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AN ANALYTICAL REVIEW OF JILD (SKIN) IN UNANI MEDICINE: STRUCTURE AND FUNCTION

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ABSTRACT

The human skin *(Jild)*, recognized as the largest organ of the body, serves as a complex and multifunctional interface between the organism and its external environment. Anatomically, it comprises three principal layers—epidermis *(Bashra)*, dermis *(Adma)*, and hypodermis *(Zera-e-jild Tabqua)* each exhibiting distinct cellular architecture and specialized physiological roles. The epidermis is primarily composed of functions such as dynamic barrier, protection, hydration control, and pigmentation. The dermis, rich in connective tissue, vascular networks, and adnexal structures, provides mechanical strength, sensory input, and thermoregulatory capacity. The underlying hypodermis, composed mainly of adipose tissue, facilitates insulation, energy storage stratified squamous epithelium, and cushioning. Functionally, the skin is involved in critical homeostatic mechanisms including immune surveillance, vitamin D synthesis, excretion, and sensory perception. Owing to its regenerative capacity and responsiveness to internal and external stimuli, the skin plays a pivotal role in health maintenance and disease manifestation. This paper aims to provide a comprehensive overview of the anatomical organization and physiological functions of the skin, emphasizing their relevance in clinical and biomedical research contexts.

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Keywords: Dermis (*Adma*), Epidermis, Pigmentation, Stratified squamous epithelium, vitamin D synthesis, Thermoregulatory.

INTRODUCTION

Dermatology is the branch of medical science that deals with the study, diagnosis, and treatment of skin-related disorders.[1] The skin is also called the integument. "Integument" is derived from Greek, where “inte” means whole and “gument” means covering. The skin is the largest and most sensitive organ of the human body, accounting for about 16% of the total body weight. It protects the internal organs from external harm and harmful radiations, and helps maintain body temperature, electrolyte balance, and hydration. The skin is a stratified structure, composed of the epidermis, dermis, and hypodermis layers. It also includes accessory structures such as hair, gland, muscles and nerves. The total surface area of the skin is approximately 1.8 square meters. The skin consists

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of three main layers such as Epidermis (outermost layer), Dermis (middle layer) and hypodermis (subcutaneous layer).[2,3] Epidermis (Outer Layer)/ Bashra: The epidermis is composed of stratified squamous keratinized epithelial cells. It is the most superficial layer of the skin and acts as a protective barrier. It does not contain blood vessels and relies on the dermis for nourishment. However, fine nerve endings are present. The thickness of the epidermis varies across different body parts. it is thicker on the palms and soles, and thinner on the eyelids. Its thickness ranges from 0.4 mm to 1.6 mm. The epidermis consists of five sub-layers and four main types of cells.[3,4] 1) Stratum Corneum (Horny Layer) / Tabqua-e-Qarnia: The outermost layer of the epidermis. It is composed of 25–30 layers of dead, keratinized, non-nucleated cells without intracellular organelles. It contains a protein called keratin and lipids, making the skin waterproof and preventing cracking and microbial invasion. These cells are continuously replaced by cells from the lower epidermal layers and shed off. This process occurs in the presence of an enzyme called cholesterol sulfatase, taking approximately 28 to 40 days.

Callus: Constant friction or abrasion can cause abnormal thickening of the stratum corneum, forming a callus.[3,4] 2) Stratum Lucidum (Clear layer)/ Tabqua-e-Safiya: it is located just beneath the stratum corrneum. It is composed of 3 to 5 layer of flattened, transparent, dead keratinized cells. These cells are shiny and translucent, which is why this layer is called "lucidum". It acts as a barrier to water movement and is clearly visible on palms and soles. 3) Stratum Granulosum/ Granular layer/ Tabqua-e-Hububiya: situated just beneath the Stratum Lucidum. It is very thin layer, usually 2-3 rows of flat diamond shaped keratinocytes. This layer is mostly found in thick skin areas such as palm and soles. It contain keratohyaln granules in the cytoplasm, which eventually convert into tonofilaments. These cells release lipid rich content, giving the skin shiny appearance.[3,4] 4) Stratum Spinosum (Spiny Layer / Prickle Cell Layer) / Tabqua-e-Shaukia: located just below the granular layer and above the basal layer.made up of 8 to 10 layer of polygonal keratinized cells. These cells have projections called as spines connected through desmosomes, providing strength and flexibility to the skin. Play a significant role in DNA synthesis.[3,4] 5) Stratum Basale / Germinativum (Basal Layer)/ Tabqua-e-Namiya: The deepest and most important layer of the epidermis. It connects directly on the dermis and receives nourishment from it. This layer is composed of columnar or cuboidal keratinocytes with distinct nuclei. The cells present in this layer continuously undergo cell division, replenishing upper layers.[3,4]

