth Sleepiness Scale; PSQI, Pittsburgh Sleep Quality Index

**Table 4: Logistic regression analysis of the factors affecting melasma**

| | Univariate Analysis | | | | | Multivariate Analysis | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | OR | %95 CI | | | *P* | OR | %95 CI | | | *P* |
| Smoking | 2.17 | 1.23 | - | 3.83 | 0.007 | - | - | - | - | - |
| History of steroid use | 3.43 | 1.3 | - | 9 | 0.013 | - | - | - | - | - |
| Fitzpatrick skin type | 1.72 | 1.19 | - | 2.49 | 0.004 | 1.88 | 1.15 | - | 3.07 | 0.01 |
| Epworth Sleepiness Scale | 1.16 | 1.01 | - | 1.24 | <0.001 | 1.13 | 1.04 | - | 1.23 | 0.006 |
| Pittsburgh Sleep Quality Index | 1.44 | 1.25 | - | 1.65 | <0.001 | | | | | |
| Subjective sleep quality | 4.17 | 2.41 | - | 7.22 | <0.001 | 2.49 | 1.26 | - | 4.89 | 0.008 |
| Sleep latency | 2.63 | 1.82 | - | 3.81 | <0.001 | 2.16 | 1.34 | - | 3.49 | 0.001 |
| Sleep disturbances | 6.33 | 3.11 | - | 12.89 | <0.001 | 2.78 | 1.17 | - | 6.57 | 0.02 |

Logistic regression analysis (Forward LR). OR, Odds ratio; CI, confidence interval

hidradenitis suppurativa are the other inflammatory dermatologic conditions that are linked to OSA. Obesity and allergic rhinitis were the important predisposition factors in these disorders.[25] Consistent with the literature, the frequency of excessive daytime sleepiness was statistically higher among melasma patients who were overweight or obese compared to those with a healthy weight in our study. The ESS score was also determined as an independent influencing factor in our study. Therefore, melasma patients with high body mass index and concomitant OSA may benefit from weight loss and positive lifestyle changes.

Sampaio Xerfan *et al.*[26] suggested that melasma itself may affect sleep quality directly or by causing stress, which may negatively affect melasma pathology. However, we did not find any correlation between the MASI, MelasQoL, and the total scores of the questionnaires. There are conflicting results in the literature regarding the effect of melasma severity on the patients' quality of life. Various studies demonstrated the correlation between MASI and MelasQoL, while some did not.[27-29] Our study showed a limited but significant correlation between the MASI and MelasQoL in melasma patients. However, the patient's sleep quality was not linearly affected, suggesting the impairment is irrespective of the melasma condition.

There are some limitations in our study. We could not administer a questionnaire related to sun exposure to patients. However, we found no significant difference between our patients' and controls' educational status, occupation, and residential location, all closely related to sun exposure. This confidence leads us to believe these limitations should not significantly impact our results. In addition, the diagnoses of sleep disorders determined by the questionnaire instruments could not be confirmed by polysomnography.

In conclusion, individuals with melasma showed notably higher average PSQI and ESS scores compared to those

in the control group. Excessive daytime sleepiness was more prevalent in melasma patients who were overweight or obese compared to those with a healthy weight. The total ESS score and impaired subjective sleep quality, the duration of falling asleep, and sleep disturbances of PSQI were the significant factors affecting melasma. Our findings suggest that various sleep disorders may contribute to the development of melasma. Gaining a deeper understanding of the causes and progression of this complex disease could significantly improve its management. Dermatologists should take into account the potential benefits of improving sleep hygiene and treating sleep disorders in melasma patients. More research is necessary to understand how enhancing sleep quality affects melasma treatment.

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### *Conflicts of interest*

There are no conflicts of interest.

