

Original Research Article

Role of skin circadian rhythm and the effect of day and night cream: a survey on Indian dermatologists' and cosmetologists' views and patient experiences

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ABSTRACT

Background: The skin plays different functions during the day and night to adapt to the changing environments. Various specialized creams are available to meet these skincare needs. The present study was conducted to explore the perspective of Indian dermatologists and cosmetologists on skin's circadian rhythm and assess the effectiveness of a particular day and night cream formulation.

Methods: A non-interventional, questionnaire-based study was conducted as part of a survey series on multiple dermatology products across India. Every month, a product-specific survey link was released to these registered doctors, and each doctor could take up to 10 surveys for a maximum of two products. A total of 379 healthcare professionals (HCPs) took the survey on the day and night cream and reported experiences of 2085 patients regarding the use of these products.

Results: The doctors believed that for majority of the patients (1997, 97%), required day and night cream to maintain their skin's circadian rhythm. Most patients (1440, 70%) were compliant with day and night care cream regimens. Most patients (966, 47%) were highly satisfied with the use of day and night cream, with majority of the patients (1028, 49.4%) experiencing considerable reduction in dark spots and uneven skin tone. Most patients (971, 47%) felt that the application of day and night cream left their skin moisturized and rejuvenated.

Conclusions: The use of day and night cream improved skin condition and hydration, addressing circadian rhythm imbalance. Indian HCPs understand the impact of skin circadian rhythm imbalance and promote a comprehensive skincare regimen to patients.

Keywords: Skin circadian rhythm, Day cream, Night cream, Day and night cream

INTRODUCTION

The intricate structure of the skin with specialized components enables it to efficiently function as a first-line defence against external factors. It harbours multiple layers, cell types, and houses mini organ-like components such as hair follicles and sweat glands, allowing it to fulfil multiple tasks such as preventing water loss,

enabling tactile sensations, and synthesising hormones.¹ With the external conditions changing constantly, mechanisms have evolved that facilitate the skin to foresee dramatic environmental variation and adapt accordingly.²

The skin has distinct roles during the day and night due to the vastly varied surroundings that are created by the day

and night cycles.¹ This can be explained by the biological rhythm in the skin, governed by the circadian clock. The circadian clock is a central autonomous clock that controls body functions at different times throughout the day. The suprachiasmatic nucleus (SCN) present in the hypothalamus drives the circadian clock machinery which is present in almost all cells. Light is the primary signal that stimulates SCN.²

On receiving light, components of the retino-hypothalamic tract transmit signals to the SCN to set circadian time. The SCN then sends signals to peripheral tissues to synchronize peripheral clocks mediated by neuronal and hormonal signals. This establishes the circadian rhythm in peripheral tissues, including the skin. Disruption in the skin's circadian rhythm contributes to the development and progression of infections, inflammatory skin conditions, and premature skin aging.²

Circadian variation is seen in various facets of dermatological physiology. For example, higher skin thickness, sebum production, pH, and lower blood flow are common during the day; while slower skin barrier recovery, higher barrier permeability, moisture loss, and blood flow occur at night.^{3,4} As the skin circadian rhythm research advances, tailored treatment options are increasingly being developed to cater to the skin's needs during the day and night for good skin health. Currently, various day and night creams are available in the market that address this issue.

One such day cream is enriched with antioxidants, and ingredients with anti-inflammatory and skin-brightening properties, including Kojic acid (2% w/w), vitamin E (1% w/w), *Artocarpus lakoocha*, curcumin, liquorice, arbutin, and mulberry, and the night cream of the same range is enriched with ingredients like Kakadu plum, *Rumex occidentalis*, hyaluronic acid, Shea butter, Macadamia nut oil, and Almond oil.

The objective of our present study was to understand Indian dermatologists' and cosmetologists' perspective on the skin's circadian rhythm and specifically understand the need and efficacy of the above-mentioned formulations of day and night cream.

METHODS

Study design

A non-interventional, questionnaire-based study was conducted as part of a survey series on multiple dermatology products across India, from June-December (2022). More than 1000 dermatologists, paediatricians, and cosmologists were registered with PAN India for the survey series. Every month, a product-specific survey link was released to these registered doctors, and each doctor could take up to 10 surveys for a maximum of two products.

A total of 379 HCPs (dermatologists and cosmetologists) took the survey on a day and night cream through which their views and experiences of 2085 patients with these products were recorded. This study did not require formal ethical approval, as it was a non-interventional, anonymized survey. Participation in the survey was entirely voluntary, and responses were collected anonymously to ensure confidentiality.