This layer contains other essential cells: melanocytes, Langerhans cells, and Merkel cells. a) Keratinocytes (Khaliyah-e-Keratin): Most abundant cells in the basal layer (95% of epidermis). Undergo a process called keratinization, where they move upward from the basal layer to the stratum corneum, undergoing structural and compositional changes. These cells produce keratin and lipids essential for forming the epidermal water barrier. Keratinocytes also contribute to calcium regulation by enabling UVB light absorption in the skin, which is critical for vitamin D activation.

Functions: Protect against physical, chemical, and biological pathogens. Help in thermoregulation and prevent dehydration. b) Melanocytes (Khaliyah-e-Mulauna): these are dendritic cells that produce melanin. One melanocyte connects with 36 keratinocytes to form an epidermal melanin unit. Melanocyte contains melanosomes, which produce melanin. Two types of melanosomes are present 1) Spherical that produces eumelanin (dark pigment), which is responsible for dark and brown skin color. 2) Ovoid that produces pheomelanin (light pigment), which is responsible for light skin color. Function: 1) Responsible for skin colour, 2) Provide protection from UV radiation, 3) Exhibit antioxidant activity. c) Langerhans Cells (Khaliyah-e-langerhan): These specialized macrophages that support the skin's immune defence. Langerhans cells are dendritic cells that act as the skin's first-line cellular immune defenders and are crucial for antigen presentation. Special stains allow visualization of these cells in the stratum spinosum. Langerhans cells are of mesenchymal origin, derived from CD34-positive bone marrow stem cells, and are part of the mononuclear phagocytic system. These cells contain Birbeck granules and tennis racket-shaped cytoplasmic organelles. Langerhans cells express major histocompatibility complex (MHC) I and MHC II molecules, uptake antigens in the skin, and transport them to the lymph nodes. d) Merkel Cells (Khaliyah-e-Markel): These are oval shaped modified epidermal cells and very few in numbers. Function: help in the perception of light touch. Merkel cells are connected to nerve endings and transmit signals to the brain

when the skin is touched by any object. Hence mainly found in fingertips, around the lips and oral areas. Merkel cells bind to adjoining keratinocytes through desmosomes and contain intermediate keratin filaments. The cell membranes of Merkel cells interact with free nerve endings in the skin.[5]

Dermis/ True skin / *Adma*: This is the inner layer of the skin, also known as the true skin. It is 10 to 30 times thicker than the epidermis and lies between the epidermis and the subcutaneous layer. Its thickness is greatest on the palms and soles (up to 1.5 mm) and thinnest on the eyelids and glans penis (about 0.1 mm). With age, this layer becomes thinner and loses its elasticity. It is capable of withstanding pressure and is highly elastic. It provides strength and elasticity to the skin. It contains connective tissue, fibres (collagen and elastic), numerous blood vessels, lymphatic, vessels, glands and nerves. [6,7,8] Dermis consist of two layers **1) Papillary Layer/ *Tabqua-e-Hulimatti***: This is the uppermost layer of the dermis, found just beneath the stratum basale of the epidermis. It contains fewer collagen and elastin fibres. It is made of loose connective tissue with small, finger-like projections called dermal papillae. These contain capillaries and nerve endings that provide nutrients to the epidermis. The papillae form ridges that protrude into the epidermis, known as epidermal ridges, which are unique to each individual and form fingerprints. **2) Reticular Layer/ *Tabqua-e-Shabki*:** This layer lies between the papillary layer and the subcutaneous tissue. It has a high concentration of collagen and elastic fibres. It contains adipocytes, blood vessels, lymphatic vessels, sebaceous glands, sweat glands, capillaries, and arrector pili muscles. If the elastic fibers in this layer rupture, permanent marks (stretch marks) may form, which are often seen during pregnancy or obesity.[6,7,8,9]

