A Comprehensive Study on Skin Whitening Products

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Abstract: **Skin whitening refers to the process of lightening or brightening the skin tone through various cosmetic treatments or products, including creams, serums, and chemical peels. The goal is often to reduce the appearance of hyperpigmentation, such as dark spots, freckles, or melasma, or to achieve a uniformly lighter skin tone. Skin brightening, a point of both corrective and social importance, alludes to the handle of helping skin tone through different strategies, counting the utilize of topical creams, chemical peels, laser medications, and other dermatological methods. This comprehensive think about investigates the organic, social, and moral measurements of skin brightening, centering on its predominance, components, and the basic inspirations for its utilize. It moreover analyzes the socio-cultural variables driving request for lighter skin, especially in districts where reasonable skin is idealized. The think about assist addresses the mental suggestions, potential wellbeing dangers, and the worldwide discussion encompassing excellence measures and the morals of skin helping hones. By synthesizing existing writing and consolidating master bits of knowledge, this inquire about points to give a adjusted understanding of skin brightening, investigating both its potential benefits and the complex, in some cases hurtful, results related with it.**

Keywords: **Adverse effect, Melanin, Pigmentation, Skin whitening.**

I. INTRODUCTION

Skin whitening is the practice used for whitening the epidermal layer of the skin with the help of cosmetic, homemade or dermatological products. Skin whitening is also called skin lightening/ skin bleaching. Skin lightening products has gained widespread popularity and is most commonly used by the non- white cultures[1]. The practice as well as belief for getting fair and lighten skin has been rooted from ancient ages. Nowadays, these products are marketed as skin lighters, skin evening creams, skin whiteners, skin toners, fairness creams etc. Both men and women are engaged in skin whitening practices but women generally have higher rates of practice than men. Similar to gender age is also a key factor. The preference of the people to have lighter and white skin has driven the skin lightening industry. In Asian market, there is about 60% sale for the skin whitening products. These products are commonly available from local convenience store, and are widely available over the internet. The consumers often show only minimum concern about the health effects of skin whitening products. Often misuse of skin whitening products may also occur. Almost 50% of the consumers of skin whitening products don't report the side effects that are developed due to the usage of the product[2].

II. STRUCTURE AND FUNCTION OF SKIN

Skin is largest organ in human body. It mainly has 3 layers: - epidermis, dermis & the hypodermis. Skin completely covers the body and it protects the body from heat, light and infections.

A) Epidermis :-It is the outer layer of the skin. It is formed by stratified, squamous epithelium. Epidermis mainly consists of 3 types of cells - Squamous cells, Basal cells & Melanocytes.

B) Dermis: - Is the middle layer of skin. It is made up of collagen & amorphous connective tissue. Dermis contains blood vessels, lymph, hair follicle, sweat gland, collagen bundles, nerves as well as sebaceous glands.

C) Subcutaneous layer (hypodermis): - It is the deepest layer of skin. Consists of network of collagen and fat cells.

Skin mainly protects the body from external factors.[3]

Function:-

* Skin regulates the body temperature and protect against UV light, trauma, pathogen, microorganisms and toxins.

* Skin provides barrier against mechanical, thermal, physical injury and hazardous substance.

* Prevent the loss of moisture from the body and it act as a sensory organ.

* Production of Vitamin D[4]

III. DISORDERS OF SKIN

The disorders associated with skin mainly involves disturbances of pigmentation which involves melanin. An increase or decrease or abnormal location or distribution of melanin pigments may lead to such disturbances. Facial pigmentation is usually associated with increased amount of melanin within epidermis, dermis or both. Pigmentation disorders can be generalized and localized pigmentation disorders.

