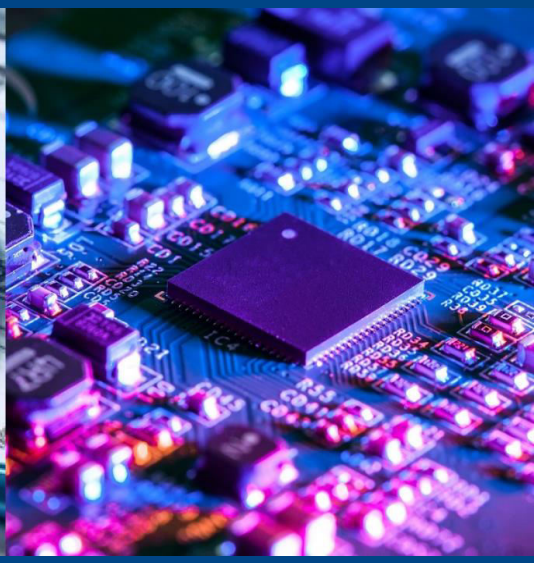
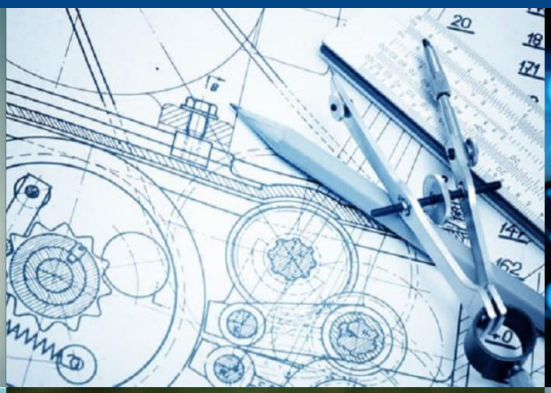
ISSN: 2582-7219

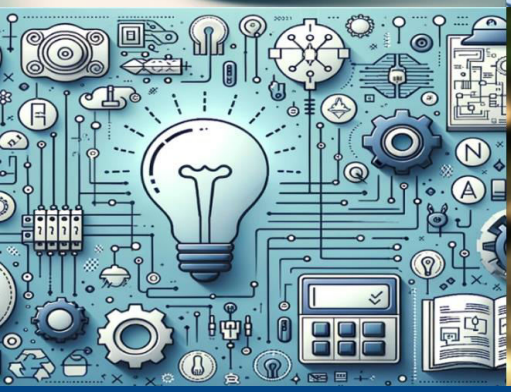




International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206 **Volume 9, Issue 3, March 2026**

© 2026 IJMRSET | Volume 9, Issue 3, March 2026| DOI: 10.15680/IJMRSET.2026.0903209

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Hyperpigmentation: Diagnosis, Management and Herbal Treatment

Ramlani Sameer, Khare Nripen Prakash, Dr. Shrivastava Satyaendra

Parijat College of Pharmacy, Indore (M.P.), India

ABSTRACT: Hyperpigmentation is a common skin condition in which certain areas become darker due to excess melanin production. It can affect individuals of all ages and skin types and is often caused by sun exposure, hormonal changes, skin injury, or aging. This review highlights different types such as melasma, sunspots, freckles, and post-inflammatory hyperpigmentation, along with their causes, symptoms, and prevention. Various treatment approaches, including topical medications, dermatological procedures, and herbal remedies, are discussed. Recent advances in research, such as nanotechnology and plant-based therapies, offer promising, safer, and more effective options for managing hyperpigmentation in a personalized manner.

KEYWORDS: Hyperpigmentation, Melanin, Herbal treatment, Skin disorder

.

I. INTRODUCTION

Hyperpigmentation is one of the most common dermatological concerns affecting people of all ages and skin types. It refers to a condition in which certain areas of the skin appear darker than the surrounding tissue due to an overproduction or uneven distribution of melanin, the natural pigment responsible for determining skin, hair, and eye colour. This pigment is produced by specialized cells known as melanocytes, located in the basal layer of the epidermis. When these cells become overstimulated by sunlight, inflammation, hormonal changes, or other factors they produce excess melanin, which accumulates in specific regions of the skin, leading to visible dark patches or spots.