Hypodermis/ Subcutaneou Layer/ *Zera e jild Tabqua*: This layer lies between the dermis and the deep fascia. It is composed mainly of adipocytes, forming a thick layer of fat. These cells store fat in their cytoplasm, which acts as a shock absorber and facilitates smooth movement of the skin. The stored triglycerides serve as an energy reserve when needed. The appropriate amount of fat in this layer contributes to the body's aesthetic appearance. The thickness of this layer varies with age, gender, and health (see the figure no.1).[5]

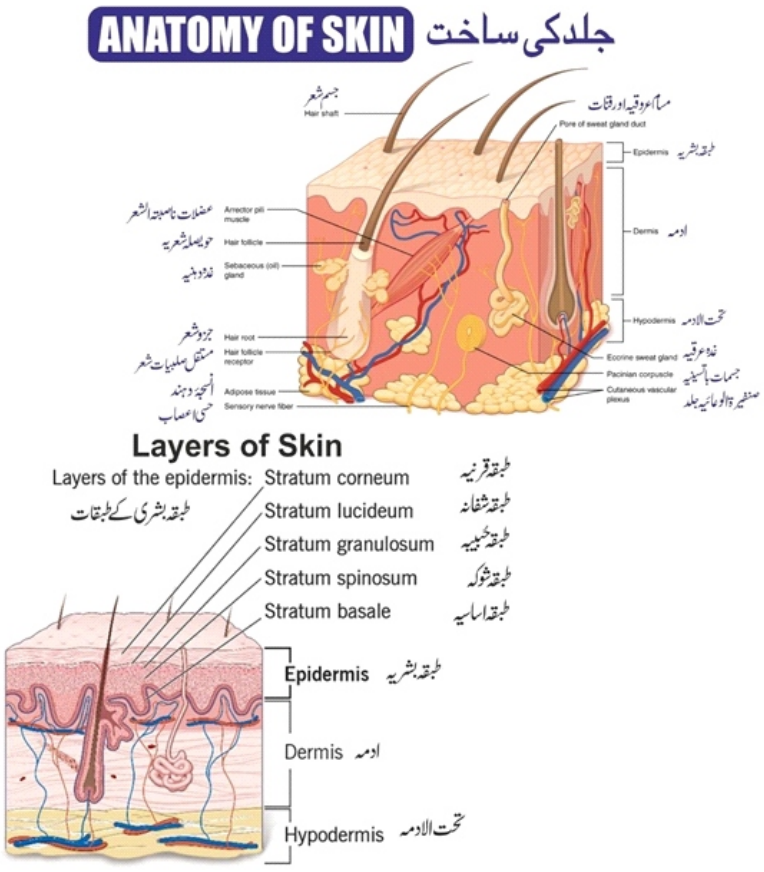

Figure No.1

Skin Appendages:

1. Hair/Baal/Shaar:

Hair covers most of the body, except the palms, soles, and penis. Hair on the scalp is usually denser and serves a protective function. Hair is composed of dead keratinocytes arranged in columns, bound together by extra proteins. Hair continuously grows and requires regular trimming. Scalp hair grows at an average rate of about 0.3 to 0.5 mm per day, which amounts to approximately 1 to 1.5 centimetres per month, or about 6 inches per year. The growth rate can vary based on factors like age, gender, hormones, and season. Hair on other parts of the body, such as the arms and legs, grows at a much slower rate and has a shorter growth cycle. On average, a single scalp hair has a growth cycle of 2 to 6 years before it falls out and is replaced by new growth. Types of Hair a) Lanugo Hair Structure: Very soft, fine, and colourless or lightly pigmented. Medulla (the innermost layer of the hair) not found in this type of hair. Location: Mostly appears on the foetus during pregnancy, especially between the fourth and fifth months. Some babies may still have it at birth, but it usually sheds within a few weeks. Function: Helps to hold the vernix caseosa (a protective greasy substance) on the fetal skin. Also temporarily assists in regulating temperature. b) Vellus Hair Structure: Short, soft, thin, and either no pigmented or very lightly pigmented. Location: Found on the skin of both children and adults, such as on the cheeks, forehead, arms, legs, and other non-sexual body areas. Function: Helps regulate superficial body temperature. Acts as a part of the skin's protective layer but is not very visible. Hormonal Influence: During puberty, some vellus hair can transform into terminal hair under the influence of hormones like androgens. c) Terminal Hair Structure: Long, thick, coarse, and darkly pigmented. They contain all three layers of hair such as cuticle, cortex, and medulla. Location: Prominently found on the scalp, eyebrows, eyelashes, armpits, pubic region, face (beard and mustache in men), chest, arms, and legs (especially in males). Function: Protection: Eyelashes protect the eyes from dust. Sensation: Nerve fibres beneath hair follicles detect even slight touch. Sexual Maturity Indicator: Terminal hair reflects hormonal changes during puberty. Hormonal Influence: Vellus hair can convert into terminal hair due to androgens, which is why men have thicker body hair. Longitudinal Section of hair: 1. Hair Shaft *(Jism-e-shaar*): This is the visible part of the hair above the skin and consists of three layers. *Cuticle (Bashra):* The outermost transparent, protective layer made of thin, flat keratinocyte. *Cortex (Qashra)*: the middle layer forming the bulk of the shaft made of elongated cells containing keratin and melanin, which determine hair color. *Medulla (Mukh)*: The innermost layer composed of irregularly shaped cells, which may not be present in all hairs. 2. Hair Root *(Asl shaar):* This is the part of the hair located within the skin, beneath the shaft. It penetrates the dermis and is the living, growing part of the hair. The root is surrounded by an epidermal tube called the hair follicle. Its components are hair follicle, hair bulb, dermal papilla, hair matrix. a) Hair follicle *(Hausikatul- shaari)*: The lower part of the root composed of epidermal cells. At its base, a cluster of cells forms the hair bulb. b) Hair Bulb *(Basl-e-shaar)*: The rounded base of the root, where mitotic cell division occurs, enabling hair growth. c) Dermal Papilla: Located beneath the bulb, it contains blood vessels that nourish the growing hair. d) Hair Matrix *(Mabda)*: The cells in this area rapidly divide and are responsible for hair growth. 3. Sebaceous Gland *(Gudda-e-Daheniya)*: An oil-producing gland connected to the hair follicle.4. Arrector Pili Muscle *(Uzlat-e-nasit-ul-shaar)*: A smooth muscle fiber attached to the hair follicle. It is responsible for causing hair to stand erect in response to cold or fear. Hair Growth & Cycle *(Shaari hausila-e-Dauraniya)*: Hair growth is a natural process involving different phases. Each hair follows a unique life cycle. Hair typically grows about 1 cm per month. A single hair can grow for 2 to 6 years before entering a resting phase. It's normal for an adult to lose 70–100 hairs per day. Phases of hair growth cycle are such as 1. Anagen Phase *(Daura-e-Faal)* – Growth Phase Duration: 2 to 7 years (for scalp hair) Feature: Active growing phase; hair matrix cells divide rapidly. About 85–90% of hair is in this phase. 2. Catagen Phase *(Daura-e-Sukoon)* – Transitional Phase Duration: 2 to 3 weeks Feature: Growth stops; the hair root shrinks and detaches from the dermal papilla. Only 1–3% of hair is in this phase. 3. Telogen Phase *(Daura-e-Aakhir)* – Resting Phase Duration: 3 to 4 months Feature: Hair does not grow further; remains in a resting state. Afterward, the hair falls out and a new one begins to grow. Around 10–15% of hair is in this phase. 4. Exogen Phase *(Daura-e-Khatima)* – Shedding Phase Sometimes considered part of the telogen phase. In this phase, old hair naturally falls out and is replaced by new hair. Shedding 70–100 hairs per day is considered normal. Some factors are affecting the growth of hair such are Genetics, Hormonal changes, Stress, Nutritional deficiencies, Illness or medications (e.g., chemotherapy) and Age etc (see the figure no.2). [10]