A) Hyperpigmentation: - Hyperpigmentation is darkening of skin's natural color, which is caused by the increased deposition of melanin in the epidermis and dermis. It can affect people of all skin types. Solar lentigines, melasma and post inflammatory hyperpigmentation are common hyperpigmentation diseases which are caused by variety of conditions like acne, eczema, trauma etc. UV light induced damages are difficult to treat. Some regions of skin become darker than other body parts. It is caused due to overproduction of melanin. Apart from UV, hormonal imbalances or changes can also cause hyperpigmentation. That's why, skin hyperpigmentation is mostly seen in women and have been linked to hormonal issues, oral contraceptives and pregnancy. Hyperpigmentation can be treated by addressing the underlying problem by lowering the pigment production. The common ingredient that can be used for treating skin pigmentation includes phenolics- which can be used as a single ingredient or as a mixture of actives in a formulation. Hydroquinone, Vitamin C, Kojic acid and its derivatives are often used substance.

3 types of hyperpigmentation are: Post inflammatory hyperpigmentation, Melasma and Age spot

i) Post Inflammatory Hyperpigmentation:- Epidermal post inflammatory hyperpigmentation is light to dark brown in color, whereas dermal PIH is grey to black in color. It develops as a result of acne vulgaris. The darker Pitz Patrick Skin types IV, V and VI are mostly prone to post inflammatory hyperpigmentation. Variation in size & shape along with color ranging from light brown to black can be observed in the lesions caused by PIH.

ii) Melasma :- Melasma is derived from Greek word Melas, which means "black". Also known as chloasma & mask of pregnancy. It is the most common facial hyperpigmentation. It mainly affects women than men. It is mainly characterized by brownish-grey macules & patches on face as well as the neck, chest and forearm. Sunscreen is recommended to prevent melasma from deteriorating due to continued sun exposure. Pregnancy induced melasma fades naturally after delivery. Therapy mainly includes the use of topical depigmentation agents. Hydroquinone is the most commonly used anti- melanogenic agent. It block the conversion it of 1, 3, 4 dihydroxy phenylalanine to melanin as they inhibit competitive tyrosinase.

iii) Age Spot:- They are characterized by brown blotches on the skin. Age spots are commonly seen in regions which are frequently exposed to sunlight like face & hands. Age spots vary in shape, size, color and degree of protrusion in the skin. Drugs used for hyperpigmentation includes: Zidovudine, anti-malarial drugs like chloroquine, quininetetracycline's, estrogens, hydroxyurea, clofazimine.[4]

IV. NATURAL INGREDIENTS USED IN HYPERPIGMENTATION DISORDERS

Includes Aloesin, Embilica Officinalis,Green Tea,Turmeric .Other ingredients used includes: - Glabridin, Arbutin, Caricapapaya, Hesperidin, Santalum album, Mulberry.[5]

V. MELANIN

Melanin is a complex set of biopolymers created by specialized cells called melanocytes. They are responsible for the color of skin, hair and eyes. Melanocyte that is located in the basal layer of skin is responsible for producing and storing melanin. The color of the skin depends on the type and amount of melanin produced. The active ingredients in the skin lightening products may inhibit the melanogenesis process. Melanocytes are produced from precursor cells known as melanoblasts. Melasma, post-inflammatory hyperpigmentation (PIH), freckles, drug-induced hyperpigmentation etc. are some of the common examples of skin pigmentation disorders. The more melanin is present, lower is the percentage of light reflected from the surface of the skin. Melanin acts as a shielding agent & protects the skin from UV radiation's damaging effects. The disease

associated with melanin is due to excessive or insufficient levels of melanin. Melanin is chemical molecule which is made up of 5,6-dihydroxyindole, produced from amino acid tyrosine. Melanocytes are the pigment - producing cells of the follicular and interfollicular epidermis. They produce melanosome. Melanocytes inject pigment into keratinocytes as melanosome bundles. There are basically two types of melanin pigments: dark brown to black eumelanin (photo protective) and reddish brown phaeomelanin (not photo protective). The melanin index (MI) was calculated as the area covered by melanin staining in the epidermis, including stratum corneum and the basal layer. Melanin act as natural sunscreens and it helps to protect the DNA and proteins from the detrimental effect of shorter wavelengths of electromagnetic radiations.[4]

