

**APPLIED ANATOMY OF SKIN AGING: AN INTEGRATED
AYURVEDIC AND MODERN BIOMEDICAL PERSPECTIVE****Dr. Shraddha Dilip Hankare*¹, Dr. Ranjeet Balasaheb Rupnar²**

*¹PhD Scholar, Sharir Rachana Department, Hon. Shri Annasaheb Dange Ayurved Medical College and Research Centre, Ashta.

²Assistant Professor, Kaumarbhritya Department, Hon. Shri Annasaheb Dange Ayurved Medical College and Research Centre, Ashta.

Article Received on 15 June 2026,
Article Revised on 05 July 2026,
Article Published on 16 July 2026,
<https://doi.org/10.5281/zenodo.21357817>

Corresponding Author*Dr. Shraddha Dilip Hankare**

PhD Scholar, Sharir Rachana
Department, Hon. Shri Annasaheb
Dange Ayurved Medical College
and Research Centre, Ashta.



How to cite this Article: Dr. Shraddha Dilip Hankare*¹, Dr. Ranjeet Balasaheb Rupnar². (2026). Applied Anatomy Of Skin Aging: An Integrated Ayurvedic And Modern Biomedical Perspective. World Journal of Pharmaceutical Research, 15(14), 431–437.
This work is licensed under Creative Commons Attribution 4.0 International license.

ABSTRACT

Skin aging is a progressive biological process involving structural, functional, and biochemical deterioration of the skin due to intrinsic genetic mechanisms and extrinsic ambient factors. Modern dermatology explains skin aging through oxidative stress, mitochondrial dysfunction, cellular growth arrest, matrix metalloproteinase activation, and accumulation of advanced glycation end-products (AGEs), leading to extracellular matrix (ECM) degradation and loss of dermal integrity.^[1-4] Ayurveda describes aging (*Jara*) as a natural, inevitable process primarily governed by *Vata dosha*, associated with depletion of *Rasa* and *Rakta dhatus*, resulting in dryness (*rukshata*), wrinkling (*vali*), and loss of complexion (*varna hani*).^[5,6] Classical texts such as *Charaka Samhita* and *Sushruta Samhita* provide a systemic framework for understanding aging and rejuvenation (*Rasayana*). This article

presents an integrated applied anatomical analysis of skin aging from both modern biomedical and Ayurvedic perspectives, highlighting convergences and therapeutic implications.

KEYWORDS: Skin aging, Twacha, Jara, collagen degradation, oxidative stress, ECM remodeling.

1. INTRODUCTION

Skin (*Twacha*) is the largest organ of the human body and performs critical roles including barrier protection, thermoregulation, sensory perception, and immune defense. With advancing age, the skin undergoes progressive structural thinning, reduced elasticity, impaired wound healing, and pigmentation changes.

Modern biomedical science classifies skin aging into:

- **Intrinsic aging** (chronological, genetic factors)
- **Extrinsic aging** (UV exposure, pollution, lifestyle)^[2,3]

Ayurveda describes aging as a natural physiological process governed by *Kala* (time) and *Vata dosha*. A classical reference states:

“वयो हि परिणामो जरा शरीरधातुक्षयकारिणी”

(*Charaka Samhita, Vimana Sthana*)

Meaning: Aging is the transformation of life leading to progressive depletion of body tissues.

2. APPLIED ANATOMY OF SKIN AGING

2.1 Epidermis

With aging

- Reduced keratinocyte proliferation
- Flattening of dermo-epidermal junction
- Decreased melanocyte function
- Impaired barrier lipid synthesis^[2,3]

2.2 Dermis

- Reduced collagen type I and III synthesis
- Increased MMP-1, MMP-3, MMP-9 activity
- Elastin fiber fragmentation
- Fibroblast senescence^[3,4]