## References

1. Morgado-Carrasco D, Piquero-Casals J, Granger C, Trullàs C, Passeron T. Melasma: The need for tailored photoprotection to improve clinical outcomes. Photodermatol Photoimmunol Photomed 2022;38:515-21.
2. Ogbechie-Godec OA, Elbuluk N. Melasma: An up-to-date comprehensive review. Dermatol Ther (Heidelb) 2017;7:305-18.
3. Jadotte YT, Schwartz RA. Melasma: İnsights and perspectives. Acta Dermatovenerol Croat 2010;18:124-9.
4. Seçkin HY, Kalkan G, Baş Y, Akbaş A, Önder Y, Özyurt H, *et al*. Oxidative stress status in patients with melasma. Cutan Ocul Toxicol 2014;33:212-7.
5. Choubey V, Sarkar R, Garg V, Kaushik S, Ghunawat S, Sonthalia S. Role of oxidative stress in melasma: A prospective study on serum and blood markers of oxidative stress in melasma patients. Int J Dermatol 2017;56:939-43.
6. Rahimi H, Mirnezami M, Yazdabadi A, Hajihashemi A. Evaluation of systemic oxidative stress in patients with melasma. J Cosmet Dermatol 2024;23:284-88.
7. Kim NH, Lee AY. Oxidative stress ınduces skin pigmentation in melasma by ınhibiting hedgehog signaling. Antioxidants (Basel) 2023;12:1969.
8. Atrooz F, Salim S. Sleep deprivation, oxidative stress and inflammation. Adv Protein Chem Struct Biol 2020;119:309-36.
9. Lateef OM, Akintubosun MO. Sleep and reproductive health. J Circadian Rhythms 2020;18:1.
10. Filoni A, Mariano M, Cameli N. Melasma: How hormones can modulate skin pigmentation. J Cosmet Dermatol 2019;18:458-63.
11. Kimbrough-Green CK, Griffiths CE, Finkel LJ, Hamilton TA, Bulengo-Ransby SM, Ellis CN, *et al*. Topical retinoic acid (tretinoin) for melasma in black patients. A vehicle-controlled clinical trial. Arch Dermatol 1994;130:727-33.
12. Dogramaci AC, Havlucu DY, Inandi T, Balkrishnan R. Validation of a melasma quality of life questionnaire for the Turkish language: The MelasQoL-TR study. J Dermatolog Treat 2009;20:95-9.
13. Ağargün MY, Kara H, Anlar Ö. Pittsburgh Uyku Kalitesi İndeksinin geçerliliği ve güvenilirliği. Türk Psikiyatri Dergisi 1996;7:107-15.
14. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Res 1989;28:193-213.
15. Johns MW. A new method for measuring daytime sleepiness: The Epworth sleepiness scale. Sleep 1991;14:540-5.
16. Izci B, Ardic S, Firat H, Sahin A, Altinors M, Karacan I. Reliability and validity studies of the Turkish version of the Epworth Sleepiness Scale. Sleep Breath 2008;12:161-8.
17. Can A, Coskun R, Karabacak DE, Tuzer OC, Yegit OO, Karadag P, *et al*. Common but neglected problem in chronic spontaneous urticaria: Sleep disturbance. Allergy Asthma Proc 2023;44:179-85.
18. Kaaz K, Szepietowski JC, Matusiak Ł. Influence of itch and pain on sleep quality in atopic dermatitis and psoriasis. Acta Derm Venereol 2019;99:175-80.
19. Yang Z, Zhao W, Hu M, Wu P, Zhang X, Wang T, *et al*. Quality of life, sleep and anxiety status among patients with rosacea in the Yunnan plateau region: A 2-year retrospective study. Skin Res Technol 2024;30:e13616.
20. Oyetakin-White P, Suggs A, Koo B, Matsui MS, Yarosh D, Cooper KD, *et al*. Does poor sleep quality affect skin ageing? Clin Exp Dermatol 2015;40:17-22.
21. Hamadi SA, Mohammed MM, Aljaf AN, Abdulrazak A. The role of topical and oral melatonin in management of melasma patients. J Arab Uni Basic App Sci 2009;8:30-42.
22. De Pasquale C, El Kazzi M, Sutherland K, Shriane AE, Vincent GE, Cistulli PA, *et al*. Sleep hygiene – What do we mean? A bibliographic review. Sleep Med Rev 2024;75:101930.
23. Garbarino S. Excessive daytime sleepiness in obstructive sleep apnea: Implications for driving licenses. Sleep Breath 2020;24:37-47.
24. Elkin PL, Mullin S, Sakilay S. Rosacea patients are at higher risk for obstructive sleep apnea: Automated aetrospective research. Stud Health Technol Inform 2020;270:1381-2.
25. Soundararajan V, Lor J, Fishbein AB. Sleep apnea and skin. Curr Sleep Med Rep 2020;6:94-100.
26. Sampaio Xerfan EM, Andersen ML, Tomimori J, Tufik S, da Silva Facina A. Melasma and the possible interaction with sleep quality. J Clin Aesthet Dermatol 2020;13:12.
27. Zhu Y, Zeng X, Ying J, Cai Y, Qiu Y, Xiang W. Evaluating the quality of life among melasma patients using the MELASQoL scale: A systematic review and meta-analysis. PloS One 2022;17:e0262833.
28. Anderson L, Rodrigues M. Quality of life in a cohort of melasma patients in Australia. Australas J Dermatol 2019;60:160-2.
29. Mpofana N, Paulse M, Gqaleni N, Makgobole MU, Pillay P, Hussein A, *et al*. The effect of melasma on the quality of life in people with darker skin types living in Durban, South Africa. Int J Environ Res Public Health 2023;20:7068.