

**MELASMA: AN AYURVEDIC PERSPECTIVE ON PATHOGENESIS AND
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ABSTRACT

Skin is the body's largest organ, serving as a protective barrier against environmental factors while regulating temperature and preventing moisture loss. It consists of multiple layers, including the epidermis, dermis, and subcutaneous tissue, each playing a crucial role in skin health and appearance.^[1] Hyperpigmentation is a common dermatological condition characterized by the darkening of certain skin areas due to excess melanin production. It can result from various factors, including sun exposure, inflammation, hormonal changes, and skin injuries. Common types of hyperpigmentation include melasma, post-inflammatory hyperpigmentation (PIH), and age spots. While generally harmless, it can affect self-esteem and may indicate underlying skin health issues.^[2] Effective management of hyperpigmentation involves sun protection, topical treatments (such as vitamin C, retinoids, and hydroquinone), chemical peels, and laser therapies.^[3] Understanding the causes and prevention strategies is essential for maintaining an even skin tone and overall skin health. Further research continues to explore advanced treatments and the role of genetics in hyperpigmentation development. Panchakarma Therapy (Detoxification) A targeted Ayurvedic detox program designed to remove toxins (Ama) from the body, which can contribute to issues with skin pigmentation. Virechana (Purgation Therapy) – A cleansing method that employs herbal laxatives to eliminate excess Pitta (heat) from the liver and enhance skin appearance. Raktamokshana (Bloodletting Therapy) – An age-old technique for blood purification that involves the use of leeches or controlled blood removal to address persistent pigmentation.

KEYWORDS: Common types of hyperpigmentation include melasma, post-inflammatory hyperpigmentation (PIH), and age spots.

INTRODUCTION**Skin Layers and the Development of Hyperpigmentation**

The skin serves as the body's largest organ and is made up of three primary layers, each essential for protection, regulation, and overall skin health. Hyperpigmentation arises when there is an excessive production of melanin, the pigment that gives skin its color, triggered by several factors such as sun exposure, inflammation, or hormonal shifts.

1. Skin Layers

A. Epidermis (Outer Layer) The outermost skin layer serves as a protective barrier. It houses keratinocytes (skin cells) and melanocytes, the cells that produce melanin. This layer is primarily where hyperpigmentation occurs due to an accumulation of melanin.

B. Dermis (Middle Layer) Positioned beneath the epidermis, this layer contains blood vessels, collagen, and elastin, which provide strength and flexibility. When the skin experiences damage or inflammation (such as from acne or injuries), the dermis prompts melanocytes in the epidermis to generate more melanin, resulting in post-inflammatory hyperpigmentation (PIH).

C. Hypodermis (Subcutaneous Layer) The deepest skin layer consists of fat and connective tissue. It functions in insulation, cushioning, and delivering nutrients to the layers above. Although hyperpigmentation does not directly impact this layer, underlying issues like hormonal fluctuations or inflammation can lead to increased melanin production in the upper layers.

How Hyperpigmentation Develops

Hyperpigmentation occurs due to an excessive production of melanin, which is regulated by melanocytes located in the epidermis.

The primary factors include^[4]

1. Sun Exposure – Ultraviolet rays activate melanocytes to generate too much melanin, resulting in sunspots or freckles.
2. Inflammation & Skin Damage – Conditions such as acne, cuts, burns, or eczema can lead to post-inflammatory hyperpigmentation (PIH).^[5]
3. Hormonal Fluctuations – Situations like pregnancy or hormonal imbalances can stimulate melanin overproduction, resulting in melasma.
4. Medications & Chemical Interaction – Certain medications (such as chemotherapy or antibiotics) and strong chemicals may lead to pigmentation problems.
5. Genetic Influences – Some individuals are genetically inclined to pigmentation issues, such as freckles or birthmarks. By grasping how the skin layers work and the origins of hyperpigmentation, it becomes more straightforward to identify treatments for prevention and correction.

