

Natural skin care: From sebum to sweat

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Body fluids naturally or unintentionally come into contact with the skin and trigger different reactions and sensations. When examined closely, some of them have very interesting properties that are worth exploring in more detail.

Our body absorbs substances from food and air, metabolises them to produce energy in the form of heat and movement, and excretes the reaction products. In addition to this "mainstream" process, there are other, comparatively minor excretions (with the exception of urine) with a variety of functions that also reach the skin.

Sebum

Sebum is naturally distributed on the skin and is part of its protective programme. The fatty acid chemistry of sebum, which is excreted by the sebaceous glands, has only recently been reported in detail.¹ Contrary to earlier assumptions, the secretion does not yet contain any free fatty acids when it leaves the glands.² Free fatty acids such as sapienic acid (16:1 n-10) at around 25% and sebacic acid³ (18:2 n-10) are apparently only produced in the hair follicles by lipases of the microbiome. The sebum secreted by the hair follicles contains:⁴

- 30–50% glycerides,
- 15–30% free fatty acids,
- 26–30% wax esters,
- 12% squalene,
- 3–6% cholesterol esters,
- 1.5–2.5% cholesterol

The aim of skin care should be to disturb the natural balance between sebum, the lipid double layers of the skin barrier and the skin flora as little as possible and to promote it as much as possible.

Earwax

Earwax, also known as cerumen, contains the same substance groups found in sebum, but in different concentrations, which is why it is highly viscous to waxy. For example, the cholesterol content is around 21%. Unlike sebum, earwax contains about 19% ceramides.⁵ It has an antimicrobial effect against facultative pathogenic germs in the skin microbiome,^{6 7} due, among other things, to antimicrobial peptides (AMP).⁸ Deep cleaning of the ear canal with cotton buds is therefore not recommended.

Breast milk

Breast milk is practically isotonic to blood and has a pH that is initially slightly alkaline (colostrum) and later more or less neutral (pH 7). The water content is about 90%. The water contains salts, including trace elements, as well as carbohydrates (e.g. lactose) and fats (e.g. triglycerides and free fatty acids), which are emulsified by proteins and phospholipids such as phosphatidylcholine.

¹ H. Lautenschläger, Langweilig oder spannend? Eine Reise durch die Fettsäure-Chemie der Haut, *Chemie in unserer Zeit*, <https://onlinelibrary.wiley.com/doi/full/10.1002/ciuz.202400008> (8. November 2024)

² C. L. Fischer and P. W. Wertz, *Skin Microbiome Handbook: From Basic Research to Product Development*, Chapter 11: Effects of endogenous lipids on the skin microbiome, Wiley Online Library (14 August 2020)

³ 5Z,8Z-octadecadienoic acid

⁴ M. Picardo, M. Ottaviani, E. Camera and A. Mastrofrancesco, Sebaceous gland lipids, *Dermatoendocrinol.* 1 (2), 68–71 (2009)

⁵ J. T. Bortz, P. W. Wertz, D. T. Downing, *Journal of the American Academy of Dermatology* 23 (5), Part 1, 845-849 (1990)

⁶ S. Gupta, R. Singh, K. Kosaraju, I. Bairy, B. Ramaswamy, A study of antibacterial and antifungal properties of human cerumen, *Indian Journal of Otolaryngology* 18 (4), 189-192 (2012). DOI: 10.4103/0971-7749.104796

⁷ K. Ambika Devi, B. K. M. Lakshmi, P. V. Ratnasri, K. P. J. Hemalatha, Antimicrobial activity of cerumen, *Current Research in Microbiology and Biotechnology* 3 (4), 670-680 (2015)

⁸ M. Schwaab, A. Gurr, A. Neumann, S. Dazert, A. Minovi, Human antimicrobial proteins in ear wax. In: *Eur J Clin Microbiol Infect Dis.* 30 (8), August 997–1004 (2011)

The proteins include antibodies such as immunoglobulins, lysozyme and lactoferrin. Many other components have been described.^{9 10}

Breast milk, processed into cosmetic products, would be very suitable for skin care if it were not needed by newborns. Mare's milk is still considered an equivalent substitute today.