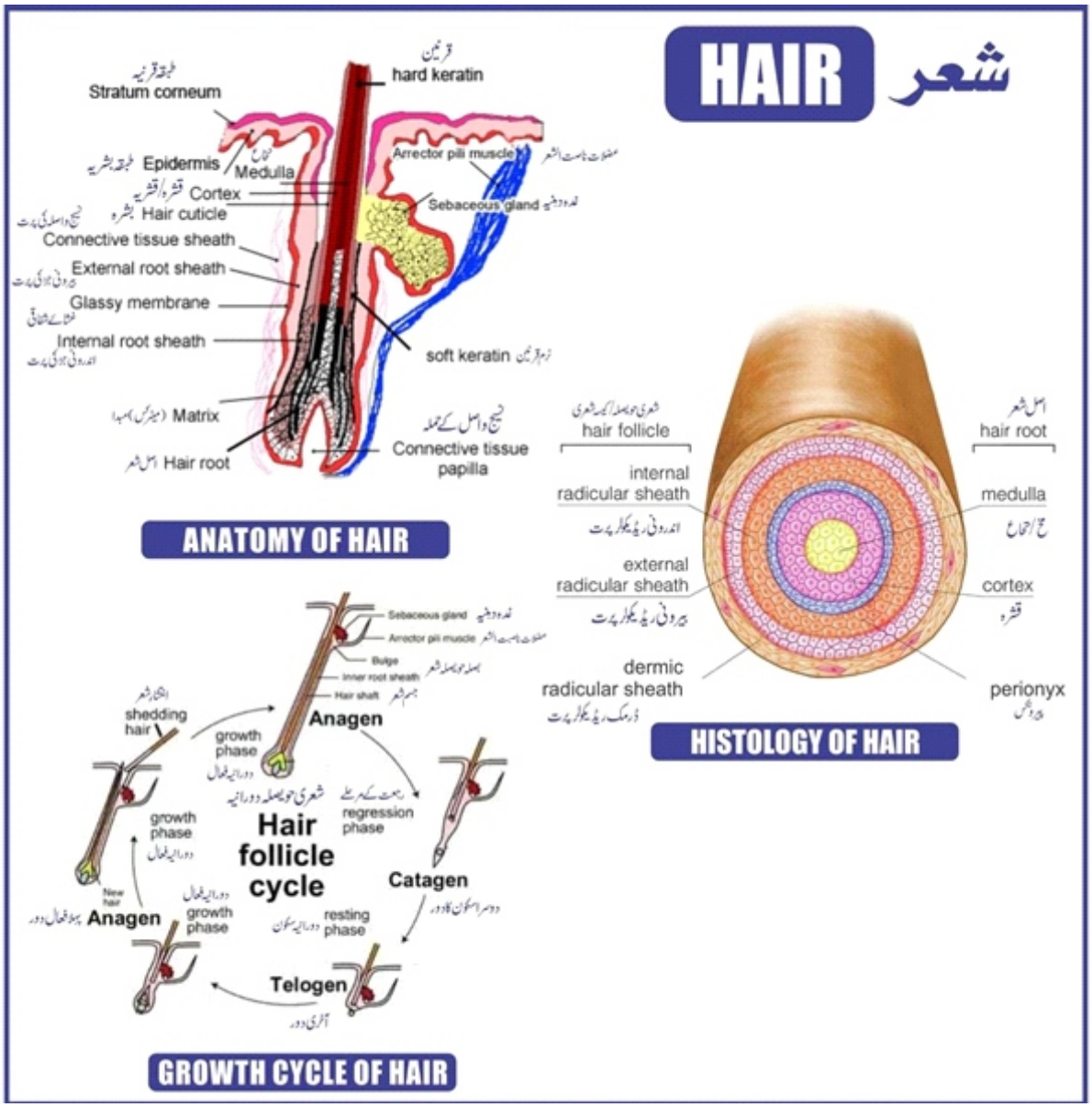

Figure No. 2

1. Nail/ Naakhun/ Zafar

The Nail is a hard keratinized structure located at the distal end of fingers and toes.it consists of the following parts such as (nail Anatomy). 1. Nail Plate *(Zafar)*: it is made up of three layers that is top, middle, and bottom. It is transparent in nature, pinkish in colour due to underlying blood vessels. It Provides protection, sensory enhancement and fingertip support. 2. Nail Bed *(Farsh-e-Zafar)*: The soft tissue beneath the nail plate contains fine blood vessels that nourish the nail and support its structure. 3. Nail Matrix *(Maadah-e-Zafar)*: The growth centre where nail cells divide and form the new nail. Permanent damage can distort nail shape permanently. 4. Lunula *(Nisf al-Qamar)*: The visible part of the matrix. Prominent or absent lunula may signal medical conditions like anemia or thyroid issues. 5. Cuticle (Eponychium) *(Jild-e-Zafar)*: A thin layer of dead skin covering the nail root. It protects against infection and bacteria. 6. Lateral Nail fold *(Tayyat-e-Zafar Janibi)*: The lateral nail folds provide the cushioned cutaneous lateral margins of the nail. They are typically more prominent in the toes than fingers, consistent with their contribution to the firm adherence of the nail to the nail bed. 7. Proximal Nail Fold*(Tayyat-e-Zafar-Qurbi)*: Skin behind the cuticle that shields the nail root from the rest of the body, forming a protective barrier. 8. Hyponychium *(Tahtul Zafar)*: Located beneath the free edge of the nail. It prevents the entry of pathogens and debris. 9. Free Edge/ Azaad Sira: The

distal, visible part of the nail that extends beyond the fingertip. It should be trimmed regularly to prevent bacterial accumulation. Nail functions such as protection, sensation (pressure and touch via underlying nerves), Grip (Assists in fine motor tasks like threading a needle) and Diagnosis (Changes in nail colour, shape, or growth may indicate systemic illnesses like liver or heart disease, or anemia) (see the figure no.3).[2,3,11] the free edge of the nail continuously grow, requiring regular trimming. Fingernails grow at the rate of about 0.1mm per day taking approximately 120 to 130 days to fully grow out. Toenail takes between 120 to 160 days for complete growth. Similarly, the thumbnails grow more slowly and steadily. On average, they grow about 1/8 inch per month. The toenail of the big toe requires about 300 to 480 days for complete regrowth.