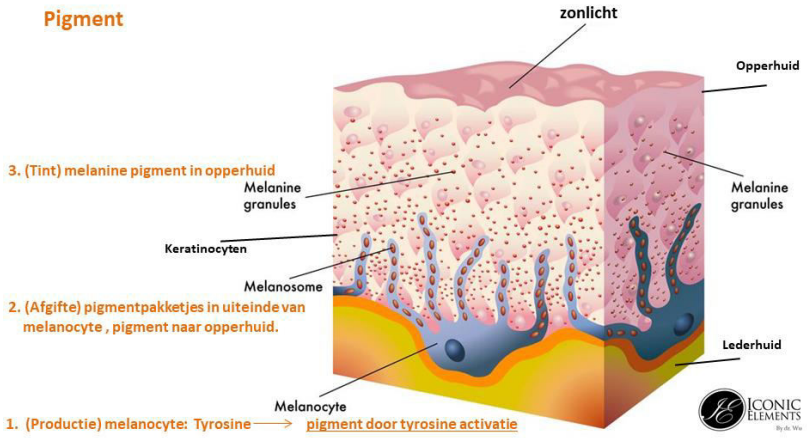


Fig.1 Location of Melanocytes

II. TYPES

1. Melasma

Definition: Melasma is a common skin condition that causes brown or grey-brown patches on the skin, mostly on the face. Often triggered by hormonal changes (e.g. pregnancy, birth control pills). Worsened by sun exposure, Appears symmetrically on cheeks, forehead, and upper lip. More common in women and people with medium to dark skin tone.

© 2026 IJMRSET | Volume 9, Issue 3, March 2026| DOI: 10.15680/IJMRSET.2026.0903209

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Fig.2 Melasma

2. Sunspots (also called Age Spots or Solar Lentigines)
Definition: Sunspots are flat, brown or black spots that develop on skin exposed to the sun over time, especially with aging. It is caused by UV damage. Typically appear on face, hands, shoulders, and arms. Common in older adults or those with a lot of sun exposure. Not harmful, but often treated for cosmetic reason.

Fig.3 Sunspots

3. Freckles (Ephelides)
Definition:Freckles are small, flat, light brown spots that are usually genetic and become more noticeable with sun exposure. Appear mostly in fair-skinned individuals. Common on face, arms, and upper body. Often fade or become lighter in winter. Harmless and typically don't need treatment.

Fig.4 Freckles

© 2026 IJMRSET | Volume 9, Issue 3, March 2026| DOI: 10.15680/IJMRSET.2026.0903209

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

4. Post-Inflammatory Hyperpigmentation (PIH)

Definition:PIH is dark discoloration that appears after the skin heals from an injury, acne, burn, or inflammation. Caused by increased melanin after skin trauma. Appears as dark spots or patches in the area of previous damage. Can occur in all skin tones, but more noticeable in darker skin.

Fig.5 PIH

III. CAUSES

- Too much sun - Excessive to ultraviolet (UV) rays triggers overproduction of melanin, the pigment that gives skin its color. This leads to sunspots, freckles, and uneven dark patches, especially on exposed areas like the face and arms.
- After skin injury - When the skin heals after cuts, acne, burns, or rashes, it may produce extra pigment in that area. This is called post-inflammatory hyperpigmentation (PIH) and often appears as dark marks or spots.
- Hormonal fluctuations-especially during pregnancy, menopause, or with birth control use—can increase melanin activity. This often results in melasma, a form of hyperpigmentation seen as brown or gray-brown patches on the face.
- Certain medicines -.Some medications, like anti-malarials, chemotherapy drugs, or antibiotics, can stimulate pigment production. They may cause widespread or localized darkening of the skin as a side effect. Skin problems – Eczema, acne, or psoriasis can lead to dark spots after healing.
- Aging -As the skin ages, its ability to regulate melanin becomes uneven. This causes age spots or liver spots, usually appearing on sun-exposed areas like the face and hands.
- Friction or rubbing – Constant rubbing from tight clothing, jewelry, or skin folds stimulates melanin production. This often leads to darkening in areas like the neck, underarms, thighs, and elbows.
- Chemical exposure -Frequent contact with harsh chemicals or irritants can damage skin cells and trigger pigmentation. This is common in people using strong skin-care products or exposed to industrial chemicals.
- Skin problems - Chronic skin conditions like eczema, psoriasis, or acne can cause inflammation that leads to dark spots. Repeated flare-ups worsen pigmentation over time, especially if the skin is picked or scratched.

