

A Retrospective Survey to Assess the Skin Lightening, Skin Moisturization and Sensorial Properties of a Broad Spectrum Sunscreen Formulation in Indian Patients

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Abstract

Introduction: Indian people primarily use sunscreens to prevent tanning and maintain a fair complexion rather than preventing sunburns and cancers which are the internationally recommended reasons for use of sunscreens. Considering these factors, a broad spectrum sunscreen formulation with anti-tanning and skin lightening properties will be an ideal formulation for Indian skin types.

Materials and Methods: A retrospective survey was conducted to assess the skin lightening, skin moisturization, and sensorial properties of a broad spectrum sunscreen formulation (octinoxate + diethylamino hydroxybenzoyl hexyl benzoate + bis-ethylhexyloxyphenol methoxyphenyl triazine + titanium dioxide, silicon dioxide, and dimethicone + diethylhexyl butamido triazone + melanostatine + tyrostat) in 30 patients at a single dermatology and cosmetology center at Amritsar. Both the patients and the treating physician rated the skin lightening, skin moisturization and sensorial properties of the sunscreen at 6 and 12 weeks.

Results: The patient's and physicians positive rating for skin lightening and skin moisturization had increased significantly at the end of 12 weeks compared to that of 6 weeks. The patients rating for sensorial properties at the end of 12 weeks were as follows: Non-irritation in 83.32% ($n = 24$), non-greasiness in 89.99% ($n = 26$), compatibility with other cosmetics in 90% ($n = 27$), non-interference with outdoor activity in 85.72% ($n = 25$), spreadability in 93.33% ($n = 27$), and sensation of softness and freshness in 89.99% ($n = 26$) at 12 weeks.

Discussion: Indian skin types react differently to chronic ultraviolet exposure compared to Caucasian skin. Uneven skin tone due to persistent pigmentation and tanning are major concerns in Indian patients; therefore, it requires a broad spectrum sunscreen with additional skin lightening (anti-tanning) properties. The sunscreen used in this survey contains two skin lightening agents' melanostatine and tyrostat which indicates why patients rating was positive for skin lightening effect for the sunscreen in this survey. It is also made in silicone base which imparts good sensorial properties.

Conclusion: A broad spectrum sunscreen with skin lightening properties may increase the adherence of patients to use sunblock regularly. Long-term, comparative studies are required.

Key words: Sunscreen, Skin lightening, Skin moisturization

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INTRODUCTION

The damage of ultraviolet (UV) sun exposure has been well documented in literature since many years now. It has been theoretically established that regular use of sunscreens is useful in preventing long-term UV associated chronic damage such as freckles, lentigines, and preventing skin

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cancer risk in Caucasians. It is also known that UV-A rays are more detrimental for skin health compared to UV-B rays as their depth of penetration is up to the dermis, and they induce free radicals (reactive oxygen species) causing damage to cell DNA.^[1] Adequate and proper sun protection methods can reduce the incidence of sunburn, skin irritation, and photoaging. Sunscreen application is recommended as the primary skin cancer prevention strategy as appropriate application of sunscreen limits the penetration of UV rays in the skin.

The people in Indian subcontinent commonly have Fitzpatrick skin type 4, 5, or 6 which is darker compared to lighter Caucasian skin type.^[2] There are many inbuilt protective mechanisms in darker skin types to protect against UV damage. Thicker epidermis and greater amount of melanin allow little amount of UV-A and UV-B radiation to filter through in dark skin types compared to lighter skin types. The melanosomes in darker skin are also resistant to degradation by lysosomal enzymes.^[3]

Indian people primarily use sunscreens to prevent tanning and maintain a fairer complexion rather than preventing sunburns and cancers which are the internationally recommended reasons for the use of sunscreens.^[3] Considering these factors, a broad spectrum sunscreen formulation with additional skin lightening properties will be an ideal formulation for Indian skin types. If it also has a good sensory profile, it may ensure optimum usage and compliance to the treatment.

We had conducted a retrospective survey based on a simple questionnaire to assess the skin lightening, skin moisturization, and sensorial properties of a broad spectrum sunscreen formulation which is marketed as La Shield Lite by Glenmark Pharmaceuticals Ltd. India. The composition of La Shield Lite sunscreen is shown in Table 1.