Types of Hyperpigmentation

Hyperpigmentation is the condition characterized by the darkening of specific areas of the skin due to increased melanin production. It can arise from various factors such as sun exposure, hormonal fluctuations, and skin inflammation. Here are the primary types of hyperpigmentation.^{[6][7]}

1. Melasma (Chloasma) Appearance: Large, dark brown or grayish patches, frequently symmetrical.
 - Common Areas: Face (cheeks, forehead, upper lip), occasionally forearms.
 - Causes: - Hormonal fluctuations (pregnancy, birth control, menopause) - Sun exposure - Genetic factors
 - Treatment: Sunscreen, topical treatments (kojic acid, hydroquinone, vitamin C), laser treatments.
2. Post-Inflammatory Hyperpigmentation (PIH)
 - Appearance: Dark spots or patches that remain after skin injury.
 - Common Areas: Any location where inflammation or injury has occurred (face, body).
 - Causes: - Acne scars - Cuts, burns, insect bites - Conditions like eczema or psoriasis
 - Treatment: Chemical peels, retinoids, exfoliation, Ayurvedic remedies (turmeric, sandalwood).
3. Sunspots (Solar Lentigines / Age Spots / Liver Spots)
 - Appearance: Small, flat, dark brown or black spots.
 - Common Areas: Face, hands, shoulders, arms (areas exposed to the sun).
 - Causes: - Extended sun exposure - Aging - UV radiation damage

- Treatment: Sunscreen, laser treatments, microdermabrasion, vitamin C serums.

4. Freckles (Ephelides)

- Appearance: Small, light brown to reddish spots that become darker with sun exposure.
- Common Areas: Face, shoulders, arms (sun-exposed regions).
- Causes: - Genetic factors - Increased visibility due to UV exposure
- Treatment: Sun protection, chemical peels, laser treatments.

5. Drug-Induced Hyperpigmentation

- Appearance: Blue-gray or brown patches, sometimes affecting nails.
- Common Areas: Face, lips, gums, nails, inner mouth.
- Causes: - Medications such as antimalarials, chemotherapy, antibiotics.
- Treatment: Discontinuing the medication topical treatments, laser therapy.

6. Acanthosis Nigricans

- Appearance: Thickened, dark, velvety skin.
- Common Areas: Neck, armpits, groin, beneath the breasts.
- Causes: - Insulin resistance (often related to diabetes) - Obesity - Hormonal disorders (PCOS, thyroid problems)
- Treatment: Addressing underlying issues, weight management, exfoliation.

Pathogenesis of Melasma

Melasma is a common pigmentary disorder characterized by symmetric, brown-to-grayish facial patches. It primarily affects areas exposed to sunlight, such as the cheeks, forehead, upper lip, and chin. The condition is more prevalent in women, especially those with darker skin tones, due to higher melanin activity.^[8]

1. Key Factors in Melasma Development

Melasma results from a complex interplay of genetic, hormonal, and environmental factors that stimulate excess melanin production. The pathogenesis involves melanocyte hyperactivity, dermal changes, and vascular involvement.^[9]

A. Melanocyte Dysfunction (Excess Melanin Production)

- In melasma, melanocytes (pigment-producing cells) are hyperactive and produce excess melanin.
- This leads to epidermal, dermal, or mixed-type pigmentation, depending on how deeply melanin is deposited in the skin.
- The condition is associated with an increased number and size of melanosomes (melanin-containing granules) in affected areas.

B. Hormonal Influence (Estrogen & Progesterone)

- Melasma is highly linked to hormonal fluctuations, especially during pregnancy, oral contraceptive use, and hormone therapy.
- Estrogen & progesterone stimulate melanocortin receptors (MC1R) in melanocytes, increasing melanin synthesis.
- Hormones also increase tyrosinase activity, a key enzyme in melanin production.^[10]

C. UV Radiation & Visible Light Exposure

- Ultraviolet (UV) rays trigger oxidative stress and activate melanocytes, leading to excess melanin production.
- Visible light (including blue light from screens) also worsens pigmentation by stimulating reactive oxygen species (ROS) in the skin.
- UV exposure increases vascularization, enhancing inflammation and pigmentation.