IV. SIGNS

- Dark patches or spots on the skin
- Uneven skin tone
- Brown, black, or grayish areas
- Spots can appear on the face, hands, neck, or other body parts
- Can develop slowly over time
- May become darker with sun exposure
- Painless itching and rashes

© 2026 IJMRSET | Volume 9, Issue 3, March 2026| DOI: 10.15680/IJMRSET.2026.0903209

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

V. SYMPTOMS

- Skin darkening
- Mild itching or irritation
- Dryness or rough skin texture
- Emotional discomfort or self-consciousness
- Sensitivity to sunlight
- Worsening of discoloration after sun exposure
- Persistent dark marks after acne or rashes heal
- No pain or swelling

VI. AREAS COMMONLY AFFECTED

- Neck - The neck often develops dark patches due to constant sun exposure and friction from collars. or jewelry.
- Hands - The hands are frequently exposed to sunlight and environmental damage, leading to age spots or sunspots.
- Face - The face is the most common site of hyperpigmentation because it's always exposed to sunlight.
- Arms - The forearms are often exposed to UV rays, resulting in freckles or sun-induced pigmentation.
- Upper chest - This area is sensitive and frequently exposed when wearing open-neck clothing.
- Inner thighs - Pigmentation here is commonly caused by friction between the thighs, tight clothing, or hormonal factors.

VII. PREVENTION

- Use of Sunscreen - Apply a broad-spectrum sunscreen with SPF 30 or higher daily, even on cloudy days. It protects the skin from harmful UV rays that trigger melanin production and dark spots.
- Avoid Excessive Sun Exposure - Limit time spent under direct sunlight, especially between 10 a.m. and 4 p.m. Wearing hats, scarves, and long sleeves helps shield the skin from UV damage.
- Gentle Skincare Routine - Use mild cleansers and avoid harsh scrubbing or strong chemical products.
- Treat Skin Conditions Early - Promptly treat acne, rashes, or eczema to prevent lingering dark marks after healing. Early management reduces inflammation and limits pigment overproduction.
- Avoid Picking or Scratching the Skin - Touching or picking pimples, insect bites, or scabs can cause injury and dark marks.
- Maintain Hormonal Balance - Hormonal changes can trigger melasma and pigmentation.
- Healthy Diet and Hydration - Eating vitamin-rich foods, especially those containing Vitamin C and E, supports healthy skin.
- Avoid Harsh Chemicals - Limit exposure to strong cosmetics, bleaching creams, or industrial chemicals. These substances can irritate or damage the skin, leading to uneven pigmentation.
- Regular Exfoliation (Mild) - Gentle exfoliation removes dead skin cells and promotes even skin renewal. However, over-exfoliating should be avoided as it can trigger irritation and darkening.
- Avoid shaving, try trimming - Frequent shaving can cause skin irritation, small cuts, and friction, leading to dark patches over time. Using a trimmer instead reduces direct contact with the skin.

VIII. TREATMENTS

8.1 Topical Treatment:-

Creams: Contain skin-lightening agents like Hydroquinone (2–4%), Tretinoin (0.025–0.05%), or Corticosteroids (in combination).

- Examples: Melalite Forte Cream (Hydroquinone 4%), Tri-Luma Cream (Hydroquinone + Tretinoin + Fluocinolone acetonide).

Ointments: Used for dry skin; provide a prolonged drug release and deeper penetration.

- Example: Aziderm Ointment (Azelaic Acid 20%) – reduces melanin formation and acne-induced pigmentation.

Gels: Suitable for oily or acne-prone skin; non-greasy and easily absorbed.

- Examples: Demelan Gel (Kojic acid + Arbutin + Glycolic acid).

© 2026 IJMRSET | Volume 9, Issue 3, March 2026| DOI: 10.15680/IJMRSET.2026.0903209

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Lotions: Used for large body areas and mild pigmentation.

- Examples: Cetaphil Bright Healthy Radiance Lotion, Meladerm Lotion (contains α-arbutin and vitamin C).

Serums: Highly concentrated, fast-absorbing liquids for targeted pigmentation.

- Examples: Olay Luminous Tone Perfecting Serum (Niacinamide), The Ordinary Vitamin C Suspension, Freshly Juiced Vitamin C Serum.

8.2 Medical Procedures

Chemical Peels (Liquid Solutions):

Use acids to exfoliate the pigmented epidermal layer.

- Examples: Glycolic acid (20–70%), Salicylic acid (20–30%), Trichloroacetic acid (TCA 10–25%) peels.
- Products: Obagi Blue Peel, Cosmelan Peel, Mesoestetic Mela Peel.

Laser Therapy:

Uses targeted light (Q-switched Nd:YAG or fractional lasers) to break down melanin.

- Products / Devices: Candela GentleLase, Revlite Q-Switched Laser, Fraxel Dual Laser.

8.3 Herbal Treatment- Herbal or plant-based treatments are gaining popularity as natural alternatives to chemical agents for treating hyperpigmentation. They typically work by inhibiting melanin production , promoting skin regeneration, or acting as antioxidants and anti-inflammatories.