MATERIALS AND METHODS

A survey was conducted using a pretested questionnaire from March 2015 to May 2015. In this survey, we had included patients who were prescribed the broad-spectrum

sunscreen for twice daily application on face for a minimum duration of 12 weeks. The questionnaire was designed to assess the skin lightening effect, skin moisturization effect, and sensorial properties of the anti-tanning sunscreen formulation. The responses were analyzed as to whether the questions were understood or not and necessary modifications were incorporated in the questionnaire. Instructions for filling the questionnaire were explained by the treating physician to all patients at the first visit. The patients were instructed to rate the skin lightening effect and skin moisturization effect on a 5 point scale as poor (1), below average (2), average (3), good (4), and excellent (5) at the end of 6 weeks and 12 weeks, respectively. Similarly, the treating physician also rated the skin lightening effect and skin moisturization effect at the end of 6 weeks and 12 weeks on another questionnaire for each patient separately.

At the end of 12 weeks, the patients were also instructed to rate the sensorial properties of the sunscreen. They were as follows: Non-irritation, non-greasiness, compatibility with other cosmetics, non-interference with outdoor activity, spreadability, and sensation of softness and freshness for the anti-tanning sunscreen formulation. The patients were instructed to rate the sensorial properties on 5 point scale as poor (1), below average (2), average (3), good (4), and excellent (5) at the end of 12 weeks, respectively.

RESULTS

At the end of the survey period at 12 weeks, the filled survey forms were collected from the physician and 30 patients who completed the survey. The entire data were collected and analyzed.

In this survey, the anti-tanning sunscreen was prescribed post-procedure in 78.26 % of patients ($n = 23$), followed by melasma in 21.74% of patients ($n = 7$).

In this survey, the physician's rating for skin lightening effect of the anti-tanning sunscreen was average to excellent in 73.3 % of patients ($n = 22$) at the end of 6 weeks, which increased to 89.9 % of patients ($n = 26$) at the end of 12 weeks. The physician's ratings for skin lightening effect of anti-tanning sunscreen are shown in Figure 1.

In this survey, the physician's rating for skin moisturization effect of the anti-tanning sunscreen was average to excellent in 72.4% of patients ($n = 21$) at the end of 6 weeks, which increased to 89.6 % of patients ($n = 26$) at the end of 12 weeks. The physician's ratings for skin moisturization effect of anti-tanning sunscreen are shown in Figure 2.

In this survey, the patient's rating for skin lightening effect of the anti-tanning sunscreen was average to excellent in

Table 1: List of ingredients of LaShield lite sunscreen formulation

Melanostatine
Tyrostat-09
Octinoxate
Diethylamino Hydroxybenzoyl Hexyl Benzoate (DHHB)
Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine (BEMT)
Titanium Dioxide, Silicon Dioxide & Dimethicone
Diethylhexyl Butamido Triazone

80% of patient's ($n = 24$) at the end of 6 weeks, which increased to 96.6 % of patients ($n = 28$) at the end of 12 weeks. The patient's rating for skin lightening effect of anti-tanning sunscreen is shown in Figure 3.

In this survey, the patient's rating for skin moisturization effect of the anti-tanning sunscreen was average to excellent in 79.32 % of patient's ($n = 23$) at the end of 6 weeks, which increased to 89.6 % of patients ($n = 26$) at the end of 12 weeks. The patient's rating for skin moisturization effect of the anti-tanning sunscreen is shown in Figure 4.

In this survey, the patient's rating for the sensorial properties was average to excellent at the end of 12 weeks as follows: Non-irritation in 83.32% ($n = 24$), non-greasiness in 89.99% ($n = 26$), compatibility with other cosmetics in 90%

($n = 27$), non-interference with outdoor activity in 85.72% ($n = 25$), spreadability in 93.33% ($n = 27$), and sensation of softness and freshness in 89.99% ($n = 26$). The patient's rating for the sensorial parameters of the anti-tanning sunscreen are shown in Figure 5a and b.

DISCUSSION

The major appearance concern in ethnic Indian people with skin is tanning and uneven tone due to immediate and