D. Inflammatory & Vascular Changes

- Inflammation from external factors (sunlight, pollution, cosmetics) can stimulate melanin production.
- Vascular abnormalities (increased blood vessels in affected areas) contribute to persistent pigmentation.
- Endothelial cells in blood vessels release growth factors that stimulate melanocyte activity.

E. Genetic Predisposition

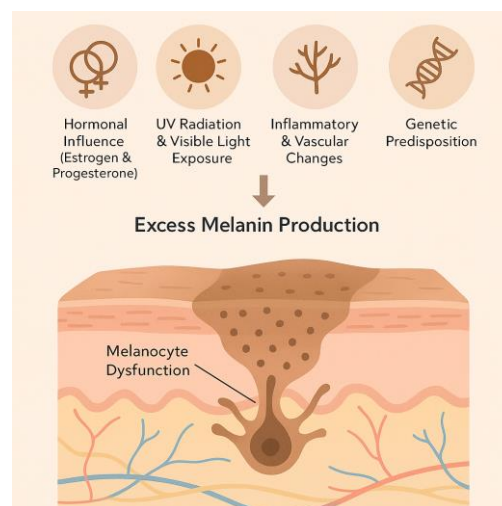
- Family history increases melasma risk, especially in individuals with darker skin types (Fitzpatrick III-V).
- Genes regulating melanocyte function, response to UV radiation, and hormone sensitivity may contribute to melasma.

2. Types of Melanin Deposition in Melasma

Epidermal Melasma: Melanin is deposited in the superficial skin layers; responds well to treatment.

Dermal Melasma: Melanin is deeper in the skin, making treatment more challenging.

Mixed Melasma: A combination of both, leading to persistent pigmentation.



METHODS AND MATERIALS

In Ayurveda, melasma is commonly linked to conditions such as "Vyanga" and "Neelika," which are marked by dark patches on the facial skin, particularly on the cheeks and forehead. It is primarily considered a disorder of Pitta and Vata doshas, frequently triggered by factors like stress, sun exposure, hormonal imbalances, and unhealthy lifestyle habits.

Here's a summary of treatments for melasma based on the wisdom of the prominent Ayurvedic acharyas.

1. Acharya Charaka's Method (Charaka Samhita) Concept

Charaka advocates for internal detoxification and blood purification to treat skin discoloration.^[11]

- Treatments: Raktashodhana (Blood Purification) – Utilization of herbs such as Manjistha, Neem, Guduchi, and Haridra.
- Shamana (Palliative therapy) – Balancing Pitta and Vata doshas with soothing and nourishing herbs.
- Nidana Parivarjana – Steering clear of causative elements (e.g., spicy foods, excessive sun exposure, emotional strain).

2. Acharya Sushruta's Method (Sushruta Samhita) Concept

Sushruta emphasizes detoxification and localized therapies.

- Treatments: Virechana Karma – Purgative therapy employing Trivrit and Avipattikar Churna to eliminate surplus Pitta.
- Lepana (Topical Applications) – Application of herbal pastes like Lodhra + Manjistha + Yashtimadhu blended with rose water or milk.^[12]
- Raktamokshana – Bloodletting (in severe cases) to rid the body of impure blood and enhance skin health.

3. Acharya Vagbhata's Perspective (Ashtanga Hridaya) Concept

Focuses on both internal and external methods with particular regard for digestion and the mind-body connection.