Herbal Creams / Ointments:

Contain extracts such as Aloe vera, Licorice, Turmeric, or Mulberry.

➢ Examples: Vicco Turmeric Cream, Bio White Advanced Fairness Cream (Biotique), Himalaya Fairness Cream (Aloe + Licorice).

Face Masks / Pastes:

Used for short-term application to remove tan and lighten pigmentation naturally.

➢ Examples: Multani Mitti (Fuller's Earth) Pack, Sandalwood + Turmeric Paste, Himalaya Neem Mask.

Herbal Serums / Oils:

Rich in natural antioxidants and essential oils for nighttime use.

➢ Examples: Kama Ayurveda Kumkumadi Tailam, Forest Essentials Soundarya Radiance Serum, Rosehip Oil (The Ordinary).

Oral Capsules / Tablets:

Used as supplements to enhance skin health and reduce melanin formation from within.

➢ Examples: Glutathione Capsules (L-Glutathione 500 mg), Grape Seed Extract Tablets, Vitamin C (Limcee 500 mg).

Herbal Gels / Toners:

Lightweight, water-based products used to refresh and even out skin tone.

➢ Examples: Aloe Vera Gel (Patanjali, WOW Skin Science), Cucumber Toner, Lemon Extract Toner.

IX. POSSIBLE FUTURE SCOPE FOR RESEARCH

Hyperpigmentation remains a challenging dermatological concern due to its multifactorial causes and variable response to therapy. Although several topical, oral, and procedural options exist, there is still significant scope for innovation and improvement. Future research can focus on the following areas:

1. Development of Target-Specific Molecules:

New research can aim to identify novel inhibitors of tyrosinase and related melanogenic enzymes with higher selectivity and fewer side effects than hydroquinone. Peptide-based or nano-formulated compounds that act directly on melanocyte signaling pathways could provide safer and more effective depigmentation.

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

2. Nanotechnology-Based Drug Delivery Systems:
Formulating existing agents like kojic acid, arbutin, or niacinamide into nanocarriers (liposomes, solid-lipid nanoparticles, nano emulsions) can improve penetration, stability, and controlled release. Such targeted delivery systems reduce irritation and enhance efficacy at lower doses.

3. Combination Therapy Optimization:
Research should evaluate synergistic combinations of topical, oral, and procedural treatments. For instance, combining antioxidants with retinoids or light-based therapies may yield more uniform and longer-lasting results with reduced recurrence.

4. Personalized and Genetic-Based Treatment Approaches:
Future studies may explore genomic profiling and biomarker identification to predict individual responses to pigmentation therapies. This personalized approach could minimize trial-and-error treatment and enhance patient outcomes.

5. Exploration of Novel Herbal and Phytochemical Agents:
Screening of unexplored plant extracts for depigmenting, anti-oxidative, or anti-inflammatory properties offers a natural, low-toxicity alternative to synthetic drugs. Standardization and clinical validation of herbal formulations remain an important area of research.

Summary:
Hyperpigmentation is a common dermatological disorder caused by the excess production of melanin, leading to dark patches on the skin. It can result from sun exposure, hormonal imbalance, inflammation, aging, or medication use. Common types include melasma, sunspots, freckles, and post-inflammatory hyperpigmentation. Treatment approaches include topical agents such as hydroquinone, retinoids, and herbal creams, as well as chemical peels, laser therapy, and oral supplements like tranexamic acid or antioxidants. Preventive measures focus on sunscreen use, gentle skincare, and early management of skin conditions. Modern research emphasizes personalized, multi-therapy regimens and the use of novel drug delivery systems for better results.

X. CONCLUSION

Hyperpigmentation, though not life-threatening, significantly impacts cosmetic appearance and self-esteem. Effective management requires identifying the cause and applying suitable preventive and therapeutic strategies. Combination therapies integrating sun protection, topical formulations, and procedural treatments yield the best outcomes. Herbal and antioxidant-based alternatives are emerging as safer and sustainable options. Future research should focus on nanotechnology, personalized treatment, and standardized herbal formulations to enhance efficacy and minimize side effects. Overall, comprehensive care—combining clinical management with patient education and lifestyle modification—can achieve long-term improvement and maintain even, healthy skin tone.