V. SKIN WHITENING AGENTS

A) Hydroquinone

Hydroquinone cream is the standard depigmentation of skin helping specialists. Clinically it is utilized to treat regions of dyschromia, such as in melasma, chloasma, sun powered lentigines, spots, and post-inflammatory hyperpigmentation. This movement diagrams the signs, instrument of activity, strategies of organization, imperative unfavorable impacts, contraindications, and checking of hydroquinone, so suppliers can coordinate quiet treatment to ideal results in conditions where it is shown Hydroquinone cream is the standard depigmentation or skin helping operator. Clinically it is utilized to treat zones of dyschromia, such as melasma,chloasma, sun oriented lentigines,spots,post-inflammatory hyperpigmentation. Its most common utilize is in patients with post-inflammatory hyperpigmentation and melasma. MOA Hydroquinone acts as a skin depigmentation specialist by repressing melanin union. It restrains the change of L-3,4-dihydroxyphenylalanine (L-DOPA) to melanin by hindering tyrosinase due to its auxiliary likeness to an analog of melanin precursors.

Administration:-

Hydroquinone is as it were utilized topically as a depigmentation specialist. A lean layer is connected with fingertips and rubbed into the confront (or other influenced ranges) 1 to 2 times a day for 3 to 6 months. If there are no comes about after 2 to 3 months, hydroquinone ought to be ceased. It is fundamental to equally apply hydroquinone over the whole confront to anticipate uneven pigmentation and utilize it concurrently with sunscreen to secure from harming UV light, which increments pigmentation. Doctors suggested ceasing treatment after this time for a few months some time recently restarting to decrease the chance of side impacts. It can too be connected amid ends of the week as it were or three times a week for more amplified upkeep treatment with negligible complications.

B) Monobenzyl ether of hydroquinone

Monobenzyl ether of hydroquinone (MBEH) is an FDA-approved treatment for advanced vitiligo, focusing on reducing skin pigmentation. This study examines how MBEH works compared to 4-tertiary butyl phenol (4-TBP), a substance linked to causing occupational vitiligo by triggering melanocyte cell death. Cytotoxicity tests show that, like 4-TBP, MBEH leads to specific death of melanocytes. To investigate the death pathways initiated by these two agents, the study analyzed typical markers of apoptosis in treated melanocytes. It was found that MBEH caused cell death without activating the caspase cascade or leading to DNA fragmentation, indicating a non-apoptotic death mechanism. The release of High Mobility Group Box-1 protein and additional structural changes in the cells confirmed that MBEH induces a necrotic form of cell death. Additionally, a negative relationship was observed between the cell death caused by MBEH and the amount of melanin present, suggesting that melanin may have a protective effect. In contrast, MBEH increased the expression of melanogenic enzymes in cultured melanocytes and skin samples, while 4-TBP decreased their levels.

In conclusion, MBEH and 4-TBP have distinctly different effects on melanocyte biology and activate separate cell death pathways. Since the type of cell death influences the subsequent immune response, these results provide insight into how each agent works in achieving depigmentation.

C) Kojic acid

Cellular and Molecular Mechanisms of Kojic Acid :-

The use of skin-lightening agents to address pigmentation issues is popular globally. However, the molecular and cellular mechanisms underlying these agents remain largely unexplored. Few compounds effectively inhibit tyrosinase while also influencing intracellular signals that lead to the transcriptional inhibition of genes involved in melanin synthesis.

Most skin-lightening agents are believed to lower melanin production by inhibiting tyrosinase activity with minimal toxicity to melanocytes. Some agents may also modulate intracellular signaling pathways, resulting in reduced melanin synthesis or increased melanocyte cell death. Malignant melanoma arises from the transformation and proliferation of melanocytes in the basal layer of the epidermis. These melanocytes can metastasize to other organs, disrupting their function. To understand the mechanisms of melanoma better, human malignant melanoma cells are often used in in vitro studies because they are reproducible, quantifiable, and easy to cultivate. These models mimic melanoma progression in vivo and offer a cost-effective alternative to clinical testing. Understanding the anti-apoptotic mechanisms that regulate cell death is crucial, as they contribute to drug resistance in tumor cells. Gaining insight into the signaling pathways that lead to tumor cell death could identify new targets for overcoming drug resistance and improving melanoma treatment.