- Treatments: Deepana & Pachana – Enhancement of digestive fire through Trikatu and Chitrakadi Vati to eliminate Ama (toxins).
- Nasya Karma – Application of medicated oils like Anu Taila into the nostrils to address hormonal and mental factors.
- Medhya Rasayanas – Incorporation of rejuvenative herbs like Shankhpushpi, Brahmi, and Ashwagandha to alleviate stress-induced pigmentation.^[13]
- Recommended Ayurvedic Formulations by Acharyas Formulation Purpose Kumkumadi Tailam Enhances complexion and diminishes pigmentation (for external use) Sarivadyasava.
- Blood purifier that operates from the inside Avipattikar Churna-Helps balance Pitta and supports gentle detoxification
- Manjishtadi Kwatha Promotes-liver function and purifies blood Chandanadi Vati Soothes Pitta, beneficial for facial heat and discoloration.^[14]

Lifestyle & Diet (Consensus Among Acharyas) Ahara (Diet)

- Steer clear of spicy, sour, fried, and fermented items. Embrace cooling, hydrating, and sattvic foods like cucumbers, ghee, and coconut water.
- Vihara (Lifestyle): Limit sun exposure, manage stress levels, and maintain consistent routines. Engage in Pranayama, meditation, and ensure adequate sleep.^[15]

Virechana Therapy Formulations for Melasma (Vyanga) in Ayurveda

Virechana, a vital Panchakarma therapy, plays a crucial role in Pitta and Rakta Shodhana (blood purification) in Ayurveda. Since melasma (Vyanga) arises primarily due to an imbalance of Pitta and Vata doshas, Virechana aids in liver detoxification, melanin regulation, and pigmentation reduction.

Herbal Formulations (Virechana Dravyas) for Melasma

Ayurvedic scholars have recommended various herbal preparations to ensure a safe and effective detoxification process for melasma treatment.^[16]

1. Avipattikar Churna

- Key Ingredients: Trikatu (Black Pepper, Long Pepper, Ginger), Triphala, Amla, Musta, Vidanga
- Benefits: Restores Pitta balance, addressing the root cause of facial discoloration.
- Detoxifies the liver and reduces inflammation.
- Improves digestion and eliminates toxins (Ama).
- Dosage: 5–10 grams with warm water before meals.

2. Trivrit Leha (Trivrit Avaleha)

- Key Ingredients: Trivrit (*Operculina turpethum*), Danti, Draksha, Sharkara (Sugar), Ghee, Madhu (Honey).^[17]
- Benefits: A potent Pitta-pacifying remedy.
- Facilitates gentle purgation and removes toxins.
- Regulates hormonal imbalances, particularly beneficial for melasma triggered by pregnancy or contraceptive use.
- Dosage: 10–15 grams with warm milk or water.

3. Aragwadhadi Churna

- Key Ingredients: Aragwadha (*Cassia fistula*), Haritaki, Vibhitaki, Amalaki, Musta, Manjistha
- Benefits: A powerful Raktashodhak (blood purifier) and liver cleanser.
- Reduces excessive melanin buildup, aiding in skin lightening.
- Promotes gut health, which indirectly enhances skin clarity.
- Dosage: 5–10 grams with warm water at bedtime.

4. Patolakaturohinyadi Kashayam

- Key Ingredients: Patola, Katurohini, Nimba (Neem), Guduchi, Patha.
- Benefits: Profoundly detoxifies the liver and blood, helping to fade hyperpigmentation.
- Corrects hormonal imbalances associated with melasma.
- Effective in treating post-inflammatory pigmentation (PIH) and acne-related dark spots.
- Dosage: 15–30 ml with warm water, twice daily.

5. Eranda Taila (Castor Oil) Purgation^[18]

- Key Ingredient: Pure Eranda Taila (Castor Oil)
- Benefits: Eliminates deep-seated Pitta toxins from the liver and intestines.
- Aids in balancing hormones that contribute to melasma.
- Enhances digestion, preventing toxin accumulation that can exacerbate pigmentation.
- Dosage: 10–30 ml with warm milk at bedtime.^[19]

DISCUSSION

Melasma is a chronic skin disorder characterized by symmetrical, brownish patches on sun-exposed areas, especially the face. It is more common in women and is often triggered by hormonal fluctuations, sun exposure, and genetic predisposition.

