

SKIN

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Skin structure

Skin is the largest body organ. Its surface covers about 2.5-3.0 square meters, and its weight is 18-30 kilograms of the whole body mass. Skin differs in thickness - the thickest under foot, the thinnest under the lower eyelid. It consists of three differently built layers: the cuticles, that is the epidermis, the corium (dermis) and the subcutaneous tissue (hypoderma). Within the body openings, the skin goes into the mucous membrane. Mucous membrane is a flexible and fibrous tissue composed of collagen connective tissue. The skin has its own immunological system.

Skin functions

Skin has many functions - it protects internal organs from damage and influence of the external environment, hinders penetration of harmful chemical pollutants and microorganisms (bacteria, viruses and fungi) into the body, participates in gas transformation and heat regulation, protects against UV radiation. Skin on different parts of body differs in structure and function.

Cuticle (epidermis)

This is the most outer layer of the skin. It has a thickness of about 50-1500 μm , consists mainly of cells filled with keratin protein, the so-called keratinocytes, lying on the basal membrane through which the gas exchange between the epidermis and the dermis that lies below takes place. There are no blood or lymph vessels. Epidermis has 5 layers: base, spiny, granular, clear (transient) and stratum corneum. Epidermis is nourished by diffusion. The base layer (stratum basale) - large cells with nuclei in one row, melanocytes producing melanin pigment and Langerhans cells responsible for the skin resistance located between them. Spiny layer - it is built by several layers of polygonal cells, connected to each other and the base layer with desmosomes. Grain layer - single or double, in the form of oblong spindly cells with nuclei filled and keratinous precursors - keratohialin. Clear layer - covers the palms. The stratum corneum - the most outer layer of the skin, flattened, free of nuclei cells, gets damaged on the surface.

Corium (dermis)

This element of skin is Located between the epidermis and the subcutaneous tissue. Its thickness is different in various parts of the body, and decreases with age. There are two layers in the dermis - papillary layer that lies directly beneath the epidermis and a deeper skin reticular layer. Collagen and

elastin fibers, blood vessels, nerve endings, lymphatic vessels are located in the dermis. Collagen, mainly of the type I and II together with elastin, give the skin elasticity and stretch ability. Collagen and elastin fibers are immersed in the extracellular matrix of the hydrated gel formed from glycosaminoglycans. Dermal cells include as well fibroblasts, histiocytes (macrophages), mast cells (mastocytes), and lymphocytes.

Subcutaneous tissue

It consists mainly of adipocytes (lobules) and lies just below the dermis. It contains secretions of glands, blood vessels and nerve fibers. Fat cells (adipocytes) produce leptin, a hormone that regulates body mass and affects appetite. Sweat glands and sebaceous glands are located in the skin. Sweat glands are of apocrystalline and eccrine type. Apocrine glands are located in the anal, genital, navel, breast, eyelid and underarm areas. Apocrystalline potassium is a cloudy, yellowish-white liquid; it secretes ugly smell on the surface. The glands are activated during adolescence. Eczema glands are located all over the body, but most of them may be found on hands and feet, forehead, axillary pits, the least are located on the buttocks. These glands are involved in body thermoregulation. The secretion is formed when the ambient temperature rises to 31 ° C or when the body temperature rises. Sweat contains big amount of potassium salts, magnesium, sodium and calcium salts, ammonia, urea, lactic acid, lipids and carbohydrates. Along with the sweat the medicines that are taken and the consumed alcohol are secreted. The pH of the sweat is 5-6, after dissolving by bacteria it becomes alkaline.

Sebaceous glands

They are located in the dermis, they open into the hair follicle, small amount is found on the edges of the eyelids and red lips. Tallow is secreted differently in different periods of life, it is very abundant in the newborns and during puberty. After the age of 40 its secretion decreases. Functioning of sebaceous glands depends on the hormones. Estrogens and antiandrogens reduce its secretion, progesterone increases. The secretions of sebaceous glands include tallow, pale yellow liquid and triglycerides that impart viscosity to tallow, free fatty acids, waxes and esters, squalene and cholesterol. On the average, 1 to 2 grams of tallow is secreted throughout the day. The largest amount is produced on face and scalp. An emulsion named hydrolipid coat is formed from the sweat, tallow and dead skin cells.

Hydrolipid coat

It covers the surface of the skin and contains fats, water, dead epidermis cells (keratinocytes). In different periods of life, its composition changes depending on functioning of sebaceous glands. Detergents have destructive effect on the hydrolipid coat. After being washed with soap, the skin is devoid of its protective layer, in older people this time may be even longer.