Sweat

The main task of the eccrine glands is temperature regulation, while the apocrine glands determine the characteristic scent of each individual through their additional organic components in interaction with the bacterial flora of the skin.¹¹

Eccrine sweat consists mainly of water, along with salts such as sodium and potassium chloride, and short- and medium-chain carboxylic acids. The pH is around 4.5. Larger amounts of sweat, for example during sport¹² and at high temperatures, lead to the concentration of salts and even their crystallisation on the skin's surface. As long as the skin barrier is intact, this is not a problem. On the contrary, the salt content of the NMF (Natural Moisturising Factor) may even be supported.

However, in the case of medical skin conditions, such as rosacea, the resulting high osmotic pressure (osmolality) causes irritation. The same is known to occur with open wounds.

Even under normal conditions, sweat irritates when it drips from the forehead into the eyes – one reason to wear a headband when exercising.

On the other hand, the antimicrobial peptide dermcidin (DCD) from the sweat glands reaches the skin surface as a broad-spectrum antibiotic. DCD fragments create ion channels in bacterial membranes and cause the membrane potential to collapse. Zinc ions (Zn²⁺) have a synergistic effect. DCD fragments occur in comparatively low concentrations in the sweat of neurodermatitis sufferers, who are more prone to infections.¹³

Lysozyme, which is part of the immune system,

has also been found in sweat.

Apocrine sweat, which is produced in much smaller quantities, is practically pH-neutral, unlike eccrine, acidic sweat. It also contains lipophilic and protein components, among other things, and has a higher consistency.

Tear fluid and tear film

The composition of tear fluid varies depending on the occasion. It mainly contains salts such as sodium chloride and, unlike acidic sweat, is slightly alkaline (pH 7.4). The osmotic pressure is almost equivalent to an isotonic saline solution. Tear fluid also has a slightly irritating effect when it becomes concentrated due to water evaporation.

Interestingly, it contains traces of long-chain fatty acids such as palmitic, oleic, γ -linolenic and arachidonic acid.¹⁴ This is not surprising, as the lipid layer of the natural tear film, which enables the eyelids to glide over the moisture film, mainly contains phospholipids in the form of phosphatidylcholine alongside triglycerides and cholesterol and its esters. The tear film is produced on the surface of the eye through the interaction of the sebaceous Meibomian glands, the lacrimal glands and the mucous glands of the conjunctiva with the blinking of the eyelids.

An insufficient tear film leads to the medical condition known as "dry eye". Adjuvant cosmetic lotions sprayed onto the closed eyelids are helpful in the symptomatic treatment of this condition.¹⁵ They contain liposomal, native phosphatidylcholine, which spreads over the tear film via the edge of the eyelid together with isotonic saline solution and mucilage such as hyaluronic acid. Irritation and feelings of tension are reduced.

Saliva

Like sweat and tear fluid, saliva consists of only water, with about 0.5% other substances. In addition to salts and α -amylase, which can break down polysaccharides such as starch,

⁹ https://www.hebammen-bw.de/wp-content/uploads/DHV_Muttermilch_Inhaltsstoffe.pdf

¹⁰ <https://assets.pubpub.org/uzc39ub6/61653059177599.pdf>

¹¹ H. Lautenschläger, Schweiß und Körpergeruch – den emotionalen "Duft" in Schach halten, Beauty Forum 2004 (4), 48-50

¹² L. B. Baker, Sweating Rate and Sweat Sodium Concentration in Athletes: A Review of Methodology and Intra/Interindividual Variability, Sports Med 47 (Suppl 1), 111–128 (2017)

¹³ M. Paulmann, T. Arnold, D. Linke, S. Özdirekcan, A. Kopp, T. Gutschmann, H. Kalbacher, I. Wanke, V. J. Schuenemann, M. Habeck, J. Bürck, A. S. Ulrich, B. Schitteck, Structure-activity analysis of the dermcidin-derived peptide DCD-1L, an anionic antimicrobial peptide present in human sweat, The Journal of Biological Chemistry 287 (11), 8434-8443 (2012)