From a treatment perspective, modern dermatology and Ayurveda approach melasma differently—modern medicine focuses on symptom relief and pigment reduction, while Ayurveda aims for root cause elimination and holistic healing. Melasma, also known as Vyanga in Ayurveda, is a common hyperpigmentation disorder characterized by dark, irregular patches on sun-exposed areas, especially the face. From a modern perspective, melasma occurs due to an overproduction of melanin triggered by factors such as hormonal

imbalances, UV exposure, genetics, and oxidative stress. It is more prevalent in women, particularly during pregnancy and while using oral contraceptives, earning it the term “pregnancy mask.” Modern dermatology primarily focuses on symptom management through topical depigmenting agents like hydroquinone, retinoids, azelaic acid, and chemical peels, along with laser therapy for resistant cases. However, these treatments often provide temporary relief, with frequent relapses once the treatment stops.

In contrast, Ayurveda takes a holistic approach to melasma treatment by addressing the root cause—Pitta and Vata dosha imbalances affecting Rakta Dhatu (blood) and Medo Dhatu (fat tissues). Ayurvedic treatment focuses on Shodhana (detoxification) and Shamana (palliative therapy) to cleanse the body and restore skin health. Virechana (purgation therapy), a key Panchakarma therapy, is highly recommended as it helps in Pitta detoxification, liver cleansing, and hormonal balance, thereby reducing pigmentation naturally. Herbal formulations such as Avipattikar Churna, Trivrit Leha, and Patolakaturohinyadi Kashayam are commonly used to support internal detoxification. In addition, Raktamokshana (bloodletting therapy) helps eliminate deep-seated toxins from the blood, promoting clearer skin.

For external care, Ayurveda recommends the application of Kumkumadi Tailam, a saffron-based oil known for its skin-lightening and rejuvenating properties. Herbal face packs containing Lodhra, Manjistha, Yashtimadhu, and Sandalwood help soothe the skin and reduce hyperpigmentation. Additionally, dietary and lifestyle modifications play a crucial role in melasma management. Avoiding spicy, fried, and fermented foods while incorporating cooling foods like ghee, pomegranate, coconut water, and amla helps in maintaining Pitta balance. Practicing Pranayama (breathing exercises) like Sheetali and Sheetkari also aids in cooling the body and reducing stress-induced pigmentation. Sun protection is essential in both modern and Ayurvedic treatments, with Ayurveda suggesting natural sunblock agents like Aloe Vera, Sandalwood, and Rosewater sprays.

While modern treatments offer quick results, they often come with side effects and recurrence issues. Ayurveda, on the other hand, provides a long-term, sustainable solution by balancing the doshas and detoxifying the body naturally. A combined approach that includes modern sun protection along with Ayurvedic detoxification, herbal formulations, and dietary corrections can be highly effective in managing melasma holistically.

CONCLUSION

Melasma is a challenging hyperpigmentation disorder influenced by hormonal imbalances, sun exposure, genetics, and oxidative stress. While modern medicine

offers topical treatments, chemical peels, and laser therapies, these approaches often provide only temporary relief and may lead to recurrence. Ayurveda, on the other hand, focuses on eliminating the root cause by balancing Pitta and Vata doshas, detoxifying the body, and purifying the blood through therapies like Virechana (purgation therapy) and Raktamokshana (bloodletting therapy). Herbal formulations such as Avipattikar Churna, Trivrit Leha, and Patolakaturohinyadi Kashayam aid in internal detoxification, while external applications like Kumkumadi Tailam and herbal face packs enhance skin clarity. Additionally, dietary and lifestyle modifications, including a Pitta-pacifying diet, stress management, and natural sun protection, play a crucial role in preventing recurrence. Compared to modern treatments, Ayurveda provides a holistic and long-term approach by addressing the internal imbalances that contribute to melasma. A combined approach incorporating Ayurvedic detoxification, herbal remedies, and modern sun protection can offer sustainable and effective management of melasma, promoting healthy, radiant skin naturally.

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