Tyrosinase catalyzes several key reactions in the melanogenic pathway, including the hydroxylation of L-tyrosine, the dehydrogenation of L-DOPA, and the oxidation of dihydroxyindole. Additionally, catalase serves as a potent inhibitor of tyrosinase, facilitating the removal of hydrogen peroxide (H2O2). Peroxidase, in the presence of H2O2 and copper ions, promotes the conversion of monomers to eumelanin polymers. Thus, changes in enzymatic activity, protein modifications, and gene expression all impact melanogenesis in melanomas. The regulation of melanogenesis is complex and involves receptor-mediated pathways activated by hormones, neurotransmitters, cytokines, and growth factors. Research has investigated the biological effects of kojic acid on the gene and protein expression profiles of A375 human melanoma cells. While the tumorigenic potential and some genotoxic effects of kojic acid on human skin cell lines have been studied, its impact on various biological functions in human skin remains less well understood. Understanding the genes and proteins involved in melanoma could lead to improved early diagnostic and therapeutic strategies. Melanogenesis is regulated by tyrosinase and tyrosinase-related proteins

1 and 2 (TRP-1 and TRP-2). Tyrosinase is crucial for melanin production, converting tyrosine into dihydroxyphenylalanine (DOPA) and subsequently oxidizing DOPA into DOPA Quinone. Therefore, inhibiting tyrosinase is a common approach for achieving skin lightening. The expression of tyrosinase, TRP-1, and TRP-2 is transcriptionally regulated by the microphthalmia-associated transcription factor (MITF).

Skin pigmentation is influenced by various intrinsic and extrinsic factors. Notably, extracellular signal-regulated kinase (ERK) negatively regulates melanogenesis in melanoma cells and plays a significant role in activating MITF.

The transcriptional regulation of tyrosinase and related enzymes is the initial step in controlling their expression. MITF, a basic helix-loop-helix leucine zipper transcription factor, regulates both melanocyte activity and the transcription of melanogenic enzymes and melanosome structural proteins. Recent advancements have enhanced our understanding of the cellular and molecular mechanisms involved in pigmentation, leading to the development of numerous skin-lightening agents aimed at reducing hyperpigmentation. There is growing interest in exploring alternative mechanisms for achieving hypopigmentation and a need for standardized protocols to screen for melanogenic regulatory compounds. Additionally, the interaction between melanocytes and keratinocytes is vital for melanosome transfer, influencing various cellular processes such as intracellular trafficking and cell-cell recognition.

D) Arbutin

Arbutin is composed of one molecule of D-glucose which is attached to hydroquinone. In aqueous solutions, D-glucose can exist in α, β, or γ forms, with the β-anomer being the most prevalent. The β-anomer, known as arbutin, is predominantly found in plants like wheat, pear, and bearberry. On the other hand, α-arbutin consists of hydroquinone linked to the α-anomer of D-glucose. Arbutin has been researched for around 30 years as a potential alternative to hydroquinone for skin lightening. Given this background, it is an opportune moment to review the existing data on the efficacy and safety of arbutin, as well as to explore its mechanisms of action. Arbutin effectively reduces melanin levels at concentrations that minimally affect the viability of human melanocytes. Research by Maeda et al. demonstrated that arbutin decreases tyrosinase (TYR) activity in a dose-dependent manner between 0.1 and 1.0 mM without significantly impacting cell survival. At 0.5 mM, arbutin was found to be more

effective at inhibiting melanin synthesis than kojic acid or L-ascorbic acid. Similarly, Akiu et al. observed that arbutin reduced melanin content in murine melanoma B16 cells, attributed to decreased intracellular TYR activity.