¹⁴ B. S. Khyshiktuev, P. P. Tereshkov, S. A. Kozlov, L. A. Golub, M. V. Maksimienia, Fatty acid constitution of the lachrymal fluid in healthy subjects and in patients with ophthalmopathology, Klinicheskaja Laboratornaia Diagnostika, 2005 (4), 18-19 (Russian)

¹⁵ H. Lautenschläger, Kosmetische Präparate gegen trockene und müde Augen, Diskurs Dermatologie 2022 (3), 16-17

lysozyme, lactoferrin, immunoglobulins, mucus-forming glycoproteins and histatins are particularly noteworthy. The latter have antibacterial and anti-inflammatory effects, exert their action via the cationic amino acid histidine and are therefore even used in the form of an external gel for gum inflammation.¹⁶

Since histatins are commonly found in mammalian saliva, the expression "licking wounds" has great practical significance for the treatment of injuries in the animal world. In addition, saliva accelerates blood clotting.¹⁷ Kissing is also said to strengthen the immune system....

The pH value of saliva varies around the neutral point between 6.5 and 7.2.

Urine

Urine also has a pH that varies more widely between acidic and slightly alkaline, ranging from 4.6 to 7.5, depending on food intake. The concentration of substances contained in urine¹⁸ depends on fluid intake and can vary between hypotonic and hypertonic.

An important function is the excretion of water-soluble nitrogenous compounds that contain ammonia bound to amides – urea, uric acid (purine derivative) and creatinine. Ammonia can be detected by its smell near urinals when urea is broken down by the enzyme urease into carbon dioxide (CO₂) and ammonia (NH₃).

Hypertonic urine in particular is a trigger for nappy rash when it comes into contact with damaged skin or when hygiene in the form of surfactant-containing cleaning agents is excessive. Switching to cleansing care with suitable plant-based oils as far as possible can help.

What else flows...

Other bodily fluids have extremely complex compositions and may remain on the skin for hours:

- **Vaginal secretions:** The low pH value of approximately 3.5–5.0 is due to the proportion of lactic acid.
- **Semen** (ejaculate) has a pH value of between approximately 7 and 8 and is therefore slightly alkaline.

- **Menstrual fluid** contains a mixture of blood, vaginal secretion, vaginal flora and components from the uterus.
- **Blood** is slightly alkaline (pH 7.4). The water content is around 90%, with proteins accounting for 8% – in addition to salts and carbohydrates.
- **Nasal secretions**¹⁹ vary in consistency, are slightly acidic and contain lysozyme and other antimicrobial peptides (AMP) that are effective against bacteria and pathogenic fungi.

The secretions do not pose a problem for the skin unless they accumulate in the genital area over a longer period of time in a warm and moist environment (tight clothing, pads), which promotes their breakdown by microorganisms. Hygiene wipes and intimate sprays are not suitable as aids due to their composition.²⁰ Disposable washcloths that are moistened before going to the toilet are recommended.

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¹⁶ D. W. Paquette, D. M. Simpson, P. Friden, V. Braman, R. C. Williams, Safety and clinical effects of topical histatin gels in humans with experimental gingivitis, *J Clin Periodontol.* 29 (12), 1051-1058 (2002)

¹⁷ P. Del Vigna de Almeida et al., Saliva composition and functions: a comprehensive review, *J contemp dent pract* 9 (3), 72-80 (2008)

¹⁸ S. Bouatra et al, The Human Urine Metabolome, *PLOS ONE*, 4 September 2013; <https://doi.org/10.1371/journal.pone.0073076>

¹⁹ <https://www.pharmazeutische-zeitung.de/schutzschild-in-der-nase-141830>

²⁰ H. Lautenschläger, Intimpflege – sensibel & schonend, *medical Beauty Forum* 2017 (6), 38-41