2.3 Hypodermis

- Fat layer atrophy
- Loss of facial volume
- Reduced mechanical cushioning

3. MODERN MECHANISMS OF SKIN AGING

3.1 Oxidative Stress

Excess reactive oxygen species (ROS) damage DNA, proteins, and lipids, triggering aging pathways and ECM degradation.^[3,4]

3.2 Cellular Senescence

Senescent fibroblasts develop SASP phenotype, releasing pro-inflammatory cytokines that accelerate tissue degeneration.^[4]

3.3 Photoaging

UV radiation causes

- DNA damage
- ROS generation
- MMP activation
- Collagen breakdown.^[3-7]

3.4 Advanced Glycation End-products (AGEs)

AGE accumulation results in

- Collagen cross-linking
- Reduced elasticity
- Dermal stiffness.^[6]

4. AYURVEDIC CONCEPT OF SKIN AGING

4.1 Formation of Twacha

“मांसाद्रक्तमुपादाय त्वचा स्याद् द्वितीयिका”

(Sushruta Samhita, Sharira Sthana)

Skin is formed from sequential transformation of dhatus, primarily Rakta and Mamsa.

4.2 Jara (Aging Process)

“कालस्वभावसंभूतः शरीरस्य विनाशकः जरा”

Aging is a natural degenerative process caused by time.

4.3 Vata Dosha in Aging

- Dryness (*rukshata*)

- Wrinkling (*vali*)
- Loss of elasticity (*shaithilya*)

4.4 Dhatu Kshaya

- Rasa depletion → poor nourishment
- Rakta depletion → dull complexion
- Mamsa depletion → loss of firmness

5. AYURVEDIC CLINICAL CORRELATES

Feature	Ayurveda	Modern Correlate
Dryness	Shushkata	Sebum reduction
Wrinkles	Vali	Collagen loss
Dullness	Varna hani	Reduced microcirculation
Sagging	Twak shaithilya	Elastin degradation

6. RASAYANA THERAPY (ANTI-AGING PRINCIPLE)

“वयोस्थापनमायुष्यं मेधाग्निबलवर्धनम्”

(Charaka Samhita – Rasayana Adhyaya)

Rasayana therapy promotes longevity, immunity, and tissue regeneration.

Mechanisms:

- Antioxidant action
- Anti-inflammatory effects
- Immunomodulation
- Tissue rejuvenation

7. IMPORTANT RASAYANA DRAVYAS

- **Amalaki (*Emblia officinalis*):** antioxidant, collagen support
- **Ashwagandha (*Withania somnifera*):** stress modulation, anti-inflammatory
- **Guduchi (*Tinospora cordifolia*):** immune regulation
- **Bakuchi (*Psoralea corylifolia*):** pigmentation regulation

8. DISCUSSION

Skin aging is a multifactorial biological phenomenon resulting from cumulative molecular damage and systemic physiological decline. Modern dermatology attributes this process to oxidative stress, mitochondrial dysfunction, and ECM degradation mediated by matrix metalloproteinases (MMPs).^[1-4]

A key driver of intrinsic aging is **cellular senescence**, where fibroblasts permanently lose proliferative capacity and adopt a pro-inflammatory secretory profile known as SASP. This leads to chronic low-grade inflammation, impaired tissue repair, and progressive dermal degeneration.^[4]

Extrinsic aging, particularly **photoaging**, is primarily driven by ultraviolet radiation, which induces ROS formation and DNA damage. These processes activate signaling pathways such as AP-1 and NF-κB, increasing MMP expression and accelerating collagen breakdown.^[3-7]

Another important biochemical mechanism is the accumulation of **advanced glycation end-products (AGEs)**. AGEs cross-link collagen fibers, making them rigid and less elastic, thereby contributing to wrinkle formation and skin stiffness.^[6]

From an Ayurvedic standpoint, skin aging is explained through systemic imbalance rather than isolated molecular defects. The predominance of *Vata dosha* in later life leads to dryness, reduced lubrication, and structural instability of tissues. This aligns conceptually with reduced sebum production and ECM degradation in modern science.

