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PHYSIOLOGICAL AND THERAPEUTIC INSIGHTS ON SKIN IN AYURVEDA

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Abstract

The skin, known as *Twak* in Ayurveda, is the outermost covering of the human body and serves as a crucial interface between the internal and external environment. As aptly quoted by Joseph Lister, “Skin is the best dressing,” highlighting its role not only as a protective barrier but also as a diagnostic surface for various pathological conditions. In Ayurveda, *Twak* is not merely a structural layer; it is the seat of numerous *Twak Vikaras* (skin disorders), making its thorough understanding vital for both prevention and treatment. This study explores the multifaceted significance of skin from the perspectives of *Kriya Sharir* (Ayurvedic physiology) and *Chikitsa* (therapeutics). Skin disorders are often reflections of deeper systemic imbalances, and hence, Ayurvedic science emphasizes a holistic approach to diagnosis and management. Classical texts elaborate on the *Panchabhoutik* composition and seven-layered structure of *Twak*, each associated with specific functions and vulnerabilities. The article also presents an analytical view of the skin’s role in *Swedavaha Srotas* (channels of sweat), thermoregulation, and sensory perception, aligning ancient knowledge with modern physiological insights. Furthermore, it discusses various Ayurvedic formulations and herbs with proven efficacy in managing skin diseases. In clinical practice, the observation of skin changes serves as a valuable diagnostic tool in Ayurveda, indicating the patient’s internal health status. This article is a humble attempt to bridge the anatomical, physiological, and therapeutic understanding of skin considering Ayurvedic wisdom.

Keywords: Twak, Chikitsa (therapeutics), Panchabhoutik, Swedavaha Srotas.

Introduction

Structure of Skin-[1]

The skin, the body's largest organ, acts as a protective barrier, aids sensory perception, and helps regulate temperature. In Ayurveda, it is considered an *Upadhatu* of *Mamsa Dhatu* and is formed from the metabolism of *Rakta Dhatu*, much like cream rising on boiled milk. It is known by several synonyms like *Twak*, *Chavi*, *Chadani*, and *Asrugdhara*. The term *Twak* is derived from *Chaadhana*, meaning "to cover." Classical texts offer varied descriptions of skin layers: Charaka, Kashyapa, and Ashtanga Sangraha describe six layers, while Sushruta and Sharangadhara mention seven, including the *Mamsadhara* layer—comparable to the hypodermis in modern anatomy.From the anatomical standpoint, skin is broadly categorized into two primary regions:

1. ***Epidermis (Outer Layer):***[2]
   a. *Avabhasini* – Corresponding to the Stratum Corneum
   b. *Lohita* – Corresponding to the Stratum Lucidum
   c. *Shweta* – Corresponding to the Stratum Granulosum
   d. *Tamra* – Corresponding to the Stratum Malpighii

2. ***Dermis (Inner Layer):***
   a. *Vedini* – Correlates with the Papillary Layer
   b. *Rohini* – Correlates with the Reticular Layer
   c. *Mamsadhara* – Comparable to the Hypodermis

This classification reflects a unique integration of Ayurvedic and modern anatomical concepts, offering a comprehensive understanding of the skin's structure and function.

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Colour and Lustre of the Skin -

The coloration of skin is determined primarily by the presence of pigments and the vascular dynamics at the capillary level. Variations in skin tone such as pink, blue, or pallor are typically associated with the pattern of blood flow through the sub-papillary venous plexus.

Several key factors contribute to the colour of the skin:

1. **Melanin:** Produced by melanosomes located in the basal layer of the epidermis, melanin is the principal pigment responsible for skin colour—ranging from black, brown, yellow, to white. It plays a crucial protective role by absorbing and neutralizing harmful ultraviolet (UV) radiation.
2. **Melanoid:** A bio-transformed derivative of melanin, melanoid enhances the skin's ability to absorb light, thereby influencing pigmentation.
3. **Carotene:** A yellow-orange pigment stored in adipose tissue, particularly more abundant in females. Carotene serves as a precursor to Vitamin A and contributes to the yellowish hue of the skin.
4. **Oxyhaemoglobin:** The oxygenated form of haemoglobin circulating in the capillaries imparts a reddish, warm tone to the skin.
5. **Reduced Haemoglobin:** The deoxygenated form of haemoglobin is responsible for the bluish appearance of the skin, often associated with cold, clammy conditions or hypoxia.
6. **Age-Related Changes in Skin:** As age advances, skin loses its elasticity, leading to wrinkles. The reduction of hypodermal fat further weakens skin support, making ageing signs more prominent.
7. **Lustre of Skin in Ayurveda:** In Ayurveda, *Prabha* (lustre) and *Varna* (colour) of the skin are key indicators of health. The concept of *Chaaya*—an internal reflection of health—is expressed through skin's appearance. When reflected externally, it is called *Pratichaaya*. Synonyms like *Sansthana* and *Akruti* are used to interpret signs (*Lakshana*) of diseases, making skin a vital tool in Ayurvedic diagnosis and prognosis.