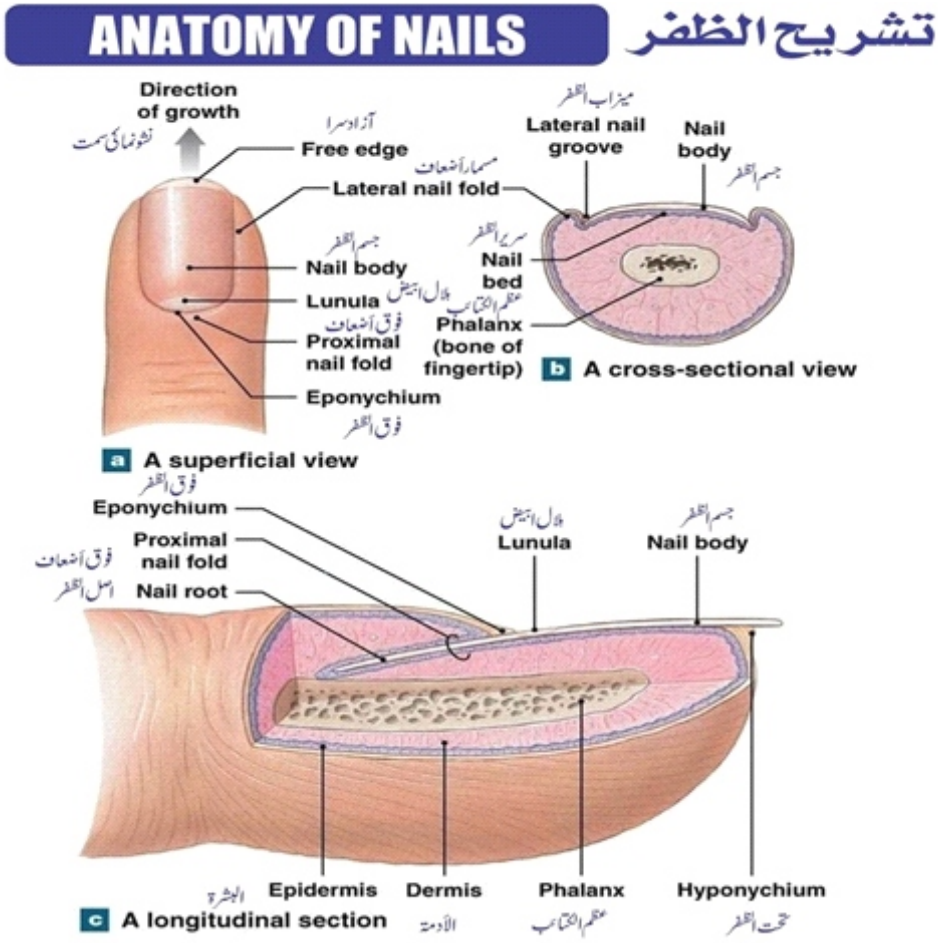

Figure No.3

1. Glands of the skin:

Types, Anatomy and Function A) Sweat Glands (Sudoriferous Glands)/ *Gudude Arqiya*: These glands excrete sweat to reduce body heat and maintain temperature balance. Types are 1. Eccrine Glands/ *Gudude Afrazi*: These are found throughout the body, especially on the forehead, palms, and soles. They open directly onto the surface of the skin through a duct. They secrete a clear sweat composed of water, salts, and urea. Function: Regulating body temperature. 2. Apocrine Glands/ *Gudude Bila Afrazi*: These are located in specific areas such as the armpits, around the navel, and near the genital organs. They open into hair follicles. They secrete a thick, protein-rich sweat which, when mixed with bacteria, produces body odor. These glands become active after puberty. B) Sebaceous Glands/ *Gudude Daheniya*: These are associated with hair follicles. They secrete an oily substance called sebum, which keeps the skin and hair soft and moist. These glands are more abundant on the face, scalp, chest, and back. Hyperactivity of these glands can lead to acne. Function: Sebum has antibacterial properties. C) Ceruminous Glands/ *Samlakhiya*: These are found in

the external auditory canal. They produce earwax (cerumen), which protects the ear by trapping moisture, dust, and microorganisms. D) Mammary Glands: These glands become active in females under specific conditions such as pregnancy or breastfeeding. They produce milk and are essentially modified apocrine glands.[12]

Embryology:
The epidermis develops from ectodermal tissue. The dermis and hypodermis are formed from mesodermal tissue, which originates from somites. Langerhans cells also develop with the help of the mesoderm. Neural crest cells, which are responsible for forming specialized sensory nerve endings and melanocytes, migrate into the epidermis during its development.[13,14]

Blood Supply *(Damvi Pervarish)* and Lymphatics *(Lymfavi Pervarish)*:
Blood vessels and lymphatic vessels are present in the dermal layer of the skin. The skin receives blood through two distinct plexuses (networks) such as one plexus lies between the papillary and reticular layers of the dermis. Second plexus lies between the dermis and subcutaneous tissue. The epidermis does not receive direct blood supply. Instead, it is nourished by diffusion from the superficial arteriovenous plexus (also known as the subepidermal or papillary plexus) located just beneath it. These blood vessels play a vital role in regulating body temperature. When the body is warm, these vessels dilate (vasodilation), allowing more blood to flow to the skin, releasing heat into the environment — thus cooling the body. When the body is cold, the vessels constrict (vasoconstriction), conserving body heat. This process is regulated by the autonomic nervous system, which involuntarily adjusts blood flow. Activation of the sympathetic nervous system causes vasoconstriction, helping retain body heat. When sympathetic activity decreases, vasodilation occurs, aiding in heat loss.[15,16]