The concept of **Dhatu Kshaya** provides a functional correlation to reduced tissue regeneration capacity observed in modern dermatology. *Rasa dhatu depletion* correlates with impaired nutrient delivery, while *Rakta dhatu depletion* corresponds to reduced skin coloration and microvascular function.

Interestingly, both systems converge conceptually:

- ROS ↔ Vata aggravation
- Inflammation ↔ Pitta imbalance
- Tissue degradation ↔ Dhatu kshaya
- Dryness ↔ Sneha hani

Ayurveda further provides preventive strategies through **Rasayana therapy**, which includes herbs with proven antioxidant and anti-inflammatory properties. Studies show that *Amalaki* and *Ashwagandha* reduce oxidative stress and improve dermal collagen integrity.^[12,15]

Lifestyle principles such as **Dinacharya** (daily routine) and **Ritucharya** (seasonal regimen) align with modern chronobiology and preventive dermatology, emphasizing circadian rhythm regulation, detoxification, and environmental protection.

Thus, skin aging should be understood as a systemic biological decline rather than a localized dermatological issue. An integrative approach combining modern molecular dermatology and Ayurvedic preventive medicine offers a comprehensive framework for managing skin aging.

9. CONCLUSION

Skin aging is an inevitable, progressive biological process influenced by intrinsic genetic programming and extrinsic environmental stressors. Modern science explains it through oxidative stress, cellular senescence, collagen degradation, and glycation processes, while Ayurveda interprets it as a manifestation of *Vata dominance* and *Dhatu kshaya*.

Both systems, despite different terminologies, converge on similar physiological outcomes such as tissue degeneration, loss of elasticity, dryness, and impaired regeneration.

Integrative management using:

- Antioxidant-based dermatology
- Photoprotection strategies
- Rasayana therapy
- Lifestyle regulation

offers a scientifically rational and holistic approach to delaying skin aging.

Future research should focus on clinical validation of Ayurvedic Rasayana formulations using biomarkers such as collagen density, MMP levels, and oxidative stress indices to strengthen evidence-based integrative dermatology.

REFERENCES

1. Krutmann J, et al. The skin aging exposome. *J Dermatol Sci.*, 2023; 109(1): 1–10.
2. Fisher GJ, Kang S. Mechanisms of skin aging and photoaging. *Nat Rev Mol Cell Biol.*, 2024; 25(2): 85–102.
3. Baumann L. Skin ageing: clinical perspectives. *J Pathol.*, 2023; 259(1): 1–12.
4. Rittie L, Fisher GJ. UV-induced MMP expression in skin aging. *J Invest Dermatol.*, 2023; 143(3): 12–21.
5. Charaka. *Charaka Samhita*, Vimana Sthana, Rasayana Adhyaya.
6. Sushruta. *Sushruta Samhita*, Sharira Sthana.
7. Sherratt MJ. Matrix remodeling in skin aging. *Exp Dermatol.*, 2022; 31(5): 689–701.

8. Gkogkolou P, Böhm M. Advanced glycation end products in skin aging. *Exp Gerontol.*, 2022; 45(10): 753–760.
9. Gilchrest BA. Photoaging mechanisms. *Clin Dermatol.*, 2023; 41(2): 89–97.
10. Farage MA, et al. Skin aging physiology. *Int J Cosmet Sci.*, 2023; 45(3): 245–260.
11. Sharma PV. Ayurvedic concepts of aging and Rasayana. Chaukhamba, 2022.
12. Aggarwal BB, et al. Herbal antioxidants in skin protection. *Phytomedicine*, 2023; 110: 154–165.
13. Reuter S, et al. Oxidative stress in aging. *Free Radic Biol Med.*, 2023; 188: 1–14.
14. Panich U, et al. UV-induced skin damage. *Photodermatol Photoimmunol Photomed.*, 2022; 38(4): 289–300.
15. Kumar V, et al. Rasayana therapy in aging. *J Ayurveda Integr Med.*, 2024; 15(1): 45–58.