Pancha Mahabhautika Description of Chaaya:[3]

In Ayurveda, *Chaaya* (complexion/reflection) is explained through the five *Mahabhutas* (elements), each imparting distinct characteristic:

- **Akasha (Ether):** Bluish, mildly unctuous, and radiant.
- **Vayu (Air):** Dry, dull, black or reddish—considered *Ashubha* (inauspicious).
- **Agni (Fire):** Bright, clean red hue with a healthy glow (*Shuddha Prabha*).
- **Jala (Water):** Clear, lustrous like a cat's eye, fluidic in quality.
- **Prithvi (Earth):** Stable, dense, smooth, with dark or fair coloration.

Vayaviya Chaaya is seen as unhealthy, while others reflect wellness (*Shubha*).

Prabha and Its Types:

Prabha (radiance) is the element enhancing *Varna* (colour), linked to *Tejas* (luminous energy). It is classified into seven types:[4]

1. Harita (green)
2. Peeta (yellow)

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3. Shveta (white)
4. Krishna (black)
5. Pandura (pale white)
6. Shyaava (greyish black)

An ideal *Prabha* is uniform, lustrous (*Snigdha*), and expansive (*Vishaala*), indicating good health. Dull or uneven *Prabha* is *Ashubha*, suggesting pathology.

Bhrajaka Pitta:[5] The Dosha of Skin Radiance *Bhrajaka Pitta*, a subtype of *Pitta Dosha* located in the skin (*Twacha*), governs:

- Transdermal absorption of therapies (e.g., *Abhyanga*, *Parisheka*, *Lepana*).
- Enhancement of complexion (*Chaaya* and *Prabha*).
- Thermoregulation through body heat.
- Overall skin lustre and healthy appearance.

Functions of the Skin[6]

1. **Protection:** Acts as a barrier against mechanical injury, pathogens, dust, radiation, and chemicals.
2. **Thermoregulation:** Maintains body temperature via conduction, convection, radiation, and sweat evaporation (300–400 ml/day).
3. **Insulation:** Conserves body heat through subcutaneous fat.
4. **Vasomotor Control:** Thermoreceptors regulate blood flow—vasodilation in heat and vasoconstriction in cold.
5. **Hair Coverage:** Assists in heat conservation.
6. **Sensory Perception:** Rich in receptors for touch, temperature, and pain, making it a major sensory organ.
7. **Absorption:** Allows transdermal absorption of certain medications and therapeutic formulations.
8. **Excretion:** Eliminates water, electrolytes, drugs, and toxins via sweat.
9. **Vitamin D Synthesis:** Converts ergosterol to Vitamin D precursor under UV exposure, aiding calcium metabolism.
10. **Secretion:** Sebaceous glands produce sebum to hydrate and protect the skin with antimicrobial properties.
11. **Water Balance Regulation:** Controls transepidermal water loss based on hydration and environment.
12. **Acid-Base Balance:** Excretes hydrogen ions through sweat during systemic acidosis.
13. **Storage:** Stores ~1000 mL of blood in venous plexus and fat-soluble vitamins (A, D, E, K) in subcutaneous fat.
14. **Gaseous Exchange:** Minor CO_2 excretion through sweat, supporting respiratory function.
15. **Seat of Bhrajaka Pitta (Ayurveda):** Governs absorption/metabolism of topical therapies (Lepa, Abhyanga, Parisheka).

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16. **Expression of *Chaaya*, *Prabha*, and *Varna* (Ayurveda):** Reflects internal health through complexion and radiance—important in Ayurvedic diagnosis.

Classification of Animals Based on Body Temperature Regulation-

Based on their ability to regulate internal body temperature, animals are classified into:

1. **Warm-Blooded Animals (Homeothermic):** Maintain a stable internal temperature regardless of the environment. Mechanisms like sweating, shivering, vasodilation, and vasoconstriction support homeostasis. Examples: Humans, mammals, birds.
2. **Cold-Blooded Animals (Poikilothermic):** Body temperature varies with the environment due to lack of internal regulation. Their temperature rises in heat and falls in cold. Examples: Reptiles (e.g., lizards), amphibians.

Average Body Temperature[7]

The normal average body temperature is approximately 98.4°F (range: 97°F–99°F) or 36.89°C (range: 36.11°C–37.2°C). This measurement typically refers to the oral temperature, which is considered a reliable indicator of the body's core thermal status.