Inclusion and exclusion criteria

HCPs (dermatologists and cosmetologists) and individuals presenting with dull skin with dark spots or uneven skin tone were included in this survey-based study. General practitioners, and individuals with other skin conditions (infections, acne, dermatitis etc.) and on prescription medications for these conditions were excluded from the study.

Study tool

Data was collected using a structured questionnaire having 13 questions. The entire questionnaire is given in the Supplementary material (Appendix I).

Data collection

The survey link was rolled out in two phases: June and November (2022).

Data analysis

The survey responses were analyzed using Microsoft excel spreadsheet version 2021. The descriptive statistics were calculated using predefined Excel formulas.

RESULTS

Patient demographics and skin characteristics

Data was collected for a total of 2085 patients through HCPs in the survey. The patient population was predominantly female (1484, 71.1%). Most of the patients presented with uneven skin tone (1248, 59.8%) and dark spots (1215, 58.2%) (Figure 1).

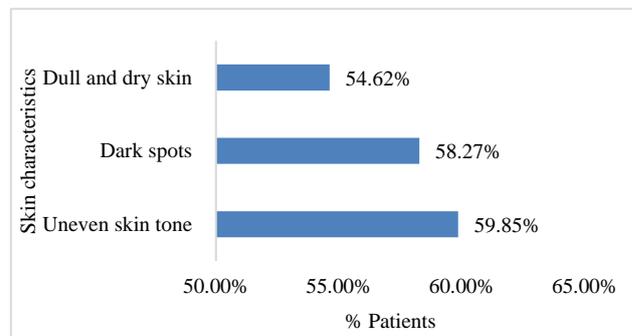


Figure 1: Skin characteristic of the patients.

Skin circadian rhythm and skincare routine

Survey analysis shows that according to dermatologists, in majority of the patients, (2016, 96.8%) an imbalance in the skin's circadian rhythm could affect skin considerably and contribute to issues like hyperpigmentation, laxity, wrinkles, dry, and dull skin (Figure 2).

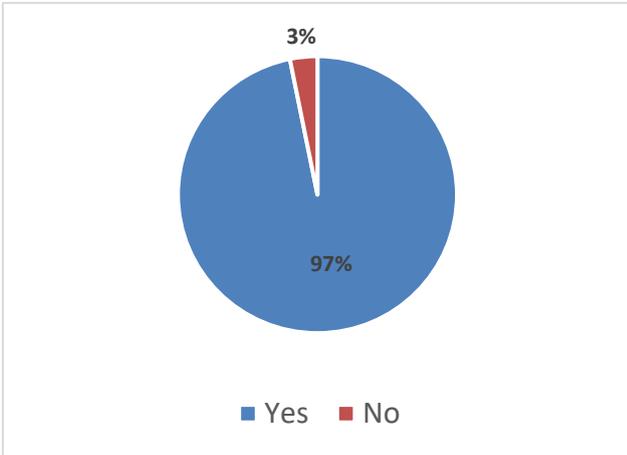


Figure 2: Proportion of patients with affected skin due to imbalance of the skin's circadian.

Additionally, they agreed to fact that following proper skincare routine could prevent conditions like hyperpigmentation in most patients (2001, 96%) (Figure 3).

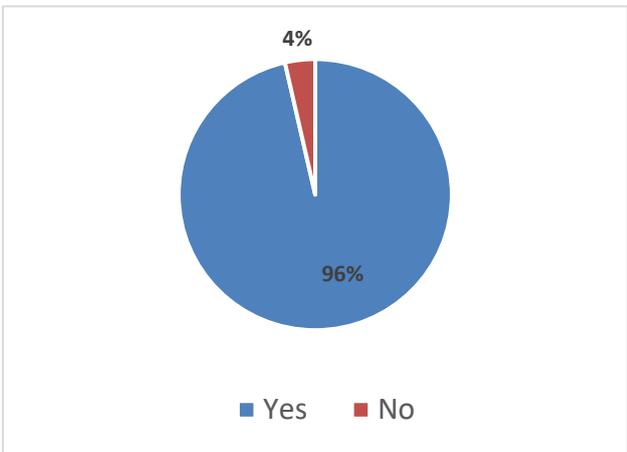


Figure 3: Proportion of patients who agreed following a proper skincare routine could prevent conditions like hyperpigmentation.