Interestingly, the reduction in TYR activity caused by arbutin does not seem to stem from decreased expression of the enzyme. For instance, Maeda et al. found that while 0.5 mM arbutin reduced intracellular TYR activity by 50%, it did not affect the mRNA levels of TYR. Furthermore, Chakraborty et al. reported that arbutin (0.37 mM) lowered melanin levels without affecting protein levels of TYR or its related enzymes. This suggests that arbutin may inhibit the post-translational modification or maturation of TYR, or it may irreversibly inactivate already synthesized TYR. Experiments showed that treatment with 1.0 mM arbutin reduced TYR activity in cell lysates by 87%, indicating that arbutin acts more as an inactivator of TYR rather than a suppressor of its gene expression. In vitro assays using protein extracts from B16 cells indicated that arbutin can directly inhibit TYR activity. When tested with mushroom TYR, arbutin exhibited a lower inhibitory effect compared to kojic acid and L-ascorbic acid, with IC50 values of 10 mM for arbutin, 0.12 mM for kojic acid, and 0.2 mM for L-ascorbic acid. For human TYR, arbutin had IC50 values of 5.7 mM and 18.9 mM for L-tyrosine and L-DOPA, respectively, suggesting a competitive inhibition mechanism. However, the concentrations required for in vitro inhibition of TYR are higher than those needed to reduce melanin in cells, raising questions about the relevance of this mechanism in a cellular context. Additionally, arbutin can also serve as a substrate for TYR. In the presence of L-DOPA, arbutin is oxidized by mushroom TYR, producing 3,4-dihydroxyphenyl-O-beta-D-glucopyranoside.
The catalytic process involves different forms of the TYR enzyme, which can convert between states to process monophenol or diphenol substrates. In the absence of suitable substrates, the enzyme can become inactive by binding to monophenol inhibitors, which could include arbutin, thereby blocking its activity.

E) Ellagic Acid

Ellagic acid is capable of preventing pigmentation which is caused due to sun burn. The tyrosinase is inhibited noncompetitively during a dose dependent manner, through its capacity to chelate copper. In brownish guinea pig , ellagic acid induce a reversible inhibition of melanin synthesis[7]. Antioxidant, anti-inflammatory, cancer fighting are the key properties of ellagic acid .Ellagic acid blocks activity of enzyme involved in the synthesis of melanin. Here, there by ellagic acid shows skin lightening properties.[6]

F) Niacinamide (vitamin B3)

Physiologically niacinamide (vitamin B3) is an active amide of niacin . Niacinamide is required for cellular metabolism. Niacinamide interferes with the interaction between keratinocytes and melanocytes . There by inhibiting melanogenesis[8]. The protease activated receptors is also modulated by niacinamide . Clinical trials using 2% niacinamide reduces the entire area of hyperpigmentation and increases skin lightening. Niacinamide is the main ingredient of the foremost popular cosmeceuticals used for hyperpigmentation[7]. This substance is presumed to contribute to maintain skin homeostasis. This was done by regulating the redox status of cells along with several metabolite. Niacinamide is useful as a cosmeceutical ingredient in controlling skin aging and hyperpigmentation. The deficiency of niacin causes systemic disease pellagra which leads to dermatitis, diarrhea, dementia[9].

G) Soya

Phospholipids (45 -60%), essential fatty oil(30 -35%) are the major components of soy. It also contains active ingredients vitamin E, serine, isoflavones, Bowmann Birk protease inhibitor. These protease inhibitors inhibit PAR -2 activation, there by inhibiting melanosome transfer. Trypsin is inhibited by fatty acid in soy[7]. Isoflavone inhibits the dopa oxidase activity. Soy is found efficacious and safe .Several skin care products containing soy as ingredient are used to enhance hyperpigmentation .Skin whitening benefit are often seen after 12 weeks of application twice daily[10]. Topical treatments of soy milk have reversible depigmentation effect and used for more than upto 7 months end in adverse effects. It contains vitamin E,which naturally lightens the skin ,which has been shown to block the synthesis of melanin. Anti -inflammatory properties in soy extract helps to calm and sooth the irritated skin[7].