Temperature Variation by Site of Measurement

Although core body temperature remains stable, slight variations occur based on the measurement site:

- **Oral Temperature:** Standard reference point.
- **Axillary Temperature:** ~0.5°F to 1°F lower than oral.
- **Rectal Temperature:** ~0.5°F to 1°F higher than oral.

Types of Temperature Measurements:

1. **Core Temperature:** Measured orally or rectally; reflects internal organs and brain temperature.
2. **Peripheral Temperature:** Measured at the axilla; indicates surface temperature and is influenced by external conditions.

Variations in Body Temperature[8]

Diurnal Variation: Body temperature exhibits natural fluctuations over a 24-hour period. The lowest temperature is usually recorded in the early morning hours (around 5:00 AM), whereas the highest temperature is observed in the late afternoon or early evening (between 5:00–7:00 PM). The average difference between these two extremes is about 1°F to 1.5°F.

Regulation of Body Temperature -[9]

Despite exposure to varying environmental conditions, the human body maintains a stable core temperature through a balance between thermogenesis (heat production) and thermolysis (heat loss).

1. Thermogenesis (Heat Production)

Heat is generated through metabolic and muscular activities:

- Metabolic Heat:
    - Carbohydrates/proteins: ~4 kcal/g

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  - Fats: ~9 kcal/g

- Skeletal Muscle Activity: Muscle contraction, especially shivering, produces heat via mechanical friction.
- Organ Contribution: Liver is the main heat producer, followed by the heart and other active organs.
- Hormonal Influence: Hormones like thyroxine, insulin, and epinephrine increase metabolic rate and heat production.
- Digestive Activity: Heat is also produced during digestion and enzyme activity.

2. Thermolysis (Heat Loss)

Heat is dissipated through several mechanisms:

- Skin (≈55% of total loss):
  - *Conduction:* Heat transfer to cooler objects in contact.
  - *Convection:* Air or fluid movement over skin aids in heat loss.
  - *Radiation:* Infrared emission to a cooler environment.
- Lungs: Heat is lost via exhalation of warm, moist air.
- Excretory Products: Minor loss through urine and faeces.

As per the second law of thermodynamics, heat loss depends on body surface area and the temperature gradient with the environment.

Other Influencing Factors:

- **Clothing:** *Light-coloured clothes* (e.g., white) reflect heat; *dark-coloured clothes* (e.g., black) absorb and retain it.
- **Balance of Production & Loss:** Thermal homeostasis is maintained through continuous heat generation and appropriate dissipation, especially critical during exercise or in hot climates.

Mechanisms of Heat Loss

Heat loss occurs through several physiological routes:

1. **Sweat and Evaporation (25%):** Approximately 25% of body heat is lost through sweating. Evaporative cooling is a crucial thermolytic mechanism, wherein body fluids evaporate from the skin surface and the respiratory tract (lungs), drawing heat away from the body. A dense subcutaneous capillary network beneath the skin supplies blood, which carries heat to the surface. The water content of sweat then evaporates, effectively reducing skin temperature and aiding in overall heat loss.
2. **Respiratory Tract (2%):** Roughly 2% of total body heat is lost through the lungs via evaporation of water from the moist surfaces of the respiratory mucosa during exhalation.
3. **Excretory Products (2%):** An additional 2% of heat is lost through the elimination of waste products, such as urine and faeces. Although minimal compared to other routes, this still contributes to the body's thermoregulatory balance.

These pathways work in concert with other forms of heat loss such as conduction, convection, and radiation, ensuring optimal body temperature is maintained even under varying environmental conditions.

Regulation of Thermotaxis

Thermotaxis refers to the body's ability to detect and respond to temperature changes through neural and hormonal coordination, primarily regulated by the hypothalamus, with support from the spinal cord and endocrine glands.

1. Hypothalamic Regulation:[10]

The hypothalamus contains two key thermoregulatory centres:

- Anterior Hypothalamus (Heat Dissipation):
  - Receives afferent input from skin thermoreceptors.
  - Activates vasodilation and sweating to enhance heat loss**.**
- Posterior Hypothalamus (Heat Conservation):
  - Triggers shivering thermogenesis and hormonal responses.
  - Increases secretion of thyroxine and epinephrine, elevating BMR and heat production.

2. Role of the Spinal Cord

- Acts as a relay system between peripheral thermoreceptors and hypothalamic centres.
- Coordinates responses by transmitting signals to effectors like sweat glands and skeletal muscles.