The need for a day and night cream and the role of ingredients

According to the survey analysis, the doctors believed that for majority of the patients (1997, 97%), there was a need to prescribe a day and night cream to maintain their skin's circadian rhythm (Figure 4).

Furthermore, for most of the patients (1255, 60.4%), HCPs rated vitamin C to be an extremely important ingredient in formulations for the skin to improve skin health. Similar findings were noted for vitamin E and hyaluronic acid (1180, 56.7% and 1345, 64.9% respectively) (Figure 5).

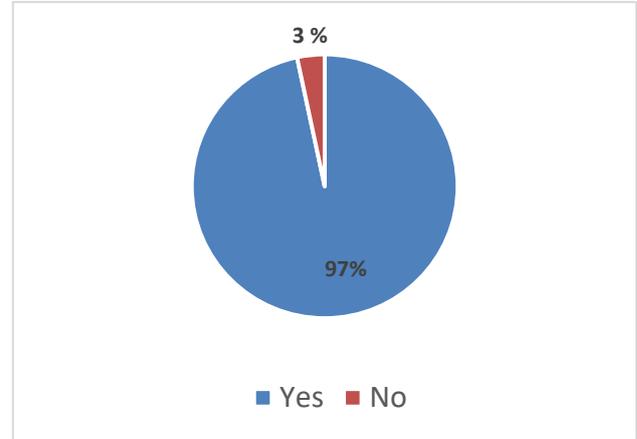


Figure 4: Proportion of HCPs who believed that there was a need to prescribe a day and night cream to their patients to maintain the skin's circadian rhythm.

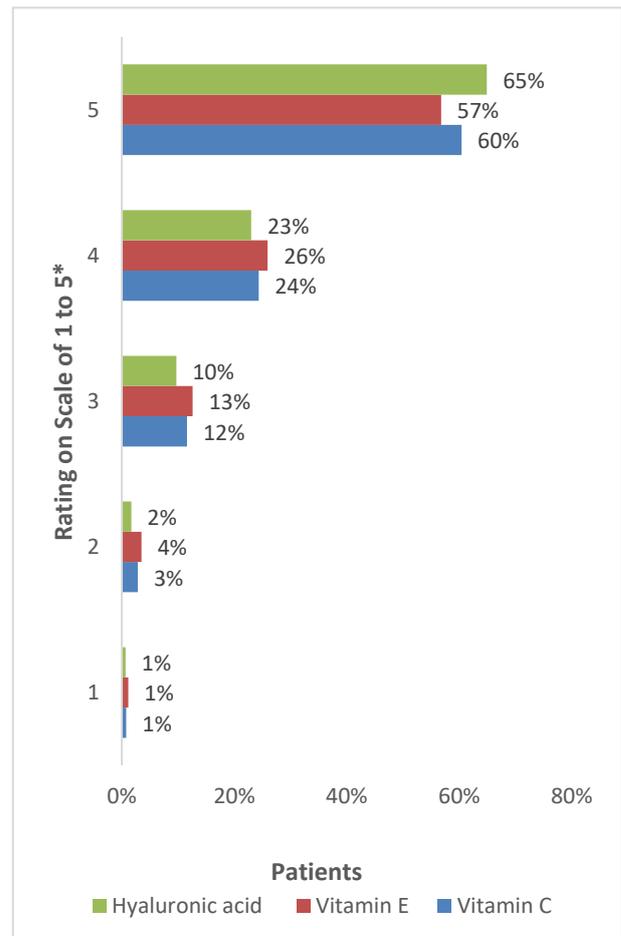


Figure 5: HCPs perception on ingredients in formulations to improve skin health.

Prescription and patient compliance

The prescribing pattern of day and night cream was also checked through the survey, and it was observed that the creams were prescribed to most of the patients (1012, 48.7%) for a duration of 1-3 months (Figure 6).

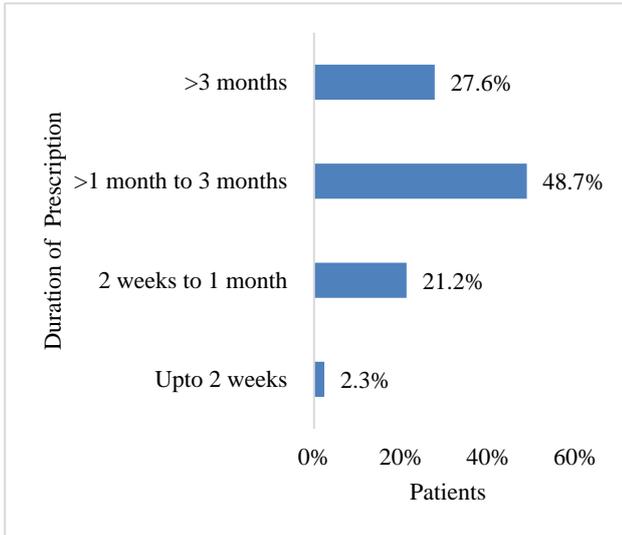


Figure 6: Prescribing pattern of day and night cream.