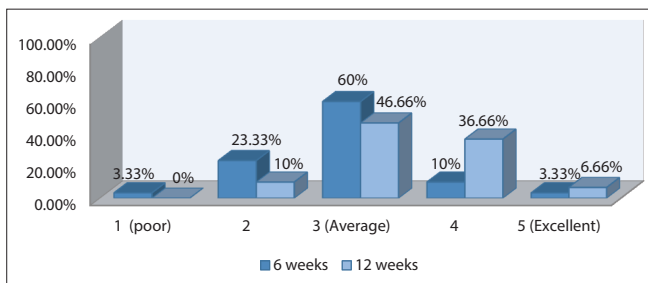


Figure 1: Physicians rating for skin lightening effect of anti-tanning sunscreen

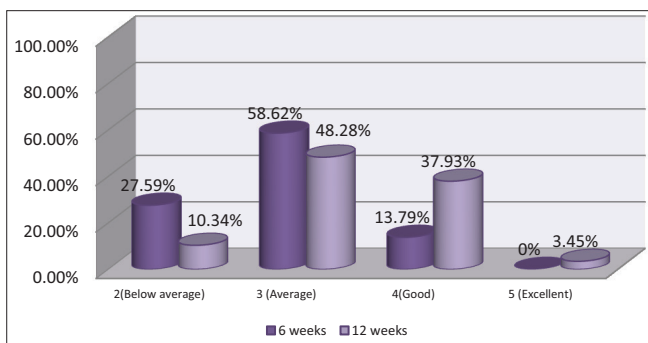


Figure 2: Physicians rating for skin moisturization effect of anti-tanning sunscreen

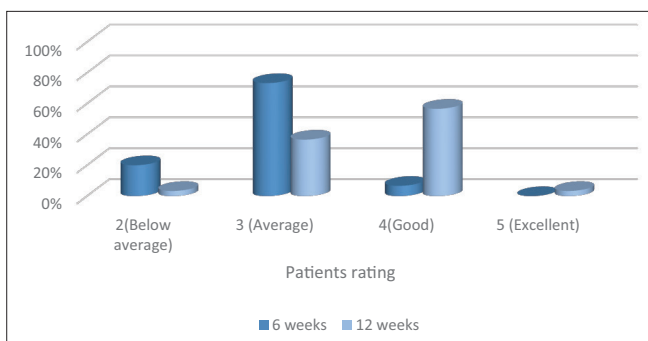


Figure 3: Patient's rating for skin lightening effect of anti-tanning sunscreen

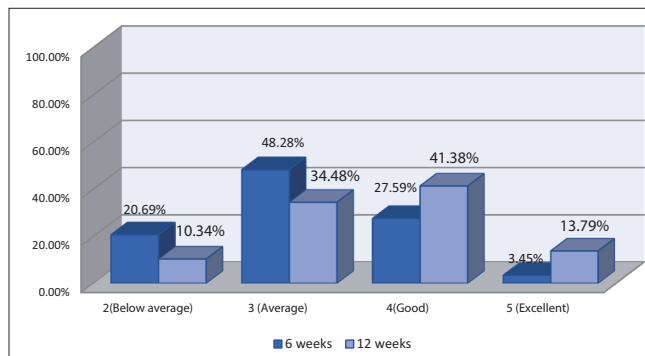


Figure 4: Patient's rating for skin moisturization effect of anti-tanning sunscreen

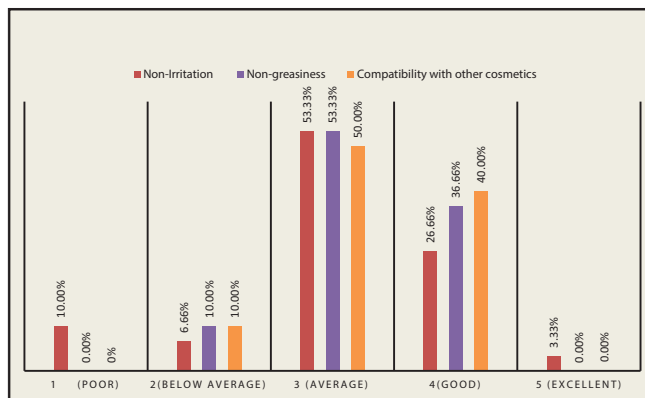


Figure 5: Patient's rating for sensorial parameters: non-irritation, non-greasiness & compatibility with other cosmetics

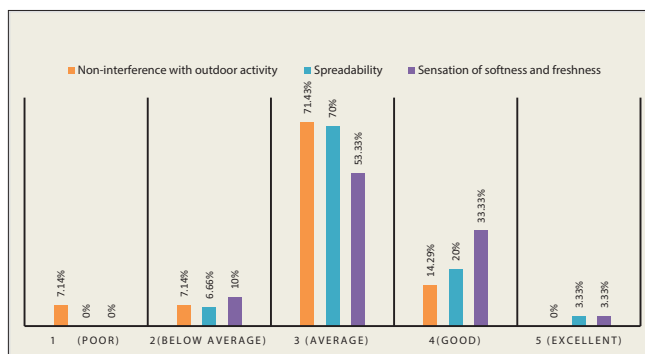


Figure 6: Patient's rating for sensorial parameters: interference with outdoor activity, spreadability, sensation of softness and freshness