Skin pH

Is different depending on the person and a part of the body, but usually falls within the range from 4 to 7. Female skin is more alkaline than male. Skin pH is important because it protects against pathogens (bacteria, viruses).

Skin flora

The skin of a fetus is sterile but after birth it acquires bacteria, fungi and viruses. There is a permanent skin flora - microorganisms permanently residing on the skin, a transient flora, occurring sporadically, and a temporary flora, occurring only in a given period.

Permanent flora

It mainly includes oxygen bacteria - staphylococcus, bacilli, coccidia. Children usually have staphylococci, streptococci, corynebacteria, escherichia coli. Adults have mainly *Corynebacterium*, *Staphylococcus epidermidis*, *St. haemolyticus*, and fungi - *Pitosporum ovale*, *Trichophyton mentagrophytes* and *Candida albicans*.

Temporary flora

The temporary flora usually resides for a few hours and mainly includes bacteria. *Enterobacteriaceae* – coming from the intestines and moved to the skin, *Pseudomonadiaceae* coming from humid environment of the people and *Staphylococcus aureus*. Using inappropriate skin care agents may increase the skin pH and destroy the permanent skin flora.

Dry skin

Is called xerosis and may be inborn or acquired. It may be a mild or severe. Severe xerosis leads to skin cracking and may result in infections. This problem is becoming increasingly common. Excessive removal of water from the skin results in increased cornification, dryness and roughness. Dryness is caused by internal (endogenous) and external (exogenous) factors. Endogenous factors may include an inborn filaggrin protein dysfunction. Filaggrin plays a significant role in the keratinisation process and in proper functioning of protective barrier of the skin. Low activity of oil glands result in dry de-oiled skin. The above activity is affected by low activity of gene for 5-alpha reductase enzyme, which metabolises testosterone to DHT (two hydroxytestosterone). Dry skin in elderly people is connected with disrupted oily acids metabolism and may also be caused by dehydration of the organism. In the case of ichthyosis, AD or psoriasis, there are inborn occurrences of keratinisation process. The skin dryness is increased by hypothyroidism, diabetes, renal failure and certain types of cancer. Exogenic factors - include disadvantageous atmospheric conditions (cold air, low humidity) increasing evaporation of water from the skin, UV radiation (sunlight and tanning beds), detergents, cleaning agents and improper skin care. Clinical symptoms of dry skin include irregular skin surface, grey colour, roughness, skin peeling, a feeling of tightened skin, itching, cracks and erosions on the skin surface. Skin hydration depends on natural moistening factor (NMF) and the

products of filaggrin protein breakdown. As a result of its breakdown and desamination, the natural moistening factor is obtained, including also urea, lactic acid, sodium, potassium and calcium ions. The components of NMF change from summer to winter season.

Oat and skin

Common oat (*Avena sativa*) (fragments)

(...) An oat grain contains the highest amount of protein among all cereals, sometimes even 20%, polyunsaturated fats and solvable food fibre. Additionally, it contains silicic acid, flavonoids, triterpene saponins, avenasin, avenacosides, high amount of ferrous, zinc and manganese salts, aminoacids, vitamins from B group. (...) Oat flour is used in the cosmetic sector as an agent which removes itching.

Oat is used in the form of oat straw added to bath in the case of dermatitis and inflammation, and itching. (...) There are no side effects even in the case of overdosing.

Literature

- Rassner, Dermatologia, Wyd. Med. Urban et Partner, Wrocław, 1994
- Frohne D., Leksykon roślin leczniczych, MedPharm Polska, Wrocław, 2010
- Baumann L., Dermatologia estetyczna, Warszawa, 2013
- Padlewska K., Medycyna estetyczna i kosmetologia, PZWL, Warszawa 2014
- Bender S., Pielęgnacja ciała, MedPharm, Wrocław, 2011
- Martini M.C., Kosmetologia i farmakologia skóry, Warszawa
- Noszczyk M., Kosmetologia pielęgnacyjna i lekarska, Warszawa, 2010-2012
- Vaughan J.G., Geissler C.A., Rośliny jadalne, Prószyński i s-ka, Warszawa, 2001
- Sorbak Z., Chemia w kosmetyce i kosmetologii, Wrocław, 2013
- van Wyk B-E., Wink Michel, Rośliny lecznicze świata, MedPharm, Wrocław, 2008
- Lamer-Zarawska E., Noculak-Palczewska A., Kosmetyki naturalne, Astrum, Wrocław, 1994