H) Linoleic acid

Linoleic acid shows the best ever lightening effect in UVB induced pigmentation. Linoleic acid accelerates

hexadeconic acid which is an antagonist mimicking protease inhibitors[11].

VII. TREATMENT OF SKIN DAMAGED BY SKIN WHITENING AGENTS

Skin infections can have a great impact on an individuals quality life causing discomfort in their mental emotions and long term damage to skin .Skin infections may begin from mild to severe conditions like atopic dermatitis, psoriasis ,vitiligo, melanoma etc. .These afflictions may require an effective treatment to prevent complications and promote healing. Skin lightening (SL) for cosmetic purposes can lead to significant negative effects on well-being and harmful consequences for the skin, posing considerable challenges forced dermatologists. In the current scenario skin lightening agents continue to dominate the cosmetic industry. A study is carried out on the dark side of skin lightening agents by the international team of dermatologists as a global public health issue. The study covers the areas of Africa, Asia, the Middle East, and the Americas which inspire a global discourse on how modern dermatologists can utilize scientific evidence and cultural competency. It ensures the concept of healthy skin and beauty on the consumers. In 1950s skin whitening became a very popular cosmetic practice in many African countries .The study conducted by the dermatologists have reported about 70% of women in Nigeria , 60% in Senegal, 50% in Mali , 30% in Ghana are using skin whitening regularly. Throughout the continent, both men and women are frequently targeted with marketing campaigns showing public figures who bleach their skin.

Consequently, individuals believes that lighter skin makes them attractive and increases their career opportunities. In the 1970s, the government began regulating active skin lightening ingredients, and by 1990, it prohibited them use of hydroquinone in cosmetic and over-the-counter products due to safety concerns and potential health risks. South Africa was the first country globally to prohibit skin bleaching products, a move recently followed by Rwanda, Côte d'Ivoire, Tanzania, Kenya, and Ghana.

A recent study conducted in four Asian countries revealed that good skin was represented as smooth and white, while bad skin was depicted as dry, dark, and wrinkled. Skin lightening products have experienced significant growth over the past few decades, with estimates indicating that 40% of South Koreans regularly use these agents. In South Korea, federal regulations have banned over-the-counter hydroquinone, yet imported and online cosmetic products containing hydroquinone, mercury, and steroid agents remain accessible. Despite awareness of the potential harmful side effects of skin lightening, trends like "glass skin"—which refers to a smooth, even-toned complexion resembling crystal clear glass—are becoming increasingly popular. Advertisements promoting intravenous glutathione injections, an antioxidant known for its ability to inhibit melanin production by blocking tyrosinase, are also on the rise. Across the Indian subcontinent, half of all expenditures in the skincare industry is directed toward skin lightening creams, highlighting the persistent prioritization of these products. In Southeast Asia, the use of whitening agents is growing, with recent studies estimating that one in two Filipino women use skin lightening products. With estimates indicating that 43.3% of Saudi women and over 60% of Jordanians use skin lightening products, along with potentially higher usage rates in other Middle Eastern countries. The cutaneous and systemic side effects of skin lightening agents are likely underestimated, as comprehensive ingredient lists—especially for illegal products—are rarely provided. While limited use of these agents may not lead to significant side effects, the risk of adverse reactions increases when they are used for extended periods or under occlusion. Preparations containing hydroquinone can lead to exogenous ochronosis, a paradoxical blue-gray hyperpigmentation resulting from the accumulation of homogentisic acid in the skin. There have also been reports of squamous cell carcinoma associated with its use. Systemic absorption may result in peripheral neuropathy, fish odor syndrome, and fetal growth retardation[12].