3. Endocrine Gland Involvement[11]

- Thyroid Gland: Cold exposure → ↑ TSH → ↑ Thyroxine → ↑ Metabolic rate and heat generation.
- Adrenal Glands: Adrenal medulla: Secretes epinephrine, increasing metabolic heat through glycogenolysis. Adrenal cortex: Produces corticosteroids, aiding metabolism and causing vasoconstriction to conserve heat.
- Liver: Converts glycogen to glucose, releasing heat during metabolism.

Special Note: Neonates

- Underdeveloped hypothalamic regulation makes neonates more sensitive to temperature changes.
- Depend on non-shivering thermogenesis via brown fat metabolism for heat production.

Herbal Drugs Useful in Skin Diseases-

Ayurveda offers a rich pharmacopoeia of herbal formulations that are beneficial in the management and treatment of various skin conditions (*Kustha*, *Vrana*, *Dadru*, *Shvitra*, etc.). These herbs exhibit a wide range of therapeutic properties including anti-inflammatory, antimicrobial, wound-healing, complexion-enhancing, and vermicide effects.

Below is a categorized list of selected herbal drugs traditionally used in the treatment of skin diseases:

1. **Ficus carica (Anjeer) -** Used in the initial stages of Shvitra Kustha (vitiligo). The leaf juice is applied externally to affected areas.
2. **Abutilon indicum (Atibala) -** A decoction prepared from the bark and aged leaves is used to wash sunburned skin, offering cooling and soothing effects.
3. **Cassia fistula (Amaltas) -** A paste of leaves is applied locally in conditions such as leprosy and ringworm (*Dadru*), providing antifungal benefits.
4. **Carica papaya (Eranda Karkati) -** The latex of the plant is utilized in skin conditions associated with gonorrhoeal infections, supporting healing of related skin manifestations.
5. **Ricinus communis (Eranda) -** A root decoction is employed in the cleansing of boils and septic wounds, owing to its antimicrobial and purifying properties.

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6. **Linumusitatissimum (Atasi) -** A poultice made from 16 parts Atasi seeds and 1 part mustard seeds is applied over boils, aiding in pus drainage and inflammation reduction.
7. **Hydnocarpushtiana (Tuvaraka) -** Seed oil is used externally, especially in the treatment of chronic skin disorders, including leprosy.
8. **Acacia catechu (Khadira) -** Used externally by mixing with beeswax for boils and pustules. A bath with its decoction is particularly effective in managing leprosy.
9. **Nerium indicum (Kaner) -** Oil prepared from Kaner decoction is applied in itching disorders and other chronic skin conditions.
10. **Mallotus Philippinensis (Kampillaka) -** A potent vermicidal agent, used in infective skin diseases like ringworm and parasitic infestations.
11. **Cinnamomum camphora (Kapoor) -** A compound balm prepared from 12 gm Kapoor, 12 gm catechu, 0.5 gm sindoor, and 120 gm ghee, washed 121 times, is used in itching skin disorders and gangrenous wounds.
12. **Nigella sativa (Kalonji) -** A combination of Kalonji, Bakuchi seeds, Guggulu, Daruharidra root, sulphur, and coconut oil is sun-cured and used externally in skin diseases.
13. **Abrus precatorius (Gunja) -** Used in boils and pustules, often combined with mercury, sulphur, Neem, and Cannabis sativa leaves.
14. **Plumbago zeylanica (Chitraka) -** The root is mixed with milk or water and applied over vitiligo patches, aiding pigmentation.
15. **Butea monosperma (Palasha) -** Acts as a strong vermifuge and is used in infective and parasitic skin diseases.
16. **Ocimum sanctum (Tulsi) -** The leaf paste is applied to the face to enhance complexion and lustre (*Prabha*).
17. **Mesua ferrea (Nagkesar) -** Nagkesar oil is beneficial in foul-smelling, gangrenous, and pus-exuding wounds. It also helps in improving the skin tone.
18. **Azadirachta indica (Neem) -** Widely used for its antibacterial, antihelminthic, and skin-purifying properties, especially in Kustha and other skin conditions.
19. **Aegle marmelos (Bael) -** The leaves are shaped into small cakes (without water) and applied on pustules for quick relief.

Conclusion

1. The skin, as the largest organ of the body, not only serves as a protective barrier against the external environment but also offers a dynamic interface for interaction with the surroundings.
2. It plays a significant role in the absorption of topical medications such as *Abhyanga*, *Parisheka*, and *Lepana*, a principle widely recognized in Ayurvedic therapeutics.
3. Among its many functions, thermoregulation remains one of the most vital, maintaining internal homeostasis.
4. Ayurvedic herbs possess powerful skin-healing, detoxifying, and rejuvenating qualities, and their topical as well as systemic application offers holistic solutions to various dermatological disorders.

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