Moreover, maximum patients (1440, 70%) were compliant with day and night cream skincare regimen (Figure 7).

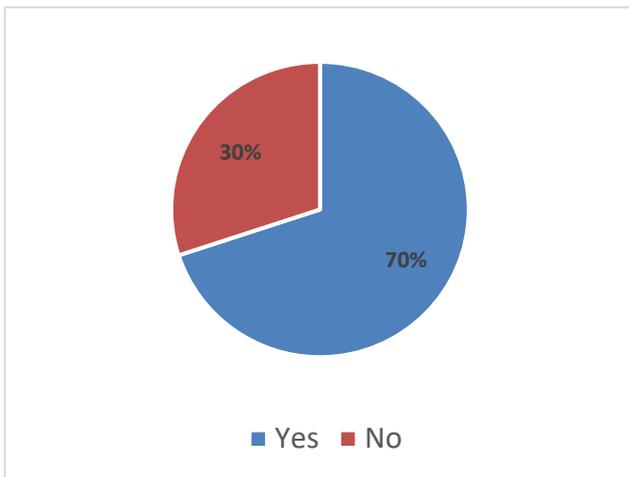


Figure 7: Proportion of patients' complaint with the day and night cream skincare regimen.

Patients' experience with day and night cream

The survey analysis shows that a considerable number of patients (966, 46.7%) were highly satisfied with the use of day and night cream, a considerable number of patients (1028, 49.4%) saw a reduction in dark spots and uneven skin tone and most of them (971, 47.07%) felt that the application of day and night cream left their skin moisturized and rejuvenated (Figure 8).

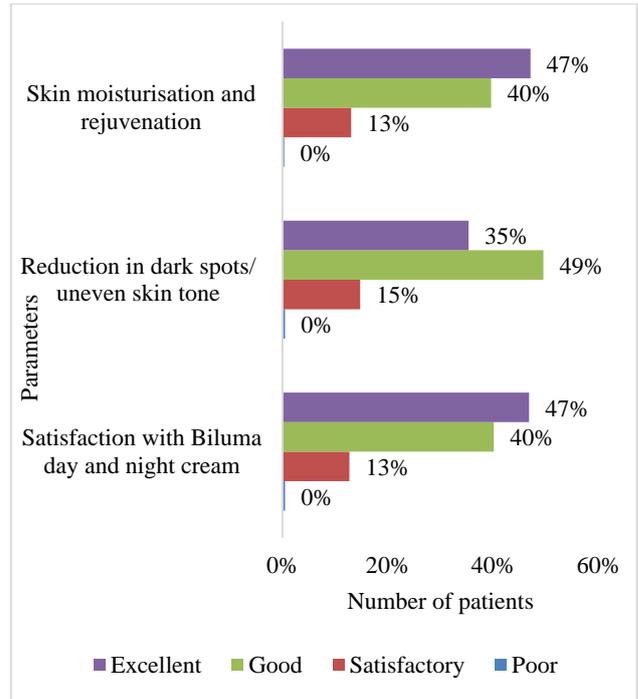


Figure 8: Patients' experience with day and night cream.

DISCUSSION

Studies have established that an impaired skin circadian rhythm can lead to various skin conditions.^{2,5} It is linked to reduced barrier function and accelerated skin aging.³ Uneven skin tone, wrinkles, and dryness are some of the common manifestations of skin aging.⁶ In the present study, most dermatologists felt that a disturbed circadian rhythm could have led to issues like hyperpigmentation and wrinkles in most of the patients.