Many Asian women prefer a lighter skin tone, making skin whitening products some of the best-selling skincare items in the region. The most common strategy for achieving skin hypo-pigmentation is through the inhibition of tyrosinase, the enzyme responsible for the rate-limiting step in pigmentation. Although numerous tyrosinase inhibitors have been identified in vitro, only a limited number have demonstrated effective results in clinical trials. The hyperpigmentation resulting from skin whitening agents is considered permanent and may persist for a lifetime. Current treatment modalities for hyperpigmentation can be broadly categorized into several areas, including photo protection, topical and systemic therapies, chemical peels, and laser or light-

based treatments. Daily use of sunscreen can help minimize damage from sun exposure. Emollients are beneficial for treating dry and cracked skin, and in cases of severe itching, a mild hydrocortisone cream may be used for a limited duration. It's essential to consult a dermatologist for medical advice when addressing skin damage caused by prolonged use of skin bleaches. Topical therapy is the preferred first-line treatment for hyperpigmentation, with hydroquinone being the gold standard. It can be used on its own or in combination with other agents. Chemical peels and laser or light-based therapies are effective complementary treatments; however, caution is necessary when using these methods on patients with richly pigmented skin, as they have a higher risk of post-inflammatory hyperpigmentation[13].

VIII. COMPLICATIONS OF SKIN WHITENING PRACTICES

Skin whitening products are widely marketed for cosmetic purposes to achieve a lighter skin tone. They are also used clinically to treat pigmentary disorders like Melasma and post inflammatory hyperpigmentation. These whitening agents work at different stages of melanin production in the skin. Many act as competitive inhibitors of tyrosinase, the main enzyme involved in melanogenesis, while others impede the maturation of this enzyme or the transfer of pigment granules (melanosomes) from melanocytes to nearby keratinocytes. The cutaneous and systemic side effects of skin-lightening (SL) agents are likely underestimated, especially since the complete list of ingredients, particularly in illegal products, is rarely disclosed. While limited use may not lead to significant side effects, the risk of adverse reactions rises with prolonged use or when applied under occlusion. In areas such as the Caribbean, Middle East, India, and parts of Africa, including Nigeria and Ghana, women often apply creams and wrap their bodies in dressings beneath their clothing. Additionally, some individuals may use tight compression garments after applying these creams or bathe in mixtures containing steroids, hydroquinone, bleach, and hydrogen peroxide. In a society that values beauty and perfection, the prevalence of idealized images, particularly online, may motivate vulnerable individuals to improve their appearance with Image Enhancing Drugs (IEDs). This term encompasses a broad array of substances designed to modify both body aesthetics and physical appearance. The undisclosed presence of active ingredients has been associated with several health risks, including allergic reactions, liver damage, mercury poisoning, brain damage, and even death.

Global beauty standards regard skin tone as equally important as body shape in defining female attractiveness. Women from various backgrounds, including European, Asian, African, and Caribbean, have expressed dissatisfaction with their skin color. Consequently, practices aimed at altering natural skin color through tanning or lightening have gained popularity across different cultures[12].Various complications associated with skin lightening products have been reported, primarily linked to the undisclosed presence of mercury, hydroquinone, and corticosteroids. While many of these complications are aesthetic or related to the skin, they can also lead to serious systemic side effects. Research has identified nineteen aesthetic conditions associated with the use of skin lightening products, including joint hyperpigmentation, striae atrophicae, skin atrophy, eczema, skin infections, and skin cancer, among others. Systemic side effects from mercury-containing products include nephrotoxicity, neurotoxicity, and paradoxical hyperpigmentation. The literature well-documents systemic adverse effects from steroid-containing products, which can include hypertension, diabetes, and immunosuppression. Additionally, hydroquinone-containing products have been associated with numerous skin and systemic adverse effects, such as dermatitis, colloid milia, cataracts, scleral pigmentation, patchy depigmentation, and exogenous ochronosis[14].