Nerve Supply *(Asabi Pervarish)* of the Skin
The skin contains two types of nerves: somatic and autonomic. 1. Somatic Sensory System: This system conveys sensations such as pain (nociception), temperature, light touch, discriminative touch, vibration, pressure, and proprioception to the central nervous system. Specialized skin receptors and end organs aid in detecting these sensations are such as Merkel discs, Pacinian corpuscle, Meissner corpuscles and Ruffini corpuscles. 2. Autonomic Nervous System: This system controls Vascular tone (constriction and dilation of blood vessels), Pilomotor activity (movement of hair roots) and Sweating. 3. Free Nerve Endings: These extend into the epidermis and are responsible for sensations of pain, heat, and cold. They are primarily located in the stratum granulosum and around hair follicles. 4. Details of Various Nerve Receptors: a) Merkel discs: Detect light touch; extend up to the stratum basale. b) Pacinian corpuscles: Sense deep pressure; found in the deeper layers of the skin. C) Meissner corpuscles: Detect low-frequency vibration or light touch; located at the surface of the dermal papillae. d) Ruffini corpuscles: Detect pressure; present in the deep layers of the skin.[17,18,19]

Arrector Pili Muscles *(Uzlat)*:
Arrector pili are bundles of smooth muscles attached to the connective tissue sheath of hair follicles. When these muscles contract, they pull the hair follicle outward, making the hair stand upright. These muscles also press against the sebaceous glands, aiding in sebum secretion. Hair does not emerge vertically but at an angle to the skin. When these muscles contract leads to piloerection (hair standing on end), resulting in goosebumps, especially in cold conditions. Research shows that piloerection not only assists in thermoregulation but also plays a role in the activation of stem cells.[20,21]

Functions *(Afaal)* of the Skin:

1. **Thermoregulation:** The skin plays a vital role in maintaining body temperature by adjusting sweat secretion and dermal blood flow. Types of Sweating a. Insensible sweating: 600–800 mL of sweat is secreted daily without being noticeable, even in cold environments. b. Thermal sweating: Occurs in hot environments to cool the body. c. Psychic sweating: Emotional sweating: Triggered by emotions like anger or fear, especially on the palms, soles, and armpits. d. Exercise sweating: Occurs during physical activity; may reduce in cold or dehydrated states. e. Hot climate sweating: Triggered by hot/spicy food. f. Sympathetic activity sweating: Occurs due to nausea, vomiting, fainting, hypoglycemia, or hypoxia.[9,12]
2. **Blood Reservoir:** The dermis contains a rich network of blood vessels, storing 8–10% of the body's total blood volume.[12]
3. **Protection:** The skin protects against microbes, friction, chemicals, heat, and dehydration. Melanin shields against UV rays.

Macrophages in the dermis destroy pathogens.[9,12]

4. Cutaneous Sensation: The skin contains nerve endings, receptors, and tactile discs that detect heat, cold, touch, pressure, vibration, and tickling.[12]
5. Excretion: Sweat glands eliminate salts, carbon dioxide, urea, and ammonia. On average, 400 mL of sweat evaporates from an adult daily.[9,12]
6. Absorption: The skin can absorb certain lipids, vitamins (A, D, E, K), medications, gases (O_2 , CO_2), toxins, organic solvents (like acetone, carbon tetrachloride), and heavy metal salts (like mercury, lead, arsenic).[12]
7. Synthesis of Vitamin D: Precursors in the skin help synthesize vitamin D.
8. Wound Healing: The basal layer of the epidermis plays a key role in healing superficial wounds.[12]
9. Storage Function: The skin stores fats, water, salts, and glucose, which the body can use in emergencies.[9]
10. Secretion: Sebum, secreted by sebaceous glands, lubricates and protects the skin. Sweat helps reduce body temperature. Mammary glands, modified sweat glands, secrete milk.[9]
11. Acid-Base Balance: Sweat is acidic. If body acidity increases, sweat becomes more acidic, helping to restore balance.[9]
12. Gaseous Exchange: In some animals (e.g., frogs), skin plays a role in breathing. In humans, a small amount of carbon dioxide is also released through the skin.[9]
13. Water Balance: Sweating helps maintain the body's water balance.[9]
14. Diagnostic Indicator: Skin characteristics such as color, softness, elasticity, and turgor provide important clues about overall health. Skin examination is an essential part of physical assessments.[9,12]

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