Several circadian rhythm modifiers are increasingly being developed to repair the skin from the inside. These products work by targeting the diurnal variation in skin properties.⁷ Following a comprehensive skincare routine consistently with appropriate products has shown visible benefits and can increase the longevity of effects.⁸

The current survey responses indicate the need for a day and night cream to balance the skin's circadian rhythm. The results also show that having a good skincare routine can prevent implications of a disturbed skin circadian rhythm, such as hyperpigmentation. A study comparing the benefits of an advanced skincare routine (including day and night creams) with a simple routine (just cleanser and day cream) reported an increase in superficial and deep hydration, with an improvement in skin roughness and melanin heterogeneity, with the advanced routine.⁹

With time, the role of bioactive substances has evolved in dermatology owing to their potential to prevent skin aging, ability to protect from oxidative damage, dehydration, and improve elasticity. Vitamin E is one

such substance, which is a potent antioxidant, promotes collagen and elastin synthesis, protects the skin lipid membrane, and has skin-barrier stabilizing properties.^{10,11} Vitamin C participates in keratinocyte differentiation, collagen synthesis, prevents melanin synthesis, and protects the skin from photoaging.¹⁰

Hyaluronic acid is also one of the most commonly used ingredients in the cosmetics industry, as it acts as a skin conditioning agent and primarily maintains the skin's hydration. It holds moisture and increases the firmness and radiance of the skin. In combination with other bio-actives such as vitamins and plant extracts, hyaluronic acid produces enhanced effects.¹²

In the present study, most dermatologists rated vitamin C, vitamin E, and hyaluronic acid to be extremely important in cosmetic formulations. A study examining the effect of a formulation containing vitamin C, hyaluronic acid, and peptides reported that participants had a more radiant skin complexion with smoother skin, and fine lines were less visible after application of the product for 28 days.¹³

The current study revealed that the day and night cream products enriched with bio-actives, plant extracts, and hydrating agents could help improve skin health, appearance, and tackle the circadian imbalance.

This study has some limitations, including the use of a non-randomized sampling method, which may introduce selection bias. Additionally, the exclusion of general practitioners and individuals with other skin conditions may reduce the generalizability of the findings.

CONCLUSION

The skin follows a circadian rhythm to achieve full functionality. Certain factors such as modern lifestyle and exposure to UV radiation interrupt the skin's circadian rhythm, and this leads to functional impairments and can stimulate epidermal jetlag. Most of the patients in the present survey had dull and dry skin with dark spots. The study revealed that the application of day and night cream helped reduce the dark spots and made the patients' skin feel moisturized and rejuvenated. Cosmetic solutions can help tackle circadian imbalance and can protect and preserve the biorhythm of the skin. The present study also revealed that dermatologists are aware of the implications of skin circadian rhythm imbalance and the importance of encouraging their patients to follow a comprehensive skincare routine.

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Conflict of interest: Dyotona Sen and Sanjay Choudhary are employees of Galderma. Other authors do not declare any conflict of interest

Ethical approval: Not required

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APPENDIX I

The following structured questionnaire was used to collect data in the survey

- 1) Patients gender
 - Male
 - Female
- 2) Can an imbalance in the skin's circadian rhythm have a significant impact leading to hyperpigmentation, laxity, wrinkles, and dry and dull skin?
 - Yes
 - No
- 3) Do you find the need of prescribing a day cream and a night cream for balancing the skin's circadian rhythm?
 - Yes
 - No
- 4) Did the patient have
 - Uneven skin tone
 - Dark spots
 - Dull and dry skin
- 5) Do you think that the skincare routine is a vital aspect in preventing hyperpigmentation?
 - Yes
 - No
- 6) What was the duration of the prescription for Biluma day and night cream?
 - Up to 2 weeks
 - 2 weeks to 1 month
 - 1 month to 3 months
 - 3 months
- 7) Was your patient compliant with Biluma day and night cream skincare regimen?
 - Yes
 - No
- 8) Rate on a scale of 1 to 5, the importance of the below ingredients (1 being the least and 5 being the most important).
Vitamin C
 - 1
 - 2
 - 3
 - 4
 - 5
- 9) Rate on a scale of 1 to 5, the importance of the below ingredients (1 being the least and 5 being the most important).
Vitamin E
 - 1
 - 2
 - 3
 - 4
 - 5
- 10) Rate on a scale of 1 to 5, the importance of the below ingredients (1 being the least and 5 being the most important).
Hyaluronic acid
 - 1
 - 2
 - 3
 - 4
 - 5
- 11) How satisfied is the patient with the usage of Biluma day and night cream?
 - Poor
 - Satisfactory
 - Good
 - Excellent
- 12) Did the patient see a reduction in dark spots/uneven skin tone?
 - Poor
 - Satisfactory
 - Good
 - Excellent
- 13) Did the patient's skin feel moisturized and rejuvenated on the application of Biluma day and night cream?
 - Poor
 - Excellent
 - Good
 - Excellent