IX. MEDIA AND CELEBRITY POP CULTURE INFLUENCE

The use of chemical agents to lighten skin, known as skin whitening, skin lightening, or skin bleaching, has become a widespread global phenomenon. Although the practice dates back to the Elizabethan era, its contemporary forms are most prevalent in communities of color, particularly among individuals of African descent. Skin bleaching is a multifaceted issue, shaped by a complex interplay of historical, cultural, socio-political, and psychological factors. Celebrities and media significantly impact the popularity of skin bleaching creams across various regions. In the United States and Africa, many celebrities have openly endorsed skin bleaching as a pathway to beauty and success, often emphasizing

that many black celebrities have lighter skin tones. This association between skin lightening and success has sparked discussions on media platforms, especially as advocacy groups and public figures increasingly denounce the practice[12]. In India, the Bollywood film industry predominantly features fair-skinned stars who are often seen in advertisements for skin lightening products. Similarly, in South Korea, actors and pop idols frequently lighten their skin and endorse such creams, reflecting a broader trend across Asia. Additionally, in Brazil, the Dominican Republic, and Puerto Rico, darker-skinned individuals, particularly black Latinos, are seldom cast as lead characters in films or appear on magazine covers. For centuries, fashion enthusiasts have relied on makeup to perfect their looks and stay in tune with rapidly changing trends. Today, the global beauty industry is undergoing a transformation led by South Korea, popularly known as K-beauty. Young people in Western countries have developed a strong fascination with K-pop—Korean pop music—and Korean dramas. Many Korean celebrities and pop stars, including the popular boy band BTS, are recognized for their distinctive styles. In addition to Korean entertainment, there has been a notable increase in the popularity of Korean beauty trends in the West over the past 18 months.

X. FUTURE DEVELOPMENT OF SKIN WHITENING CREAM

Skin-lightening ingredients that are very effective but cannot be patented to make more profit for companies are not used in cosmetic products. This is because companies don't invest in developing them. Ingredients like exfoliants and parabens are often used in cosmetics. Exfoliating ingredients, such as glycolic acid and lactic acid, can lighten the skin by removing layers of skin cells that contain melanin, showing that some cosmetic ingredients can make skin lighter. Parabens, which are used as preservatives in cosmetics and food, can also stop melanin production more effectively than some active ingredients used in skin-lightening products. There are many cosmetic ingredients that can lighten the skin, so the active ingredients in skin-lightening products must be more powerful than those in regular cosmetics (excluding makeup). In Japan, pharmaceutical skin-lightening products must say they can improve freckles and spots. These products work by reducing melanin production and preventing dark spots. Special cells called melanosomes increase in the skin of people with freckles. The time it takes for skin cells to renew is important in how quickly melanin fades. Some ingredients, like adenosine monophosphate and Dex panthenol, help skin cells renew faster, which helps melanin move out of the skin. Consumers expect their spots and freckles to fade, so a committee of experts has proposed a new standard for skin-lightening products that focuses on improving pigmentation gently. To prevent skin problems, like white patches (leukoderma), third-party test results should be used for approval instead of tests done by the cosmetics company itself. In the future, better definitions and testing methods for skin-lightening products will be created through cooperation between universities, dermatologists, and companies[15].

XI. CONCLUSION

In many societies, lighter skin is historically associated with higher social status, beauty, and privilege. This has led to widespread use of skin whitening products. Media, advertisements, and even the fashion and entertainment industries have perpetuated this ideal, influencing people's desire for fairer skin. Common methods for skin whitening include the use of topical creams, serums, chemical peels, laser treatments, and oral supplements. Some skin whitening treatments, particularly those containing mercury, have been linked to toxic effects such as kidney damage, neurological problems, and skin discoloration. If skin lightening is desired for specific concerns like hyperpigmentation or age spots, it's important to seek professional guidance and use products that are scientifically validated and safe. While the desire for lighter skin is influenced by deep-seated cultural and societal factors, it is important to be aware of the health risks and ethical implications of skin whitening practices. Prioritizing skin health, embracing natural beauty, and promoting inclusivity are key to breaking the harmful cycle of colorism. Instead of striving for lighter skin, we should focus on fostering confidence in all skin tones and advocating for diversity and acceptance.

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