delayed hyperpigmentation. These pigmentary changes are magnified by photodamage either in the form of temporary UV-A-induced tanning or the more permanent formation of lentigenes. Furthermore, skin aging in the ethnic skin is not as prominent as Caucasian skin. Therefore, products designed for Fitzpatrick skin Types 1, 2, or 3 may not meet these needs. Experience from day-to-day clinical practice suggests that broad spectrum sunscreens with a mix of organic and inorganic filters with additional protection against immediate and persistent pigment darkening may be more suitable for Indian skin types particularly in Indian women who want to maintain fair complexion. There is a high incidence of postinflammatory pigmentation post esthetic procedures and light-based treatments in darker skin types.^[4] This is why essential protection of Indian Skin especially following any dermatology procedure by application of a broad spectrum sunscreen agent containing both UV-A and UV-B filters is very important to prevent further damage.

At molecular level,^[5,6] it is well established that UV exposure increases levels of alpha-melanocyte-stimulating hormone (α -MSH), interleukin (IL-1), corticotrophin which, in turn, increase the melanogenesis. α -MSH binds to melanocortin 1 receptor (MC1-R) receptor, stimulates adenylate cyclase, which increases the intracellular levels of cAMP. This results in increased tyrosinase activity through increased tyrosinase mRNA and protein levels, leading to the induction of melanogenesis. The sunscreen formulation assessed in this survey contains a skin lightening active agent melanostatine. It is an oligopeptide with a high affinity for MC1-R receptor.^[6,7] As an antagonist, it competes against the natural ligand (α -MSH) on its specific receptor (MC1-R) by preventing any further activation of the tyrosinase, and thus blocking melanin synthesis.

Melanogenesis is controlled by an enzymatic cascade which is regulated by tyrosinase, tyrosinase-related protein-1 and tyrosinase-related protein-2 (*TYRP1* and *TYRP2*).^[8] The modulation of tyrosinase activity, therefore, represents a key-process for the regulation of skin pigmentation. The sunscreen formulation assessed in this survey also contains another skin lightening agent tyrostat. Tyrostat is obtained from a plant species *Rumex occidentalis* that is native to Northern Canada.^[6,8] It is an inhibitor of enzyme tyrosinase and helps to even out skin tone by reducing age spots. One study showed that tyrostat down-regulated the expression of tyrosinase and tyrosine-related proteins genes which are involved in the regulation of melanogenesis indicated by decreased expression of *TYR*, *TYRP1*, and *TYRP2* genes.^[8] Down-regulation of these genes leads to inhibition of melanogenesis as shown by decreased tyrosinase activity and decreased melanin content in skin melanocytes.^[9]

In this survey, both the physician and patients rating for skin lightening at 6 weeks was average to excellent in 73.3% ($n = 22$) and 80% ($n = 24$) of patients. This suggests that the complementary and synergistic melanogenesis inhibiting activity of both melanostatine and tyrostat reduced sun spots, freckles, uneven pigmentation for a lighter and luminous skin tone. Further, at 12 weeks, the physicians rating for skin lightening increased from 73.3% to 89.9%, and patients rating increased from 80% to 96.6% of patients. This indicates that the skin lightening effect of this sunscreen formulation and its active agents is directly proportional to the duration of its use.

The sunscreen assessed in this survey, also contains octinoxate, diethylamino hydroxybenzoyl hexyl benzoate, bis-ethylhexyloxyphenol methoxyphenyl triazine, diethylhexyl butamido triazone, titanium dioxide, silicon dioxide, dimethicone, and cyclopentasiloxane crosspolymer. The absorption profile and photostability of these filters are well documented in literature.^[10] It is made on silicone gel base which is a novel form of drug delivery for other formulation ingredients and imparts silky feel, non-greasiness and superior spreadability. This justifies the high rating by patients for skin moisturization and sensorial properties of the sunscreen.

This survey has certain limitations. Due to the observational design of the survey, the possibility of selection bias cannot be ruled out. The survey was conducted at a single dermatology and cosmetology clinic on a small sample. Treatment with other skin lightening agents such as topical agents or laser procedures was not taken into consideration which may have impacted the final outcome. Long-term comparative studies in different skin types, indications and different sunscreen formulations to address the shortcomings of this survey are warranted.

CONCLUSION

Photoprotection in ethnic Indian skin is challenging due to tropical humid climate and high incidence of pigmentary changes in Indian skin types. A broad spectrum sunscreen formulation with organic filters, inorganic filters along with skin lightening agents will ensure optimum usage and better compliance to therapy by patients.

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