REFERENCES

1. Hollinger J.C., Angra K & Halder R.M. "Are natural ingredients effective in the management of hyperpigmentation", "Journal of Clinical and Aesthetic Dermatology", edition 11, volume 2, pg no. 28–37.
2. Rathee P., Kumar S., Kumar D., Kumari B. & Yadav S.S. "Skin hyperpigmentation and its treatment with herbs: an alternative method", "Future Journal of Pharmaceutical Sciences", edition 7, volume 1, pg no. 132–140.
3. Huerth K.A., Hassan S. & Callender V.D. "Therapeutic insights in melasma and hyperpigmentation management", "Journal of Drugs in Dermatology", edition 18, volume 8, pg no. 718–729.
4. Philipp-Dormston W., Callender V.D., Hexsel D. & Trindade de Almeida A.R. "Melasma: a step-by-step approach towards a multimodal combination therapy", "Clinical, Cosmetic and Investigational Dermatology", edition 17, volume 1, pg no. 1203–1216.
5. Ogbechie-Godec O.A. & Elbuluk N. "Melasma: an up-to-date comprehensive review", "Dermatology and Therapy", edition 7, volume 4, pg no. 305–318.
6. Sheth V.M. & Pandya A.G. "Melasma: a comprehensive update: Part I", "Journal of the American Academy of Dermatology", edition 65, volume 3, pg no. 479–490.

7. Sheth V.M. & Pandya A.G. "Melasma: a comprehensive update: Part II", "Journal of the American Academy of Dermatology", edition 65, volume 4, pg no. 699–714.
8. Rendon M., Berneburg M., Arellano I. & Picardo M. "Treatment of melasma", "Journal of the American Academy of Dermatology", edition 54, volume 5 (Suppl. 2), pg no. S272–S281.
9. Ogbechie-Godec O.A., Elbuluk N. "Combination and multimodal therapies in melasma management", "International Journal of Dermatology", edition 57, volume 6, pg no. 629–639.
10. Grimes P.E. "Melasma: etiologic and therapeutic considerations", "Archives of Dermatology", edition 131, volume 11, pg no. 1453–1455.
11. Taylor S.C., Torok H., Jones T., Lowe N., Rich P., Tschen E. "Efficacy and safety of a new triple-combination agent for the treatment of facial melasma", "Journal of the American Academy of Dermatology", edition 56, volume 3, pg no. 416–422.
12. Del Rosario E., Tovar-Garza M., Rodrigues L. "Randomized, placebo-controlled, double-blind study of oral tranexamic acid in treatment of moderate-to-severe melasma", "Journal of Cosmetic Dermatology", edition 17, volume 3, pg no. 634–645.
13. Khurana V.K., Sharma Y., Al-Yacoub I. "A randomized open-label comparative study of oral tranexamic acid and tranexamic acid microinjections in patients with melasma", "Indian Journal of Dermatology, Venereology and Leprology", edition 85, volume 6, pg no. 725–732.
14. Wang W.J. et al. "The optimal dose of oral tranexamic acid in melasma: a network meta-analysis", "International Journal of Dermatology", edition 62, volume 4, pg no. 452–462.
15. Ogbechie-Godec O.A. "Role of oral and topical tranexamic acid in melasma", "Journal of Cosmetic and Laser Therapy", edition 21, volume 2, pg no. 66–74.
16. Ogbechie-Godec O.A., Elbuluk N. "Polypodium leucotomos and antioxidants in managing hyperpigmentation", "Dermatologic Therapy", edition 30, volume 5, pg no. 450–460.
17. Gupta A.K. & Gover M.D. "Hydroquinone and its alternatives for treatment of melasma and post-inflammatory hyperpigmentation", "Journal of the American Academy of Dermatology", edition 55, volume 5, pg no. 885–892.
18. Ogbechie-Godec O.A. "Azelaic acid, kojic acid, arbutin and other non-hydroquinone agents in PIH and melasma", "International Journal of Dermatology", edition 50, volume 9, pg no. 1027–1036.
19. Pennitz A., et al. "Self-applied topical interventions for melasma: a systematic review", "British Journal of Dermatology", edition 187, volume 3, pg no. 309–323.
20. Murphy M.J. "Natural cosmeceutical ingredients for the management of hyperpigmentation", "Journal of Clinical and Aesthetic Dermatology", edition 14, volume 5, pg no. 24–32.
21. Siahaan E.A., Pangestuti R. "Marine-derived actives and hyperpigmentation: potential cosmetic ingredients", "Marine Drugs", edition 20, volume 7, pg no. 734–748.
22. Sanchez V., Perez-Bernal A. "Management of facial hyperpigmentation: topical, systemic and procedural options", "American Journal of Clinical Dermatology", edition 1, volume 4, pg no. 261–278.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com